

Original Article



Driving Continuance Usage in Mobile Payments: An S-O-R Analysis of User Experience and Psychological Mechanisms

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Abstract:

This study investigates the factors influencing the continuance usage of mobile payment applications by integrating the Stimulus-Organism-Response (S-O-R) framework. Focusing on post-adoption behavior shaped users' internal psychological states (satisfaction, flow, and resistance to change), which in turn drove sustained engagement with mobile payment. A survey-based approach targeting 524 experienced mobile payment users in China is a mature cashless society. The findings revealed that convenience, security, compatibility, network externalities, media literacy, and mobile self-efficacy significantly enhanced user satisfaction. Security and media literacy uniquely influenced flow and resistance to change, while convenience, compatibility, and network externality primarily enhanced satisfaction. This study extends the SOR framework to post-adoption contexts, emphasizing the dynamic interplay between external stimuli and internal states in sustaining mobile payment usage.

Key words: Mobile payments, S-O-R model, continuance usage

Introduction

The rapid rise of digital commerce has transformed transaction payment systems globally, by 2019, 272 mobile payment licenses had been issued in China alone, yet the market share of leading providers like WeChat Pay and Alipay declined to 21.7% and 1.4%, respectively, by 2021¹. This decline is further evidenced by low user retention rates, with only 24% of users retaining these apps for three months, dropping to 14% in six months, and to 4% after a year². As the global mobile payment market is expected to grow from \$1.48 trillion in 2019 to \$12.06 trillion by 2027³, understanding user retention has become a critical challenge for providers, especially given the low cost of user conversion^{1,4}.

Despite the importance of user retention, most research on mobile payments has focused on

factors influencing initial adoption, such as convenience, security, compatibility, and network externalities^{5,6}. However, there is a significant gap in understanding the factors that drive “continuance usage”—the decision to continue using a mobile payment app after initial adoption. While technology adoption theories (e.g., TAM and UTAUT) have been widely applied to study adoption intentions, they fail to address the psychological and behavioral shifts that influence long-term usage. Specifically, while TAM/UTAUT explain initial adoption, they overlook post-adoption psychological shifts (e.g., flow, resistance to change), which the S-O-R framework explicitly addresses. This gap is particularly relevant given that continuance usage is more likely to be driven by internal psychological changes (e.g., feelings, perceptions,

and thoughts) rather than direct adoption effects². To address this, we adopt the “Stimulus-Organism-Response (S-O-R) framework,” which posits that external stimuli (e.g., app features) influence internal psychological states (e.g., satisfaction, flow), which in turn drive behavioral responses (e.g., continuance usage).

Prior research has identified “satisfaction,” “flow,” and “resistance to change” as key psychological states that mediate the relationship between external stimuli and continuance usage⁷. For instance, when users experience pleasure, immersion (flow), and satisfaction through a system, they are more likely to continue using the system to maintain positive emotional states^{7,8}. Additionally, “media literacy” and “self-efficacy”—users’ ability to navigate digital information and execute transactions effectively—have been shown to enhance satisfaction and flow, further influencing continuance usage⁹. These findings suggest that continuance usage is a complex process that is shaped by both external stimuli and internal psychological responses.

The significance of this research is underscored by the rapid growth of e-commerce, particularly in Asia, where e-commerce growth rates outpace global averages (51% in Asia vs. 47% globally)³. China, as a leader in mobile payment adoption, provides an ideal context for studying continuance usage owing to its large consumer base and advanced digital infrastructure. By focusing on Chinese consumers, this study offers insights that are valuable not only for the Asian market, but also for global mobile payment providers seeking to improve user retention.

Stimulus-Organism-Response (The S-O-R model)

The SOR model indicates a relationship between behavior and stimulus. External stimuli affect the participants’ organic experience (emotional and cognitive state), which leads to approach or avoidance behaviors (response)^{10,11}. This

framework is often adopted in the study of consumers’ behavioral reactions to stimuli, and has been extended to research on computer experience, consumer behavior, and website experience. Stimulation can be expressed in different forms, such as the retail environment, product display, and usability of salespeople¹² and mobile commerce applications, online platforms, environmental conditions, architecture, and spatial layout related to technical characteristics act as stimuli¹⁰.

Recently, Chen et al. (2019)¹³ applied the SOR model in the context of mobile payment and pointed to hedonic and utilitarian value and salesperson selling behavior as stimulus factors that affect consumers’ cognitive state (satisfaction) and response (use mobile payment). Therefore, it is important to identify different factors affecting mobile payments; these factors can be considered separate areas of research. Based on a review of the previous literature and the context of our research, we are sure that the SOR model provides a theoretical foundation that is suitable for our study¹¹, and it allows us to explore the effects of continuance usage of mobile payment factors and capture their holistic impacts on users’ varying organismic states and consequence responses.

Research model and hypotheses development

Fig.1 illustrates the research framework of this study. The stimulus (S) on the left presents six factor variables, namely convenience, security, compatibility, network externalities, media literacy, and mobile self-efficacy affecting mobile payment adoption, which have been variously validated^{5,6}. The user’s internal psychological factors (i.e., satisfaction, flow, and resistance to change) are the organism (O)^{8,10} and lead to continuance usage is the response (R). Thus, we make the following assumptions based on the S–O–R model framework.

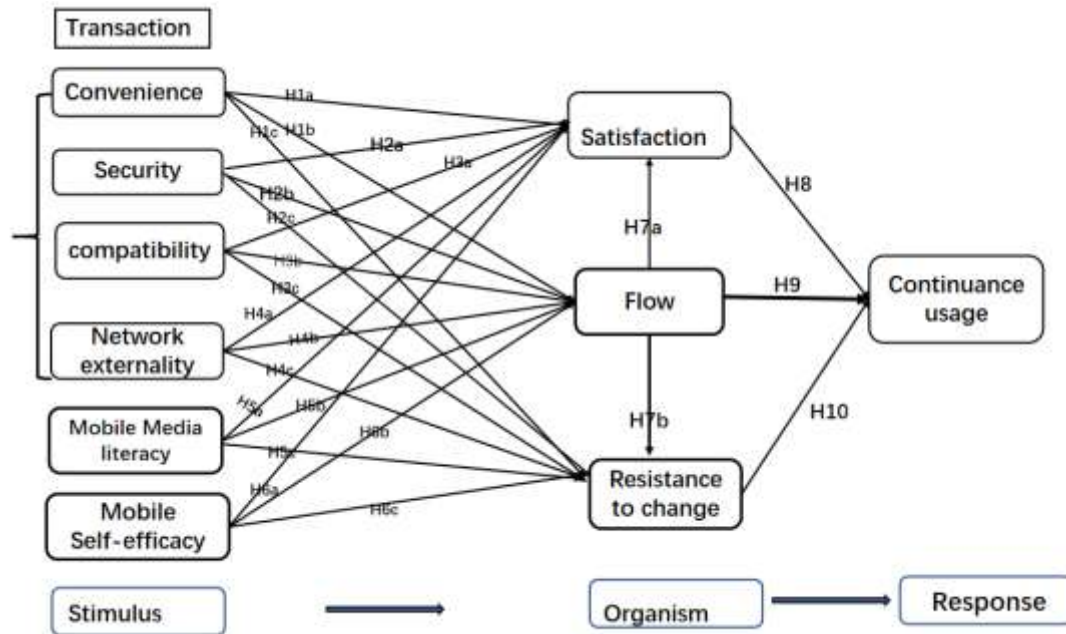


Figure 1 Research Model

Stimuli-Organism

Perceived convenience is defined as consumers finishing the operation using less effort, time, and energy⁹. Convenience refers to making people's daily lives or work easier and more effective than before⁵. Mobile payments improve shopping speed, ease, and efficiency. Users can pay anytime and anywhere, regardless of time and place, saving time and energy, and one-stop shopping^{5,9}. Meanwhile, mobile payment eliminates the inconveniences of carrying multiple bank cards or coins and does not change.

Satisfaction often combines utility value and perceived value corresponding to the psychological state of demand, such as flow^{8,10}. Users are satisfied with the convenience of mobile payment and perceive it as useful⁵ and perceived convenience enhances the perceived value delivered to consumers. Therefore, refuse to change to any other payment style. Thus, we propose the following hypotheses: Thus, we propose the following hypotheses:

H1a. Perceived convenience also has an impact on satisfaction.

H1b. Perceived convenience impacts flow.

H1c. Perceived convenience impacts resistance to change.

Compatibility is the consistency among innovations, experience, existing values, and

needs of potential users. It is related to new technologies used in the existing environment, and the outcome can fit expectancy and reduce uncertainty¹⁴. The more innovation that can meet personal needs, the higher is the level of compatibility¹⁴, which is a direct predictive factor of people's intention to adopt new technology. Mobile payment is compatible with people's daily payment needs, which greatly promotes the adoption of mobile payment¹⁴ and a high level of compatibility makes users feel comfortable and satisfied in the process of using this form of payment⁵. A lack of compatibility may cause users to resist using mobile payments¹⁴. Thus, the following hypothesis was proposed:

H2a. Perceived compatibility affects satisfaction.

H2b. Perceived compatibility impacts flow.

H2c. Perceived compatibility impacts resistance to change.

Security means that transactions on the mobile payment platform are secure and reliable as the traditional way when it comes to financial and personal information¹⁵. According to Karsen et al. (2019)¹⁶, mobile payments are non-repudiating and can guarantee the security, availability, and confidentiality of any financial service, thus ensuring the protection of personal information. Another study suggested that perceived behavioral control, compatibility, and perceived security are factors that influence consumers' choice of

payment system¹⁷. The use of mobile payment depends on mobile payment system factors such as convenience and speed⁹, compatibility, perceived use, security and trust^{9,17}.

Security and convenience stimuli can lead to consumers' emotional arousal¹³, which provides satisfaction and flow; this kind of good experience affects the continuance usage of mobile payment^{13,18}. Several prior studies have indicated a strong association between satisfaction, flow, and the consequent behavior of continuance usage¹⁹. Zhou (2014)¹⁹ suggested that resistance change and flow experience affect continuous usage⁸. Prior evidence confirms that perceived security significantly affects continuance usage²⁰. In brief, when users expect that mobile payments will result in positive utility in the future, they continue to use mobile payments. Thus, the following hypotheses are proposed:

H3a. Perceived security affects satisfaction.

H3b. Perceived security affects flow.

H3c. Perceived security impacts resistance to change.

The number of consumers affects a platform's supply of products and services, resulting in indirect network externalities¹⁵. Consumer utility depends on the number of buyers participating in a network. Direct network externalities mean that consumers receive more benefits²¹. Further, more users on the platform will be more attractive to merchants. The more consumers and merchants there are, the more value the platform will have²¹, which will encourage it to continue to improve its services. Thus, the following hypotheses are proposed:

H4a. The perceived network externalities affect satisfaction.

H4b. The perceived network externality impacts flow.

H4c. Perceived network externality impacts resistance to change.

There are many forms of individual responses to media information, such as reading, consuming, actively creating information, or spontaneously writing, which can be conceptualized as functional and critical literacy. Functional literacy is related to skills and knowledge, the capabilities of knowing how and the ability to access new

media and understand the content conveyed²². Critical literacy focuses on the ability to express meanings and judge the credibility and usefulness of information.

People are satisfied with information from various mobile apps. Mobile self-efficacy and media literacy reflect users' abilities to understand and use information. Mobile users' ability to read product information, use promotional coupons directly, forward promotional information to others, and obtain discount coupons. Doing these activities stimulates users' feelings of satisfaction and joy^{18,23}. Thus, we propose the following hypothesis:

H5a. Mobile media literacy affects satisfaction.

H5b. Mobile media literacy impacts flow.

H5c. Mobile media literacy impacts resistance to change.

Self-efficacy construction was introduced by Bandura in 1977 and is defined as one's judgment of an individual's ability to deal with the events happening around them. The core belief of this concept is that individuals can make changes through their actions^{9, 24} and affect a person's attitude toward and willingness to use technology²⁵. Mobile self-efficacy refers to an individual's belief that he or she is capable of using a mobile device to complete a series of specific operations⁹, such as mobile commerce adoption. Jaradat and Faqih (2014)²⁶ point out that several studies confirm that self-efficacy moderates the positive relationship between perceived joyfulness and mobile shopping behavior. Therefore, we infer that self-efficacy can stimulate users to feel pleasure when using mobile phones for shopping⁴. Self-efficacy not only directly influences resistance but also indirectly through the mediation of anxiety²⁵. Thus, we hypothesize as follows:

H6a. Mobile self-efficacy affects satisfaction.

H6b. Impact of Mobile Self-efficacy on Flow.

H6c. Mobile self-efficacy affects resistance to change.

In Organism The individual believes that the activity itself will produce feelings of happiness and success. Flow is a state of inner enjoyment and absorption in an activity maintained for some time^{2,8}. Flow occurs in the experience with the

perception of pleasure and interest between the individual facing challenges and the skills needed to deal with them^{2,8}. Zhou (2014)¹⁹ found that users are satisfied with mobile payment discounts and payment convenience, so they are not resistant to change. Therefore, perceived enjoyment influences satisfaction²⁷. Flow can lead to user satisfaction, which has been verified in different fields²⁸. and flow experience affected consumers' resistance to change¹⁹ and continuance usage has been validated¹⁹. Thus, we propose the following hypotheses:

H7a. Perceived flow affects satisfaction.

H7b. Perceived flow impacts resistance to change.

Organism- Response Satisfaction is an affective, cognitive, and conative response that is an emotional state. Establishing and maintaining long-term relationships with customers is considered a key factor for an organization²⁹. Satisfaction occurs in consumers' expectations and effects on continued use intention, thus leading individuals to repeat the same activities⁶. Satisfaction has been verified as a determining factor affecting users' continuance usage⁶. Research on mobile services supports the notion that customer satisfaction is positively related to continuous usage⁹. Thus, we propose the following hypothesis:

H8. Perceived satisfaction impacts continuance usage.

Flow indicates a holistic feeling and is a determinant of brand or information system (IS) loyalty³⁰. The significant effect of flow on satisfaction in various contexts (such as using websites, experiencing instant messaging, and online banking) has been verified. Zhou (2014)¹⁹ pointed out that satisfaction and flow influence people's behavior, which is resistance to change use in mobile payment, for the organism's response is continuance usage. Similarly, research on the effect of resistance to change on the continuous use of mobile payments is rare. This study used resistance to change as an organism variable. Thus, we propose the following hypothesis:

H9. Perceived flow impacts continuance usage.

"Resistance to change" refers to any behavior consistent with trying to maintain the status quo, and as insisting on avoiding change, not buying

in, push-back, foot-dragging, criticism, etc.³¹. Sometimes, resistance to change reflects individual loyalty, maintaining the status quo, and hoping for improvement, which depends on consumers' personality, attitudes, and perceived values³². Therefore, in the mobile payment domain, resistance to change occurs when consumers believe they can control the payment, trust the mobile payment system, and enjoy the payment process¹⁹. Thus, we propose the following hypotheses:

H10. Resistance to change impacts continuance usage.

Method

Scale Development

A structured questionnaire was designed and administered as a core methodological approach in psychological research to collect quantitative data from the participants. The questionnaire was developed following established guidelines for survey design, ensuring clarity, validity, and reliability of the measurement instruments. The questionnaire used a 5-point Likert scale from "1 = totally disagree" to "5 = totally agree". All items were adapted from the extant literature with some adjustments based on the research model.

Specifically, we adapted three items of convenience from Ghali (2021)⁹, three items related to security from Zhang et al. (2019)¹⁵ and Ghali(2021)⁹, three items related to compatibility from Hosseini et al. (2016)³³, and three network externality items from Chiu et al. (2013)⁶. Media literacy (three items) was drawn from Schreurs and Vandenbosch (2020)³⁴; mobile self-efficacy (three items) was based on Hosseini et al. (2016)³³; satisfaction (three items) was taken from Hsiao et al. (2016)³⁵; flow (three items) was adapted from Lee et al. (2007b)²⁸ and Zhao et al. (2019)⁷; resistance to change (three items) was also adopted from Hosseini et al. (2016)³³; R oth and Spieth (2019)³²; and continuance (three items) was drawn from Hsiao et al. (2016)³⁵ and Bhattacharjee (2001)³⁶.

As shown in Table 1, the questionnaire was translated into Chinese by a bilingual professional and reviewed by two scholars to ensure its content validity. Furthermore, we conducted a pilot test with 30 samples. The results were used to improve the content validity and wording modification.

Table 1. Measurement Items

Construct	Code	Item	Adapted from
Convenience	CO1	Mobile payment is convenient because I can use it anytime.	Ghali (2021)
	CO2	I want the convenience that mobile payment offer.	
	CO3	I would like to shop at my own pace while using mobile payment services.	
Security	SU1	The mobile payment services have adequate security features	Zhang et al. (2019), Ghali(2021)
	SU2	I feel safe in my transactions with mobile payment services.	
	SU3	I perceive that mobile payment platforms are secure systems to conduct a transaction	
Compatibility	CP1	Mobile payment fits with multiple merchant services.	Hosseini et al. (2016)
	CP2	Mobile payment fits with my habits of life paying and works paying.	
	CP3	Mobile payment can be bound to all kinds of bank cards.	
Network Externality	NE1	I think that most people use mobile payment.	Chiu et al. (2013)
	NE2	More and more merchants will accept mobile payments.	
	NE3	Mobile payment has an extremely large user base.	
Media Literacy	ML1	I can read and understand information on the Internet and distinguish the meanings of different information.	Schreurs and Vandenbosch (2020)
	ML2	I know how to download and forward coupons provided by merchants.	
	ML3	I will use all the functions in the mobile payment APP.	
Mobile Self-efficacy	MS1	I am confident about understanding and using mobile phone payment.	Hosseini et al. (2016)
	MS2	I am confident that I can learn mobile payment	
	MS3	I would be able to operate mobile payment, even if I had never used it before.	
Satisfaction	SF1	I think I made the correct decision in using this mobile payment.	Hsiao et al. (2016)
	SF2	My experience of using mobile payment has been satisfactory.	
	SF3	I am satisfied with the mobile payment I have used.	
Flow	FL1	When I used mobile payment, my attention was focused on the activity.	Lee et al. (2007b); Zhao et al. (2019)
	FL2	When I used mobile payment, I felt in control.	
	FL3	When I used mobile payment, I found a lot of pleasure.	
Resistance to change	REC1	Changing mobile payment seems like a real hassle to me.	Hosseini et al. (2016) ; R�oth and Spieth (2019)
	REC2	I fear certain changes mobile payment may impose on me.	
	REC3	It is unlikely that I can change to mobile payment shortly.	
Continuance usage	CU1	I intend to continue using mobile payment in the future.	Hsiao et al. (2016); Bhattacharjee (2001)
	CU2	I will always try to use mobile payment in my daily life.	
	CU3	I will keep using mobile payment as regularly as I do now.	

Sample and Data Collection

Alibaba, the largest e-commerce market leader, launched Alipay in 2004 with transaction failures. In 2013, the largest social media app, WeChat, launched an m-payment system for its established customer base.

Therefore, we designed questionnaires through Sojump, the largest survey platform in China, and distributed the questionnaires to users of WeChat in the form of QR codes or links, inviting them to fill in the questionnaires, and 524 valid samples

were collected.

The respondents' demographic characteristics are presented in Table 2. The information is summarized as follows: 296 were male (56.49%) and 228 were female (43.51%); 247 (47.14%) were between 20 and 30, 150 (28.63%) were between 31 and 40, and 127 (24.23%) were more than 40 years old. All participants had experienced m-payment users for years. Our sample profile is similar to that of previous studies; therefore, it is suitable for this empirical study.

Table 2. Sociodemographic characteristics of the sample

Measure	Items	Frequency	Percentage
Gender	Male	296	56.49
	Female	228	43.51
Age	20-30	247	47.14
	31-40	150	28.63
	> 40	127	24.23
Education	Junior High	11	2.1
	High school	50	9.54
	Bachelor's Degree	340	64.89
	Master's Degree or above	123	23.47
Frequency of Mobile payment	Almost everyday	524	100

Data Analysis and Results

Validity and reliability of the measurement model This study used SPSS 24.0 and AMOS for the analysis of the data. The SEM-AMOS is suitable for measuring the goodness of fit of the proposed models and testing the hypotheses. The first-order reflex structure of the model was tested by evaluating the convergence validity and

discriminant validity. It is generally judged by mean variance (AVE > 0.5) and comprehensive reliability (CR > 0.7). The results of the data analysis are shown in Table 3, and good convergent and discriminant validity were obtained (Table 4). Factor analysis was carried out using SPSS, and the results were KMO and Bartlett's test: 0.934, df:435; Sig: 0.000 ≤ 0.001.

Table 3. Measurement model results

Construct	Items	Loadings	Composite reliability	AVE
Convenience	CO1	0.794	0.843	0.642
	CO2	0.82		
	CO3	0.791		
Security	SU1	0.864	0.89	0.73
	SU2	0.823		
	SU3	0.87		
Compatibility	CP1	0.844	0.873	0.6963
	CP2	0.842		
	CP3	0.817		

Network Externality	NET1	0.878	0.9	0.75
	NET2	0.827		
	NET3	0.899		
Media Literacy	ML1	0.769	0.857	0.664
	ML2	0.844		
	ML3	0.834		
Mobile Self- efficacy	MS1	0.805	0.88	0.71
	MS2	0.835		
	MS3	0.892		
Satisfaction	SF1	0.865	0.89	0.73
	SF2	0.848		
	SF3	0.854		
Flow	FL1	0.839	0.87	0.7
	FL2	0.874		
	FL3	0.795		
Resistance to change	REC1	0.648	0.77	0.55
	REC2	0.529		
	REC3	0.969		
Continuance usage	CU1	0.84	0.88	0.7
	CU2	0.835		
	CU3	0.839		

Table 4. Discriminant validity results

	CU	REC	FL	SF	MS	ML	NET	CP	SU	CO
CU	0.85									
REC	0.55	0.74								
FL	0.63	0.61	0.84							
SF	0.64	0.42	0.71	0.85						
MS	0.59	0.52	0.64	0.75	0.84					
ML	0.53	0.55	0.63	0.53	0.58	0.66				
NET	0.59	0.41	0.54	0.67	0.66	0.54	0.87			
CP	0.56	0.4	0.49	0.5	0.58	0.45	0.61	0.54		
SU	0.47	0.5	0.6	0.58	0.55	0.55	0.45	0.47	0.854	
CO	0.59	0.37	0.49	0.63	0.64	0.53	0.6	0.55	0.453	0.8

Note: CU=Continuance usage; REC=Resistance to change; FL=Flow; SF=Satisfaction
MS=Mobile Self-efficacy; ML=Media Literacy; NET=Network Externality; CP=Compatibility
SU=Security; CO=Convenience

Common Method Variance

The contents of the questionnaire may cause co-variability due to various factors, so it is necessary to use statistical methods to check for common method bias (CMB). We performed this test as a factor analysis using SPSS, in which all items were loaded with a threshold to attain one factor.

The results showed that a single factor contributed 34 % of the total variance extracted, which was well below 40 %. This confirms that CMB is not a major concern of this study³⁷. Pearson correlation coefficients were used to verify the multicollinearity of the items in our study. A correlation between the items lower than 0.7 indicated the item's multicollinearity was good³⁸.

The results of the analysis supported the hypotheses: the correlation between items FTF and SM was 0.55, that between FTF and e-WOM was 0.53, and that between SM and e-WOM was 0.49, showing moderate ($0.3 < r > 0.69$) results for correlation classification³⁸. Thus, the results indicate that multicollinearity was not a serious issue in this study.

Structural Equation Modeling Results

Structural equation modeling using the maximum likelihood method was applied to test the hypotheses. The results show good model fits in

Table 5, and Figure 2 illustrates the hypothesis testing results in terms of main path coefficients and explained endogenous variables' variance (R²). This study proposed a specific mediating relationship model that integrates six antecedents to explain 72% of satisfaction, 56% of flow, and 44% of resistance to change. Finally, it explains 54% of the continuous use of mobile payments. The results partially support H1, H3, H4, and H6. Thus, H2, H5, H7, and H8 are fully supported. The results of the hypothesis testing are summarized in Table 6.

Table 5. Goodness-of-fit Measurements and structural Models

Statistical check	Goodness-of-fit criteria	Measurement model	Structural model	Result
$\chi^2/d.f.$	<3	2.26	2.11	Good
GFI	>0.9	0.905	0.95	Good
NFI	>0.9	0.917	0.951	Good
CFI	>0.9	0.951	0.973	Good
IFI	>0.9	0.952	0.973	Good
RFI	>0.9	0.901	0.937	Good
TLI	>0.9	0.942	0.966	Good
PGFI	>0.5	0.714	0.667	Good
PCFI	>0.5	0.803	0.763	Good
PNFI	>0.5	0.773	0.746	Good
RMR	<0.08	0.035	0.027	Good
RMSEA	<0.08	0.049	0.046	Good

Table 6. Testing results of hypotheses

Hypothesis		P-Value	Result
Hypotheses 1a	CO → SF	***	Supported
Hypotheses 1b	CO → FL	0.708	No supported
Hypotheses 1c	CO → REC	0.399	No supported
Hypotheses 2a	SU → SF	0.002**	Supported
Hypotheses 2b	SU → FL	***	Supported
Hypotheses 2c	SU → REC	0.036 *	Supported
Hypotheses 3a	CP → SF	0.037 *	Supported
Hypotheses 3b	CP → FL	0.186	No supported
Hypotheses 3c	CP → REC	0.157	No supported
Hypotheses 4a	NET → SF	***	Supported
Hypotheses 4b	NET → FL	0.2	No supported
Hypotheses 4c	NET → REC	0.574	No supported
Hypotheses 5a	ML → SF	0.018*	Supported
Hypotheses 5b	ML → FL	***	Supported
Hypotheses 5c	ML → REC	***	Supported
Hypotheses 6a	MS → SF	***	Supported
Hypotheses 6b	MS → FL	***	Supported

Hypotheses 6c	MS → REC	0.1	No supported
Hypotheses 7a	FL → SF	***	Supported
Hypotheses 7b	FL → REC	***	Supported
Hypotheses 8	SF → CU	***	Supported
Hypotheses 9	FL → CU	0.004 **	Support
Hypotheses 10	REC → CU	***	Support

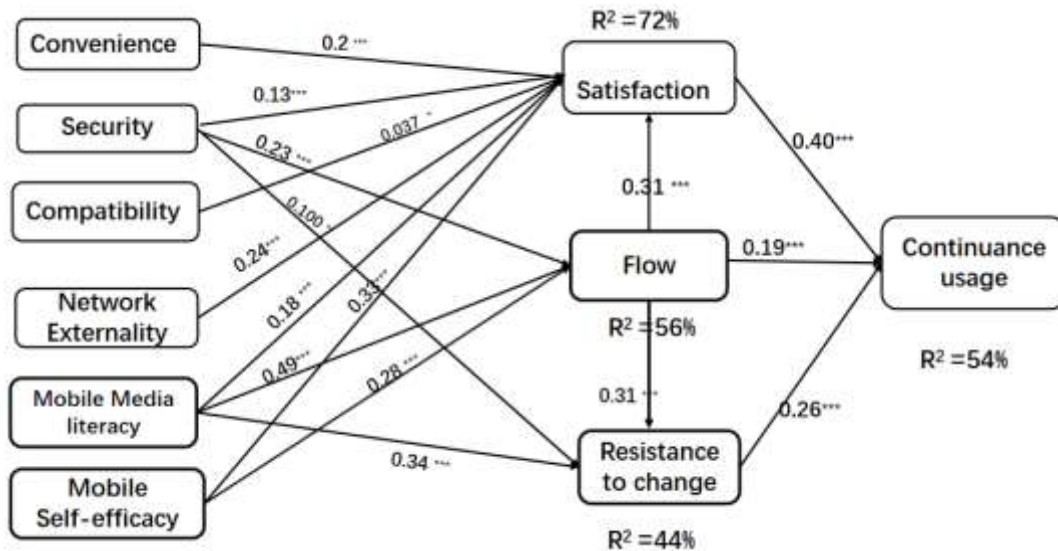


Figure 2. Path coefficients of the structural model

Discussion

In an e-commerce context, maintaining an app’s continuance usage is a challenge and the main concern of app providers. However, few studies have been conducted on this issue, and continuous app usage is a complex and ambiguous phenomenon. In this context, based on the “stimulus-organism-response” framework, this study aims to understand how in-platform factors and device-related factors trigger users’ psychological process change (e.g., satisfaction, flow, and resistance to change) and indirectly drive their app continuance usage. Six stimulus factors were identified: convenience, security, compatibility, network externality, media literacy, and mobile self-efficacy. An empirical study was conducted using a questionnaire. The sample randomly acquired 524 respondents from a large number of mobile payment users. The findings of this study are noteworthy.

First, the findings indicate that convenience, security, compatibility, network externality, media literacy, and mobile self-efficacy increase satisfaction, which is consistent with the findings of previous research¹⁹. Thus, convenience,

security, compatibility, and network externality are the basic and necessary features for attracting consumers to use an app. However, convenience, compatibility, and network externality do not affect flow and resistance to change. This may be because these are the most basic common features of mobile payment apps, and there are no unique features that cause emotional or cognitive changes in the users’ inner processes.

Second, security, media literacy, and mobile self-efficacy affect flow, which is similar to the findings of previous studies^{13,18,26}. It is not difficult to understand that users can easily enter the flow state when they perceive the safety of the app, that is, they feel happy when operating the mobile app and do not feel the passage of time. Security and media literacy affect resistance to change, which differs from the findings of a previous study.

Our findings show that the strongest positive factor for m-payment continuance is satisfaction, following resistance to change and flow. Not surprisingly, users’ overall satisfaction with in-platform services, savvy mobile knowledge, and degree of device familiarity have a positive impact on their m-payment continuance, which is

supported by McLean *et al.* (2018)³⁹ and Chiu *et al.* (2013)⁶, who suggest that some actions should be taken to improve users' satisfaction, habit, and flow. We then discuss useful actions that should be conducted based on external stimuli.

Summary and Conclusions

We used the SOR model to examine the joint effects and interactions between satisfaction, flow, resistance to change, and continuance. Our research exhibits more complete constructions to explain mobile payment continuance. Theoretically, this study contributes to the literature by providing a comprehensive model that examines leading m-payment gateways and users' media literacy and that device capabilities influence their continuance intentions in a cashless society.

We believe that prior drivers contributed to experienced consumer responses based on satisfaction as a mediator of continuance usage. Once experienced users accept m-payment as an alternative to cashless payments such as credit, debit, and value-stored cards, they will reject changing their cashless life in the future. Thus, two mediators of flow and resistance to change were integrated from previous studies to reflect users' pleasure and self-control of the m-payment ecosystem, which expands the research breadth of intermediary variables on continuance usage, especially in the field of cashless society.

In the context of the pandemic, our study highlights the importance of media literacy and self-efficacy, which leads to a new direction of mobile device features for add-on communications with transactions or vice versa. We expect that future mobile payment providers will provide apps and processes that consider users' required skills.

Theoretical Contributions

Extension of the S-O-R Framework to Post-Adoption Behavior

Prior research has predominantly applied the SOR model to initial adoption contexts, such as technology acceptance or short-term usage. By focusing on continuance usage, this study shifts its theoretical lens to post-adoption behavior, addressing a critical gap in the mobile payment literature. The integration of psychological mediators—satisfaction, flow, and resistance to

change—demonstrates how external stimuli (e.g., security and media literacy) dynamically interact with users' internal states to drive long-term retention. This expands the applicability of the S-O-R model beyond adoption to encompass sustained engagement, offering a holistic framework for understanding user behavior across the entire lifecycle of mobile payment usage.

Identification of Novel Mediators and Stimuli

This study introduces media literacy and mobile self-efficacy as critical stimuli within the SOR framework, which are factors underexplored in prior mobile payment research. These constructs reflect the evolving digital ecosystem, where users' ability to navigate information and execute transactions confidently shapes their psychological response. Additionally, the dual role of resistance to change as both an organismic state and a mediator bridges behavioral inertia theories with the S-O-R paradigm. By validating these variables, this study enriches the model's explanatory power, providing a nuanced understanding of how cognitive and emotional states (e.g., flow and resistance) translate stimuli into sustained behavioral outcomes.

Contextual Refinement of the S-O-R Model

These findings reveal context-specific nuances that refine the assumptions of the S-O-R model. For instance, while convenience, compatibility, and network externalities significantly impact satisfaction, they exhibit limited direct effects on flow and resistance to change. This suggests that in mature mobile payment ecosystems, such as China's cashless society, foundational features (e.g., convenience) become baseline expectations rather than drivers of emotional engagement. Conversely, security and media literacy emerged as pivotal stimuli for flow and resistance, highlighting the role of trust and digital competence in sustaining usage. These insights recalibrate the SOR model for mobile payment contexts, emphasizing the need to differentiate between hygiene factors (e.g., convenience) and differentiators (e.g., security) in shaping continuance intentions.

Collectively, this research extends the SOR model to a critical yet underexplored phase of user behavior, but also redefines its components to align with the complexities of modern digital transactions. By integrating novel variables and

contextual insights, this study provides a robust theoretical foundation for future investigations of post-adoption dynamics across technology-driven domains.

This study pioneers media literacy as a critical stimulus in S-O-R, reflecting digital competence's role in sustaining payment usage.

Practical implications

The findings of this study offer several actionable recommendations for mobile payment app providers, particularly for enhancing user retention and continuance usage. These recommendations are grounded in empirical evidence that convenience, security, compatibility, network externalities, media literacy, and self-efficacy significantly influence user satisfaction, flow, and resistance to change, which in turn drive continuance usage. Below, we outline the specific design and marketing strategies that app providers can implement to leverage these findings.

User satisfaction is a critical mediator of the continuous usage of mobile payment apps. To enhance satisfaction, app providers should focus on optimizing the convenience and compatibility of their platforms. A streamlined user interface (UI) design is essential; simplifying the interface to reduce cognitive load and making the payment process as seamless as possible can significantly enhance perceived convenience. For instance, integrating one-click payment options and minimizing the number of steps required to complete a transaction can make an app more user-friendly. In addition, it is crucial to ensure cross-platform compatibility. The app should function smoothly across various devices and operating systems, including iOS and Android, and be optimized for different screen sizes. Compatibility with other frequently used apps such as e-commerce platforms and social media can enhance user satisfaction by creating a more integrated experience. Furthermore, implementing personalization features such as customizable dashboards, preferred payment methods, and tailored notifications can enhance the perceived value of the app, leading to higher satisfaction levels.

Security is another pivotal factor influencing both satisfaction and flow. Users must feel confident that their financial and personal information is

secure when using mobile payment apps. Transparent security protocols are essential; clearly communicating security measures in place, such as encryption, two-factor authentication, and fraud-detection systems, can reinforce user trust, and design security pop-ups with real-time encryption icons to enhance trust. Providing real-time security alerts and updates can further bolster confidence. Additionally, offering educational content within the app to inform users about the best practices for securing their accounts, such as creating strong passwords and recognizing phishing attempts, can empower users and contribute to their overall satisfaction and flow experience. Regular security audits and updates are also necessary to ensure that the app remains resilient against emerging threats, and publicizing these efforts can further enhance user confidence on the platform.

Network externalities play a significant role in user satisfaction and continuous usage. The more users and merchants there are on the platform, the more valuable it becomes. To leverage this, app providers should form strategic partnerships with a wide range of merchants to expand the utility of the app. Offering exclusive deals or discounts through the app can incentivize users to continue using the platform. Implementing referral programs that reward users to bring new users and merchants to the platform can also accelerate network growth and enhance the app's perceived value. Additionally, creating a sense of community among users by integrating social features such as user reviews, ratings, and forums can enhance user engagement and foster a loyal user base.

Media literacy and self-efficacy are critical factors that influence user satisfaction and flow. App providers should focus on enhancing the users' ability to navigate and utilize apps effectively. Interactive tutorials and guides within the app can help users understand their features and functionalities, reduce the learning curve, and enhance their confidence. Robust customer support, including live chat, FAQs, and video tutorials, ensures that users can easily access help when needed, thereby significantly enhancing their self-efficacy and overall satisfaction. Incorporating gamification elements, such as badges, rewards, and progress tracking, can make the learning process more engaging, further

enhancing users' media literacy and self-efficacy, while increasing their enjoyment of the app.

Flow, characterized by a state of deep engagement and enjoyment, is a key driver of continuance usage. App providers should design experiences that motivate users and keep them engaged. Intuitive navigation is essential to ensure that the app's navigation is user-friendly, and reducing friction points can enhance the flow experience. Incorporating interactive features, such as animations, feedback mechanisms, and real-time updates, can create a more dynamic and engaging user experience. Additionally, using data analytics to personalize content and recommendations based on user behavior and preferences can create a more immersive and enjoyable experience, enhancing the flow state of users.

Resistance to change is a significant barrier to their continuous usage. App providers should implement strategies to mitigate resistance and encourage their long-term adoption. Incentivization, such as offering discounts, cashbacks, or loyalty points, can encourage users to continue using the app and help them overcome initial resistance. Establishing mechanisms for collecting and acting on user feedback demonstrate that user input is valued and acted upon, which can reduce resistance and enhance user loyalty. Implementing a gradual onboarding process that introduces users to the app's features over time can also reduce overwhelming and make the transition to using the app more manageable.

The findings of this study provide a robust foundation for mobile payment app providers to enhance user retention and continuance usage. By focusing on convenience, security, compatibility, network externalities, media literacy, and self-efficacy, app providers can create a more satisfying and engaging user experience. Implementing the specific design and marketing strategies outlined above can help app providers not only attract new users, but also retain existing ones, ensuring long-term success in the competitive mobile payment market.

Limitations and future research

Our study has some limitations. First, the data used to evaluate the research model comes from a relatively mature cashless society during the COVID-19 pandemic. The degree of mobile

penetration rate, values, cultural differences, social influences, infrastructure, and other factors may cause different findings, so we suggest further research to re-examine these issues. Second, our sample aged under 40 years is a relatively younger generation than other aged societies in Japan, Taiwan, and Europe. Further research should be based on these studies to investigate the factors that affect service quality.

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