Improving the Loyalty of Mobile Payment Users in China by Increasing the Fit between Skill, Technology and Task

Charlie Chen
chench@appstate.edu

Hoon Seok Choi
choihs@appstate.edu

Jason (Jie) Xiong
xiongjj@appsatete.edu

Department of CIS and SCM
Appalachian State University
Boone, NC 28608 USA

Yong Tang
tangyong@uestc.edu.cn
School of Computer Science and Engineering
University of Electronic Science and Technology of China

Abstract

User attrition is a prevalent issue in the mobile payment market due to severe competition. High churn rate in information systems can result in the decreased revenues and market share, the lowered cost of searching for new customers, and significant savings in operating costs. Our study examines key factors contributing to the loyalty of mobile payment services by adopting flow and task-technology fit (TTF) theories. Based on a survey of 228 mobile payment users, our findings suggest that as the degree of fit among all three dimensions – task, skill and technology - increases, users are more likely to perceive mobile payment useful, to be satisfied, and to continue to use it. These findings provide practical implications for developing effective user retention strategies in the market.

Keywords: Mobile Payment Service, Task-Technology Fit Theory, Flow Theory, Loyalty, Perceived Usefulness

1. INTRODUCTION

Although mobile payment adoption rate is generally low around the world, it is highly successful in China. Mobile payment services are ubiquitous and are becoming a dominant payment method in China (Wallis, 2015). More than 90% of 1.4 billion Chinese users are currently using smart phones to surf on the Internet. About 50% of them are active users of mobile payment services. According to Wall Street Journal, from 2015-2016, mobile payment

more than quadrupled, while in the United States the growth rate is only 40% (Abkowitz, 2018). The rapid adoption of mobile payment service has enabled China to become a leading cashless society (@WhartonKnows, 2018; Abkowitz, 2018). There are two main mobile payment service providers, Tencent, which owns WeChat Pay, and Ant Financial, which owns Alipay (Y. Wang, 2018). These two apps account for the majority of the mobile payment industry in China. The Economist newspaper has identified that financial technology, or fintech, including Alipay and WeChat pay, has revolutionized the behavior of Chinese consumers (Solutions, 2018).

The domination of the mobile payment market by two major local players (WeChat an d Aplipay) in China has created a market, where many international players compete for customer retention (e.g. Apple Pay, Xiaomi Pay, and Huawei Pay). There are several reasons for the customer retention issue. First, users have trouble deciding which mobile payment apps to use because too many options are available. Second, mobile payment apps are often not integrated well with varying mobile payment services (e.g. money transfer, mobile commerce, renting a bike, paying for food, tickets and utilities). Third, the switching cost from one mobile payment service provider to another is low for users because the market is competitive. As such, users often do not care which digital wallet app to use as long as the purpose of each transactional services can be fulfilled. These reasons resulted in high user attrition in the market and thus, user retention is challenging for the mobile payment companies.

The current literature on mobile phone technologies primarily focuses on the antecedents for behavioral adoption intention of mobile phones, using technology adoption theory and economic consumption analysis (Zhang, 2017). Key factors identified in the literature include use expectancy, intrinsic motivation, requisite knowledge (K. H. Wang, Chen, & Chen, 2017), demographics, trust, performance expectancy, technology characteristics and task technology fit (Oliveira, Faria, Thomas, & Popovič, 2014). A growing number of scholars are exploring factors that cause the mobile divide between age, gender, and ethnic groups (Zhang, 2017). Some other scholars adopt the social network theory to explore the usage pattern of mobile applications. These studies identify key factors, such as social influence, perceived ease of use, perceived enjoyment and perceived interactivity (Lee, Park, Cho, & Jin, 2017). The factors identified in the previous study have been contributing to the maturity of smart phone adoption. However, there is little literature to discuss the primary factors of mobile payment customer retention.

Our study adopts flow and task-technology fit (TTF) theories to examine key factors contributing to the loyalty of mobile payment services. Flow theory asserts that user satisfaction or ultimate pleasure relies on a good fit between skill and the challenge level of tasks (Csikszentmihalyi, 1990). Completing a mobile payment service (task) requires different skill sets (e.g. entering bank information, navigation, picture taking, scanning, and user interface). TTF theory can extend our understanding of the fit between task and technology because mobile payment services are supported with various technologies (e.g. cell phone functions, features, bandwidth, mobile banking, and personalized marketing tools). According to TTF theory, information technology is more likely to have a positive impact on user performance and to be used if IT capabilities match the tasks performed by users (Goodhue, 1995). This implies that the fit should complement the dimensions of task and technology. Therefore, when the degree of fit among all three dimensions – task, skill and technology - increases, users are more likely to perceive mobile payment useful and satisfactory, and consequently, to continue to use it. Our primary research question is about the continued use of mobile payments.

Based on the theoretical foundations, this study examines; (1) the interactions among the three key factors (i.e., skill, task-technology fit, and machine interaction), (2) how these factors individually and jointly influence user's perceived usefulness, (3) whether perceived usefulness can directly affect the flow experiences of mobile payment users, and (4) how to improve the user loyalty of users to mobile payment services via the increase of user satisfaction.

The remainder of this paper is organized as follows. *Conceptual Formation* discusses relevant literature to the aforementioned theories and major hypotheses of this study. *Research Methodology* introduces research design, data collection, and analysis method. *Hypothesis Test* presents results of the hypothesis test. *Theoretical and Practical Implications* discusses academic and practical contributions of this study. Finally, *Limitations and Future Research* discusses about the limitations of this study and suggestions for future studies on mobile payment.

2. CONCEPTUAL FORMATION

Requisite skills to perform mobile payment
Flow theory asserts that a person can enter into a mental state of full immersion, involvement and enjoyment when their perceived challenges of the task matches with their perceived skills to achieve a clear set of goals or progress (Tse, 2018). Users engaging in mobile payment services often have a clear goal of completing a transaction with others (e.g. money transfer), vendor (e.g. ordering a product or a service), or government (e.g. filing income tax or paying utility bill). When users cannot complete the goal of a transaction (e.g. using smart phone to order a food delivery), they will worry and experience anxiety and arousal. On the other hand, they can feel apathy or boredom if completing a transaction (e.g. money transfer) is too easy. Therefore, it is imperative that users have a right requisite skill set of using mobile payment services in order to perform their transactional tasks.

Transactional tasks vary in complexity and require corresponding skill set in order to achieve a transactional goal. For instance, using a smartphone to rent a bike requires that a user (1) download a bike rental app or install a mini app within mobile payment app, (2) scan personal ID to activate a bike rental account, (3) connect the bike account to bank account or smart phone's payment system for verification, (4) use the bike rental app to locate an available bike, (5) scan a barcode on the bike to check out the bike, and (6) file a claim if the rented bike is broken. Users will experience anxiety and will not be able to complete the goal of checking out bike if they do not possess the right skill set. In contrast, paying to a convenience store for a beverage purchased requires that users (1) open up mobile payment app, (2) have the vendor scan the QR code on the mobile app, and (3) receive a transactional receipt. Some users will feel that completing such a simple task is not challenging. Users who have a right skill set to accomplish a transactional task are more likely to have positive influence on the increase of perceived task-technology fit. Thus, we propose:

H1: The right skill set to use mobile payment services has positive effect on the increase of perceived task-technology fit

Users tend to have positive experience with mobile payment services if they have acquired the right skill sets to achieve transactional goals (e.g. mobile commerce, mobile top-up, pay credit card, buy lottery, money transfer, pay for leisure services, overseas transfer). When users have positive experiences with new technology, they tend to have more positive perceptions about their usefulness (Ritu & Jayesh, 1998). Such a correlation is also likely to be present for the adoption of mobile payment services. When users with right skill sets to use mobile payment services and achieve transactional goals, they could become enthusiastic at communicating their usefulness to others. Therefore, users with right skills to use mobile payment are more likely to perceive it useful. Thus, we propose

H2: The right skill set to use mobile payment services has positive effect on the increase of perceived usefulness

Effective system use is comprised of three elements: user's competencies, the purpose of systems, and task characteristics (Andrew, 2013). However, when there is a mismatch among the three elements, users will have poor machine interaction experiences. A positive machine interaction indicates that a high degree of fit between individuals, tasks and technologies is achieved, which improves IS-enabled task performance (Goodhue, 1995). In face of poor machine interaction, users often try to compensate for the limitations of technology in order to achieve successful outcomes in using the technology (Serrano & Karahanna, 2016).
Mobile payment services also involve user's skill sets, the purpose of transactions, and task characteristics. To wire money to a friend, for instance, a user needs to open a mobile payment app, enter his friend's phone number, and follow the wiring instructions. To order a food delivery service, a user needs to learn how to install the food delivery app, connect mobile phone information to the app, enter delivery address, request a receipt, submit an order, track the order, and communicate with the deliver about the specific location. As task complexity is increased, users need to improve their corresponding competencies of using varying mobile payment services in order to achieve different transactional goals. The variations of user's competence in using different mobile payment services are technology-specific user characteristics (Upadhyay, 2016). When users have positive interactions with mobile payment services, they are more likely to have (1) a high perceived task-technology fit and (2) a high perceived usefulness. Thus, we propose:

H3: Positive user interactions with mobile payment applications have positive effect on the increase of perceived task-technology fit

H4: Positive user interactions with mobile payment applications have positive effect on the increase of perceived usefulness

Achieving a fit between task and technology can lead to the effective use of information systems. A high degree of task technology fit (TTF) can be ensured with three steps of test: (1) clarifying distinct tasks to be completed, (2) adopting ideal information systems to support the completion of each task, and (3) testing the performance effects of task/technology alignments (Venkatraman, 1990). TTF theory is also applicable to understanding of mobile payment. First, mobile payment refers to a transaction task operated and performed from or via a mobile device. Second, completing a transaction anytime and anywhere involves mobility. Therefore, smart phone is an ideal information system to support mobile payment services. Third, users will find mobile payment is useful when a transactional task is successfully completed. Each mobile payment task dimension has a prescribed, best-fit technology dimension associated with mobile payment services. Increasing TTF can potentially increase the perceived usefulness of mobile payment services. Thus, we propose:

H5: A user's perceived task-technology fit of using mobile payment services has positive effect on the increase of perceived usefulness

When users have high degree of perceived usefulness of an information system, they tend to have a high satisfaction. The positive correlation has been supported by different theories, such as information system success theory, technology acceptance model, and affinity theory (Xu, 2018). Moreover, the logical relationship is evident in varying information systems, such as e-learning systems (Marjanovic, 2016), customer relationship management (CRM) systems (Tung, Lee, Chen, & Hsu, 2009), and building information model (G. Wang, & Song, J. , 2017).

User satisfaction with mobile payment services should be susceptible to the positive influence of perceived usefulness. Many studies have found that perceived usefulness plays a critical role for user's intention to adopt varying mobile services, such as mobile payment systems (Kalinic & Marinkovic, 2016; Liébana-Cabanillas, 2018; Thakur, Angriawan, & Summey, 2016), mobile banking services (X. Luo, 2010), mobile financial services (Y.-K. Lee, 2012), mobile commerce (M. Khalifa, 2008), and mobile application (H. Verkasalo, 2010). The skill sets required to perform these mobile services are replicable in advanced mobile payment services with varying mobile commerce applications. Given the previous studies that have shown that a positive relationship between perceived usefulness and user satisfaction in the adoption of mobile payment services (X. Chen, & Li, S. , 2017), it is plausible that the relationship would remain constant in the mobile payment. This discussion introduce the following hypothesis:

H6: A user's high perceived usefulness of mobile payment services has positive effect on the increase of user satisfaction

User satisfaction is an important perquisite for continuance intention to use information systems. When users have high satisfaction with an information system, they tend to have high loyalty (Xu, 2018). Previous studies found the empirical evidences in a range of information system domains, such as clinical information systems (Hadji, 2016), e-learning information systems (T. Lin, & Chen, C. , 2012), and social media (Kaewkitipong, 2016). The findings also corroborate with those of mobile payment (Cao, 2018; X. Chen, & Li, S. , 2017). Thus, we propose:

H7: A user's high user satisfaction with mobile payment services has positive effect on the increase of user stickiness with mobile payment services

The above discussion leads to the development of the research model of this study (Figure 1).

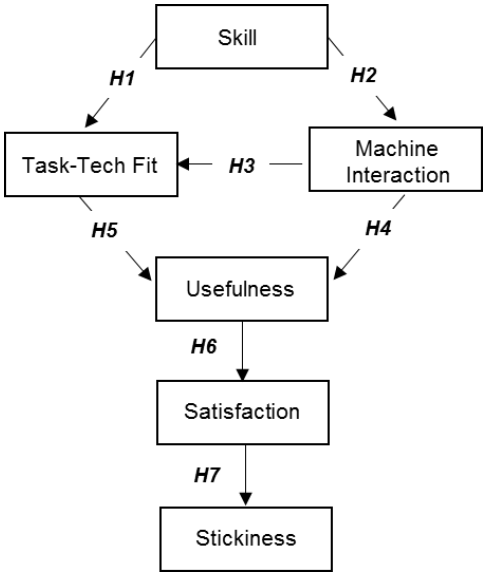

Figure 1. Research Model

3. RESEARCH METHODOLOGY

Survey Design

We designed a survey to measure constructs of the proposed hypotheses by employing established items in the previous studies (Please see Appendix 1). Questions for the constructs are in the 7-likert scale from 1 "strongly disagree" to 7 "strongly agree". We collected the data from users of WeChat, which is one of the most popularly used mobile payment apps in China, to rule out possible differences among the apps that should affect the constructs.

Data Collection

We conducted an online survey for students in a Chinese university to collect data to test our proposed hypotheses. We had a total 228 valid responses for analysis. The survey has a balanced ratio in gender while most respondents (81%) are in the age group between 18 and 39. This corresponds to the major user group of mobile payment services in China. In terms of longevity and frequency of WeChat Use, the majority of the respondents have used it for more than 1 year (91%) and more than 2 times per day (99.2%). Therefore, we can assume that the respondents are active users of WeChat with sufficient experience, who are adequate to provide reliable data for understanding mobile payment behaviors. Table 2 summarizes profiles of the respondents.

Category	Group	Frequency	Portion
Gender	Males	119	52%
	Females	109	48%
Age (Years Old)	18-22	73	32%
	23-39	112	49%
	30-39	16	7%
	over 40	27	12%
Longevity of WeChat Use (Years)	< 0.5	5	2%
	0.5 – 1	16	7%
	1- 1.5	49	22%
	1.5 – 2	35	15%
	2 – 2.5	123	54%
Frequency of WeChat Use per Day (Times)	< 1	2	0.8%
	2 - 4	36	15.8%
	5 - 6	44	19.3%
	7 - 9	15	6.6%
	> 10	131	57.5%

Table 2. Profile of Respondents

Reliability and Validity Tests

We conducted several reliability and validity tests to ensure adequacy of our research design. Before the tests, we performed Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy statistics to examine whether the items measure distinct factors. All Bartlett's sphere values are significant ($p>0.01$), indicating that the correlation matrix does not have an identity matrix. All KMO values higher than 0.5, indicating that further factor analysis is adequate for the data (Kaiser, 1974).

All item loadings in factor analysis for indicator reliability are larger than 0.7 and therefore, all items for the constructs were included in our analysis. For testing internal consistency validity, Cronbach's α coefficients of the measurement are larger than 0.7, the acceptable threshold (Chin, 2010). To ensure convergent validity, we performed an analysis for average variance extracted (AVE) and composite reliability. The smallest AVE (0.521) is greater than 0.5, which is the recommended cut-off value (Fornell & Larcker, 1981; Hulland, 1999).

Cons.	CR	AVE	VIF
SK	0.896	0.613	1.88
MI	0.878	0.563	1.70
PU	0.865	0.521	1.56
PTTF	0.874	0.560	1.69
USF	0.864	0.525	1.58
USN	0.855	0.533	1.69

※ **CR:** Composite Reliability, **AVE:** Average Variance Extracted, **VIF:** Variance Inflation Factor, Square of AVE on the diagonal in bold

Table 3. Quality Indicators of Reliability and Validity

Likewise, all the values for composite reliability (c.f., the smallest is 0.85) are higher than the acceptable threshold, 0.7 (Fornell & Larcker, 1981). Table 3 summarizes the results of reliability and validity tests discussed above. Square root of the construct's AVE exceeds the correlations with other constructs, which ensures discriminant validity of the measurement, as presented in Table 4. In addition, we estimated variance inflation factors (VIFs) for multicollinearity among constructs. The largest

VIF is 5.43, which is significantly lower than the recommended cut-off of 10 (Chin, 2010). Therefore, the model does not have significant multicollinearity.

Cons	SK	MI	PU	PTTF	USF	USN
SK	**0.61**					
MI	0.45	**0.56**				
PU	0.45	0.43	**0.52**			
PTTF	0.27	0.32	0.33	**0.56**		
USF	0.39	0.27	0.23	0.46	**0.53**	
USN	0.02	0.04	0.06	0.17	0.31	**0.53**

Table 4. Correlations with Square Root of AVE on the Diagonal

4. HYPOTHESIS TEST

Structural Model

In order to test the proposed hypotheses, we adopted Structural Equation Modeling (SEM) with Partial Least Square (PLS). The estimation approach has advantages in that it can test multiple causal relationships (Henseler, Ringle, & Sinkovics, 2009) that our research model has. In addition, it is less subjects to the issues caused by scale of measurement and residual distribution (Fornell & Bookstein, 1982).

Analysis Results

Table 5 summarizes the PLS analysis results, including path coefficients and t-statistics for path significance.

Hypothesis	Coeff.	t-stat.	Test Result
H1: SK → PTTF	0.289	3.38**	*Supported*
H2: SK → PU	0.405	4.87**	*Supported*
H3: MI → PTTF	0.412	4.31**	*Supported*
H4: MI → PU	0.275	3.07**	*Supported*
H5: PTTF → PU	0.319	3.32**	*Supported*
H6: PU → USF	0.567	5.80**	*Supported*
H7: US → USN	0.719	6.02**	*Supported*

※ Significance: **p <0.01

Table 5. Results of Hypothesis Testing

All seven hypotheses are supported at the 99% confidence level. Hypothesis 1 is supported (β=0.289; p<0.01), suggesting that a right skill set to use mobile payment increases perceived task-technology fit of its users. The significant and positive relationship between skill and perceived task-technology fit (β=0.405; p<0.01) supports Hypothesis 2. This indicates that as mobile payment users are more skillful in using it, they perceive it more useful. Support of Hypothesis 3 (β=0.412; p<0.01) and Hypothesis 4 (β=0.275; p<0.01) suggests that as machine interaction, which presents interactivity between users and mobile payment technology, increases, the user perceive it is more suitable and useful to complete the payment task. The significant and positive relationship between perceived task-technology fit and perceive usefulness (β=0.275; p<0.01) indicates that mobile payment users who have a high level of task-technology fit would perceive it more useful, supporting Hypothesis 5. The perceive usefulness is found to have a positive relationship with user satisfaction (β=0.567; p<0.01), supporting Hypothesis 6. Lastly, the user satisfaction has a significant and positive relationship with user stickiness (β=0.719; p<0.01) and thus, Hypothesis 7 is supported.

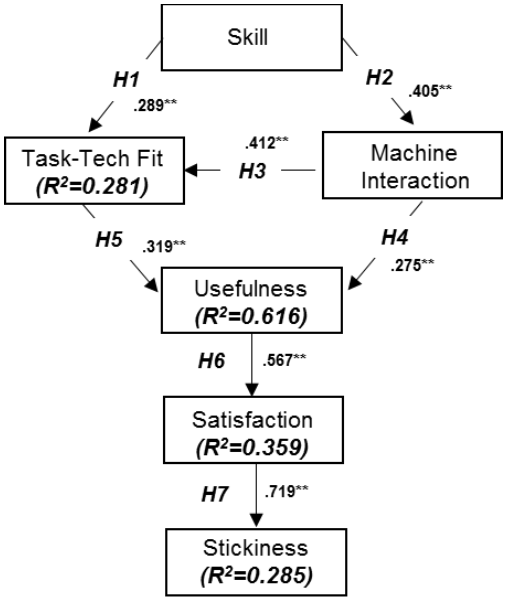

Figure 2. Research Model with Test Results

As illustrated in Figure 2, the two constructs Skill and Machine Interaction explain 28.1% of variation of Perceived Task-Technology Fit and 61.6% of variation of Usefulness, which does 35.9% of variation of Satisfaction. Lastly,

Satisfaction is found to account for 28.5% of variation of Stickiness.

5. THEORETICAL AND PRACTICAL IMPLICARTIONS

Innovation in mobile payment is one of the emerging technologies that have the potential to change the dynamics of IT industry (Panetta, 2017). In China, although mobile payment has a relatively short history, its dramatic growth and saturation of the market have introduced numerous challenges to mobile payment companies, including retention of their customers. In the context of the Chinese mobile payment market, the findings of this study provide both theoretical and practical implications.

Grounded in flow and task-technology fit (TTF) theories, key factors contributing to the loyalty of mobile payment in China are identified. Support of Hypotheses 1 and 2 suggests appropriate skill sets of the mobile payment users positively affect the perceived task-technology fit as well as the perceived usefulness. These findings confirm that a fit between the skill sets and the level of difficulty is necessary to increase customer satisfactions (Goodhue, 1995). They also suggest that mobile payment providers need to consider strategies to equip users with proper skill sets to operate mobile payment services. For example, cultural differences, which is beyond language differences, may influence to proficiency about a technology use (Dai & Palvi, 2009; Harris, Rettie, & Cheung, 2005; Lu, Wei, Yu, & Liu, 2017). Shuter & Chattopadhyay (2014) shows that cultural value (e.g. vertical vs. horizontal individualism) affects the users' intention to engage in smart phone functions. Mobile payment app developers may want to understand the functional preference of users given their cultural background, and customize the design of mobile payment services. In addition, individual characteristics, such as professions, regions, and social influence (Bachfischer, Lawrence, & Steele, 2004; Kim, Mirusmonov, & Lee, 2010; Yang, Lu, Gupta, Cao, & Zhang, 2012), affect the perceived task technology fit. The sophistication level of smart phone technology needs to be tailed to the phone use based on users' characteristics (Serdarevic, Fazzino, MacLean, Rose, & Helzer, 2016).

Support of Hypotheses 3 and 4 indicates that effective and efficient design of machine interaction have a positive impact on perceived task-technology fit and perceived usefulness. This further confirms that the IS-enabled task performance can be enhanced by the alignment of machine interaction and the task characteristics (Andrew, 2013). In practice, while complexity of mobile payment process may vary, the service providers need to be aware of the different competencies of using mobile payment services.

Support of Hypothesis 5 confirms that perceived TTF of using mobile payment has a positive effect on the increase of its perceived usefulness. This finding offers a practical implication that mobile payment service providers may consider collecting information about the perceived TTF and usefulness from users. For example, surveys or in-depth interviews may help develop future features of mobile payment apps. Listening to various customers may provide important, useful implications to improve their app design (Hsu & Liou, 2017).

Finally, support of Hypotheses 6 and 7 implies that high perceived usefulness of mobile payment has a positive effect on the increase of user satisfaction, and high user satisfaction with mobile payment services has a positive effect on the increase of user stickiness with mobile payment. As an important prerequisite for continuance intention to use, high perceived usefulness of mobile payment service is critical to the future growth of the services as well as the entire market. This finding corresponds to that of the previous mobile payment studies of X. Chen and Li (2017); Park, Jun, and Park (2017). Therefore, practitioners in the market need focus on improving user satisfaction and stickiness for their success.

6. LIMITATIONS AND FUTURE RESEARCH

There are several limitations of the research, as other studies. First, all the samples are students in one university in China. This may introduce a bias as most of the students might have similar experiences in mobile payment systems. Second, response biases, including acquiescence bias, demand bias, and social desirability bias, may exist during the survey data collection process, and their pontifical influence on our findings were not assessed in the study. Third, the survey limits mobile payment services to only one mobile payment app – WeChat. User behaviors in other mobile payment apps (e.g. Apple Pay, Alipay) could be different from those of WeChat, decreasing generalizability of our findings. Although it enabled a more rigorous research design, however, it did not allow considering behavioral difference across mobile payment platforms. In the future, researchers may consider conducting a survey with diverse

samples as well as having more samples from different locations in the world. They also may investigate perceptions and behaviors of other mobile payment apps such as Apple Pay and Alipay in the future.

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Appendix.1: Constructs and Items

Construct	Item	Reference
Skill (SK)	I am very skilled at using mobile payment services via WeChat. I know how to use mobile payment services via WeChat to get what I want. I know more about using mobile payment services via WeChat than most users.	Novak et al. (2000) Koufaris (2002) Kaur et al. (2016)
Perceived Task-Tech Fit (PTTF)	In helping complete my mobile payment tasks, the functions of WeChat are enough. In helping complete my mobile payment tasks, the functions of WeChat are appropriate. In helping complete my mobile payment tasks, the functions of WeChat fully meet my payment needs.	Zhou et al. (2010) Lin and Huang (2008)
Perceived Usefulness (PU)	Using WeChat enhances my daily productivity in China. I find WeChat useful in my daily activities in China. Using WeChat enhances my effectiveness in daily activities in China.	Davis (1989)
Machine Interaction (MI)	Mobile payment services via WeChat works fast. WeChat processes payment fast. WeChat operates at high speed.	Novak et al. (2000) Koufaris (2002) Kaur et al. (2016)
User Satisfaction (USF)	WeChat satisfies my need to explore mobile payment services in China. WeChat satisfies my need to explore China. WeChat satisfies my need to cultivate my skills to use mobile payment services.	Wu et al. (2010)
User Stickiness (USN)	I would stay longer on WeChat than others when using mobile payment services. I would prolong my stay on WeChat when using mobile payment services. I would use mobile payment services via WeChat as often as I can. I would use mobile payment services every time I need to use WeChat.	Wu et al. (2010)