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The Impact of Use Context on Mobile Payment User Adoption: An Empirical Study in China

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Abstract: The study aims to investigate the factors that affect users' intention to adopt mobile payment services. Drawing upon the Technology Acceptance Model, the study integrates use context and subjective norm to put forward a theoretical model. 375 valid survey responses were collected. The results show that use context is the strongest predictor of intention to adopt mobile payment services. It has both direct and indirect effects on behavioral intention, and the indirect effects are mediated by perceived ease of use and perceived usefulness. Subjective norm and perceived ease of use significantly influence perceived usefulness. Both theoretical and practical implications are discussed.

Keywords: Use context, Technology acceptance model, User adoption, Mobile payment, Mobile service

1. INTRODUCTION

In recent years, mobile services such as mobile payment have gained increasing popularity. According to a report by China Internet Network Information Center, by the end of June in 2015, the number of mobile payment users in China has reached 276 million, accounting for 46.5 percent of all Internet users in China [1]. Despite of the potential of mobile payment market, users are still hesitant to adopt the mobile payment services due to the reasons such as uncertainties of transaction handling and potential risks[2]. Therefore, an investigation on how to attract users and to facilitate their intention to adopt mobile payment services is of great relevance to both IS researchers and the practitioners.

In the literature, a variety of theories have been employed to explain the intention to adopt mobile services. Technology Acceptance Model (TAM) is widely acknowledged as one of the most popular ones for predicting acceptance and utilization of mobile services. A body of evidences has shown that TAM is a robust and powerful model for predicting adoption of mobile services. However, TAM pays little attention to identify antecedents that could affect perceived ease of use and perceived usefulness [3] [4]. Park stated, "the model cannot fully explain why people accept and use a particular technology" [3][5]. TAM assumes that attitude is the sole factor that determines user intention and ignores "the influences of reference groups and other contextual factors"[6]. Moreover, researchers have paid attention on the effects of context awareness and contextual factors on the adoption of mobile services, such as mobile ticketing services[7], mobile computing systems[8] and mobile payment[9]. Note that user behavior may be influenced by referents, such as family and colleagues[10]. Thus, this study attempts to integrate two important factors, subjective norm and use context, into TAM to provide a better predictive power in the context of mobile payment services.

The objective of this study is to develop a model to investigate factors affecting behavioral intention to adopt mobile payment services. Specifically, based on TAM, the study sought to investigate the effects of use context and subjective norm on user perception of mobile payment services and behavioral intention. The empirical data were collected among mobile payment users in China through an online survey. Partial least squares (PLS) method is employed to do model testing. In doing so, this research expects to contribute to new insight into the impacts of use context on the adoption of mobile services.

The rest of the paper is organized as follows. Theoretical background and research hypotheses are

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introduced in section 2. Section 3 presents the research methodology. The results are described in section 4. Section 5 discusses the key findings, following up with implications and limitations of the research.

2. THEORETICAL BACKGROUND AND RESEARCH HYPOTHESES

2.1 Technology acceptance model

Originated from theory of reasoned action (TRA)[11], TAM postulates that beliefs impact attitude toward a technology, further affecting intention to adopt the technology, while intention in turn brings about adoption behavior[12]. The two core beliefs are perceived ease of use and perceived usefulness [12]. Perceived ease of use refers to "the degree to which a person believes that using a particular system would be free from effort", while perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" [12]. A number of studies have applied TAM to examine user acceptance of information technologies, and found that perceived ease of use directly and indirectly affects behavioral intention through perceived usefulness, and perceived usefulness positively influences behavioral intention, such as [5], [13] and [14]. In the context of mobile payment services, when users perceive the easiness and utility of services, they may be more likely to adopt the services. Also, users' perception of easy to use may result in the perception of usefulness. Thus, based on the previous studies on TAM, we put forward the following hypotheses.

H1: Perceived ease of use positively affects behavioral intention.

H2: Perceived usefulness positively affects behavioral intention.

H3: Perceived ease of use positively affects perceived usefulness.

2.2 Subjective norm

Subjective norm can be defined as "perceived pressures on a person to perform a given behavior and the person's motivation to comply with those pressures" [10]. It reflects how user behavior is influenced by some significant referents, such as colleagues and friends[15]. Subjective norm has been found to be a significant predictor of behavioral intention and perceived usefulness. In a study on customers' acceptance of airline B2C eCommerce websites, Kim, Kim and Shin[16] found that subjective norm had significant positive impacts on perceived usefulness and intention to reuse the website. In their study on information technology acceptance by individual professionals, Yi et al. indicated that subjective norm significantly affects behavioral intention and perceived usefulness[17]. Based on prior studies on subjective norm, the opinions of important referents would impact a user's feelings about the utility of the mobile payment services and also affect the user's decision on whether to adopt the services. For example, if a person who is important to the user suggests that the mobile payment services are useful, the user would perceive the services to be more useful, and also become more willing to use it. Therefore, we made the following hypotheses.

H4: Subjective norm positively affects behavioral intention.

H5: Subjective norm positively affects perceived usefulness.

2.3 Use context

Use context can be defined as "the very concrete environment in which a technology is going to be used"[18]. As users always carry mobile devices (such as mobile phones) with them and use them in a variety of environments, the use context becomes an issue and could affect users' adoption behavior[19]. Van der Heijden et al. stated that, if a technology does not fit the context of use, a user may not evaluate the service positively[20]. Liu and Li also noted that a user may value a service when situated in certain use contexts. Prior studies have revealed the effects of use contexts on user adoption behavior [14]. For example, Mallat et al. argued that use contexts include budget constraints, the availability of other alternatives and time pressure in the service usage situation; and further found that use context has a significant effect on service adoption and perceived usefulness

[7] [21]. Liu and Li also indicated that contextual factors positively affect early adopters' usage of mobile Internet technology; and users have a high preference for their usage in certain contexts, for example, when they felt bored or urgently needed to access the Internet when outdoors[22]. In the context of mobile payment services, we argue that users tend to adopt the services in a number of particular situations. In other words, users' perceptions in relation to mobile payment services would be context-related [14]. For example, a user is likely to increase his/her perception on the utility of mobile payment services, when the user is in a hurry for payment and there are queues. Also, a user would be more willing to adopt the service when there are no other choices for payment. Thus, we put forward the following hypotheses.

H6: Use context positively affects behavioral intention.

H7: Use context positively affects perceived ease of use.

H8: Use context positively affects perceived usefulness.

Figure 1 presents the research model in this study.

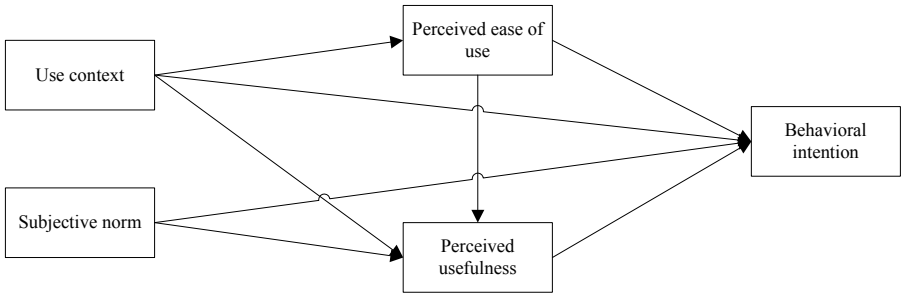

Figure 1. Research model

3. RESEARCH METHODOLOGY

3.1 Instrument development

The research model consists of five constructs, including perceived ease of use (EU), perceived usefulness (PU), subjective norm (SN), behavioral intention (BI) and use context (UC). All the measurement items were adapted from prior research to ensure the content validity and were modified to fit the mobile payment service context. The items of perceived ease of use and perceived usefulness were adapted from [12] and [23]. The items of subjective norm were adapted from [24]. The items of behavioral intention were modified from [12]. The items of use context were taken from [7]. All the items are listed in the Table 1.

As the items were originally created in English, a back-to-back translation procedure was conducted to ensure translation validity. The questionnaire was translated into Chinese by a researcher and then translated back into English by another researcher to ensure the consistency of the content. Each item was measured with a 5-point Likert scale, ranging from "strongly disagree (1)" to "strongly agree (5)".

When the questionnaire had been constructed, two IS experts were invited to assess its logical consistencies, contextual relevance, validity, and clarity. Next, the wording of the initial questionnaire was modified based on their comments. Then, twenty-five users with rich mobile payment usage experience were selected for a pilot survey, and feedback on the questionnaire was solicited. According to their comments, some items were revised to improve the questionnaire's clarity and understandability.

3.2 Data collection

The data collection was conducted through an online survey, targeting at the users with mobile payment usage experience. The respondents were asked to indicate what motivated their behavioral intention regarding the use of mobile payment services. A total of 419 responses were collected, and 44 were dropped with the same values for all questions. As a result, we obtained 375 valid responses. 56% of the respondents are female and

44% were male. Most of the respondents (78.7%) were aged between 18-25. A total of 31.2% of respondents had used mobile payment services for 1-2 years, while 25.1% and 21.6% had experiences of 2-3 years and above 3 years, respectively.

Table 1. List of survey items

Construct	Items	Sources
Perceived Ease of Use (EU)	EU1: Learning to operate the mobile payment system is easy for me.	[12] [23]
	EU2: I find mobile payment services easy to use.	
	EU3: It is easy for me to become skillful at using mobile payment services.	
Perceived Usefulness (PU)	PU1: Mobile payment services improve my quality of life.	[12][23]
	PU2: Mobile payment services make my life better.	
	PU3: Mobile payment services are useful for my life.	
Subjective Norm (SN)	SN1: People who are important to me think that I should use mobile payment services.	[24]
	SN2: People whose opinions I value prefer that I should mobile payment services.	
	SN3: People who influence my behavior think that I should mobile payment services. (Deleted)	
Behavioral Intention (BI)	BI 1: I intend to use the mobile payment services in the near future.	[12]
	BI 2: I predict I would use the mobile payment services in the near future.	
	BI 3: I plan to use the mobile payment services in the near future.	
Use Context (UC)	UC1: I use mobile payment services if I have no other choices for payment.	[7]
	UC2: I use mobile payment services if I am in a hurry or need payment fast.	
	UC3: I use mobile payment services if there are queues for payment.	

Table 2. Demographic information of the respondents

Demographic profile	Items	Frequency	Percent (%)
Gender	Female	210	56.0
	Male	165	44.0
Age	Under 18	2	0.5
	18-25	295	78.7
	26-35	65	17.3
	36-45	12	3.2
	Above 45	1	0.3
Usage experience	Below 1 year	83	22.1
	1-2 years	117	31.2
	2-3 years	94	25.1
	Above 3 years	81	21.6

Because self-reported data may suffer from common method bias, we tested for such bias by conducting a Harman's single-factor test[25]. The results showed that none of the factors can explain the majority of the variance, confirming that common method bias should not a concern of the research.

4. RESULTS

4.1 Scale reliability and validity

The partial least squares (PLS) method was employed to evaluate the proposed hypotheses and research model. Data analysis was conducted following the two-step approach. The measurement model was first assessed

to ensure reliability and validity, and the structural model was then assessed to test the research hypotheses.

To assess the measurement model, we conducted convergent and discriminant validity tests. Convergent validity measures whether items can effectively reflect their corresponding factor, and can be assessed by examining composite reliability (CR), item reliability and average variance extracted (AVE). The recommended threshold value of AVE for each construct is 0.5[26]. Reference [27] suggests that a generally acceptable value of CR is 0.7, and when the value of the standardized loading score is larger than 0.70, item reliability can be considered as satisfactory. As shown in Table 2, all standardized loadings are larger than 0.7. All AVE values are above 0.5 and CR values exceed 0.7. The results in the current research indicate good reliability, confirming the convergent validity of the measurement model.

Table 2. Research validity and reliability (Diagonal elements are the square root of AVE)

Construct	Item	Standardized item loading	AVE	CR	Cronbach's Alpha	EU	PU	SN	BI	UC
EU	EU1	0.879	0.798	0.922	0.873	**0.893**				
	EU2	0.911								
	EU3	0.889								
PU	PU1	0.878	0.767	0.908	0.849	0.568	**0.876**			
	PU2	0.865								
	PU3	0.885								
SN	SN1	0.836	0.734	0.846	0.639	0.244	0.243	**0.857**		
	SN2	0.877								
BI	BI 1	0.882	0.815	0.929	0.886	0.639	0.539	0.179	**0.903**	
	BI 2	0.937								
	BI 3	0.887								
UC	UC1	0.813	0.759	0.904	0.841	0.603	0.544	0.157	0.728	**0.871**
	UC2	0.914								
	UC3	0.884								

Discriminant validity measures whether two factors are statistically different. Fornell and Larcker recommend that the evaluation criterion for discriminant validity is that the square root of each construct's AVE should be greater than the correlation of the construct with other latent variables [26]. As also shown in Table 2, for each variable the square root of the AVE is significantly larger than its correlations with other variables. This indicates good discriminant validity of the measurement model.

Additionally, we tested the cross-loadings of all the items included in this research, and found that each within-construct item loading is higher on the measured construct than the cross-loadings on the other items, further confirming the discriminant validity of the measurement model [27].

4.2 Structural model assessment and hypothesis testing

Figure 2 presents the results of the path coefficients and the corresponding levels of significance. The model explains 60.2% of the variance in behavioral intention to use mobile payment services. As expected, behavioral intention to use mobile payment services is significantly affected by perceived ease of use, perceived usefulness and use context, thus H1, H2 and H6 are supported. However, subjective norm is found to have no impact on behavioral intention ($\beta = 0.010$, $t=0.431$), therefore H4 is not supported. Also, subjective norm and use context have significant positive impacts on both perceived ease of use and perceived usefulness, supporting H5, H7 and H8. Also, perceived ease of use is positively related to perceived usefulness, thus H3 is supported.

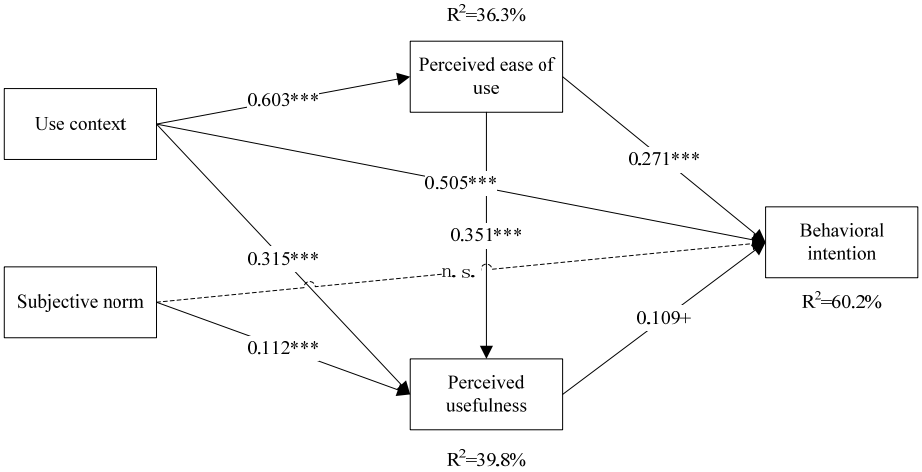

Figure 1. The structural model (*: p< .001; +: p< .1)**

5. DISCUSSIONS

This study examined the factors affecting the behavioral intention to adopt mobile payment services. The results show that perceived ease of use was positively related to behavioral intention and perceived usefulness. This is consistent with prior findings (e.g., [13] and [14]). Also, perceived usefulness has a weak effect on behavioral intention. To explain the weak relationship, we separately deleted subjective norm and use context, and conducted three model tests. The results from the basic model indicate that perceived usefulness significantly affect behavioral intention in three models at the level of 0.001 (β = 0.884, t=3.865). While the effect stays at the same level of 0.001(β = 0.262, t=3.918) when subjective norm exists; the effect has reduced to the significance level of 0.10 (β = 0.110, t=1.915) when use context exists. It indicates the crucial role of use context in affecting users' perception of usefulness and predicting users' behavioral intention to adopt the mobile payment services. Whether users will adopt the mobile payment services depends on the use context users situate. For example, when users are in a hurry for payment, they would perceive the usefulness of the mobile payment services and thus intend to adopt it.

As expected, use context was found to have positive impacts on all aspect of mobile payment services, including perceived ease of use, perceived usefulness and behavioral intention. These findings were consistent with that of Liu and Li [14]. It indicates that users' belief and behavior is context-relevance and based on the particular contexts. When users can only conduct payment through mobile technologies, the perception of ease of use and usefulness can be easily developed. Also, when situated in the right contexts, users will be more likely to adopt mobile payment services [14].

In addition, subjective norm significantly influences perceived usefulness. It indicates that users' perception of the utility of mobile payment services depend on the important referents, for example, those who are important to the user, or whose opinions the user value. However, subjective norm was found to have no impacts on behavioral intention. The possible explanation is that behavioral intention to adopt mobile payment services largely depends on the use context and perceived ease of use, and subjective norm may affect users' perception of usefulness of the services.

6. IMPLICATIONS AND LIMITATIONS

From a theoretical perspective, this study highlights the importance of use context in explaining behavioral intention. It was found that use context has the strongest effect on behavioral intention. Perceived ease of use and perceived usefulness can be still a good predictor of user adoption of mobile services. However, users'

intention to adopt the mobile services is conditional upon the use context. Secondly, this study expands the research scope on TAM with reference to the antecedents of perceived ease of use and perceived usefulness. This research investigated the effects of use context and subjective norm on perceived ease of use and perceived usefulness. Thirdly, this study revealed the crucial role of use context in affecting users' perception of usefulness. In other words, users' perception of mobile services is context-related. Users may have different perceptions toward the same services and develop different behaviors.

From a managerial perspective, the weak effect of perceived usefulness on behavioral intention when use context exists implies that users' perception toward utility of mobile services depends largely on use context. Mobile payments service providers should take the typical context into consideration, such as places where there are always queues or where the consumers are always in a hurry for time-saving. Thus, it is important for service providers to determine suitable contexts in which users are more willing to adopt mobile payment services. Also, service designers should offer users with timely and necessary services according to their particular environments[28]. In other words, it should make users perceive the easiness to use the services in particular use contexts. For example, users can quickly learn how to operate the payment system; the payment process is simple for users.

Although this study has revealed interesting and useful findings on adoption behavior in mobile services, there are a few limitations that should be borne in mind. First, the data in this study were collected from China and most of the respondents were university students. Hence, cautiousness should be taken when generalizing the findings to other age groups and other cultural environments. Future research can examine the validity of the proposed model in different user groups from various cultural backgrounds. Second, use context is a complex construct[29]. This study only focuses on one aspect of users' life. Future research should investigate the impacts of other use contexts on user adoption of mobile services. Third, this study only examines the behavioral intention to adopt mobile payment services. A further study on actual use may deepen our understanding of user behavior.

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