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Gamification in Mobile Payment: An Empirical Investigation

Completed Research Paper

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Abstract

Mobile payment has evolved from a basic payment method into a community that provides a variety of value-added services. These services are meant to encourage continuous use by enhancing the value and experience of the fundamental payment services. This paper investigates the effects of gamification on the sustained usage of mobile payment. Using a sample of 323 Alipay Ant Forest users collected through online questionnaires, we find that gamification has a strong and direct impact on the continuous use of mobile payment. Interestingly, despite the fact that gamification also positively influences flow experience, flow experience derived from gamification has no significant impact on continuous use. Despite the fact that gamification provides an enjoyable and immersive experience and raises users' awareness of the mobile payment app, it appears that the key utilitarian value of the app is still a payment tool with a focus on its convenience, security and versatility.

Keywords: Mobile Payment, Gamification, Flow Experience, Continuous Use

Introduction

With the proliferation of smartphones and an increasing level of digitalization in the world, mobile payment, a payment method that facilitates payment transactions for goods, services, and bills via mobile devices (Dahlberg et al., 2008), has grown in popularity across a variety of consumption scenarios (Khayer and Bao, 2020). In many countries and regions, mobile payment has evolved beyond a simple financial tool, diversified services have been integrated into mobile payment apps to attract users and encourage sustained use (Putri et al., 2019; Yuan et al., 2020). Recently, service platforms are increasingly integrating games into their apps to enhance user experiences (Wong et al., 2022). For example, Alipay has integrated the Ant Forest games into its app, allowing users to enjoy the interactive features and contribute to the eco-friendly initiatives promoted by the game. As competition between the platforms intensifies, it appears that providing more values to create long-term relationships with users has become a new challenge for the

mobile payment industry and a critical factor of success for maintaining sustained growth (Yuan et al., 2020).

Prior studies have conventionally categorized the perceived benefits of utilizing mobile payment into three principal aspects: utilitarian, hedonic, and social values (Cocosila and Trabelsi, 2016). However, current research has mainly focused on investigating how utilitarian factors affect the continuous adoption of mobile payment (e.g., Ashraf et al., 2019; Chen et al., 2019; Yang and Han, 2021). There is still a lack of comprehensive research that explores the collective influence of hedonic and social values on the sustained use of mobile payment. The impact of gamification has recently attracted the attention of academics, with previous research indicating that gamification can improve user engagement and experience, leading to increased stickiness and continuous use (Zhang et al., 2023). Gamification in mobile payment provides users with a new experience. High-quality game design, user interaction and collaboration, and rewards can significantly increase their interest in the game and thus encourage continuous use. However, the role of gamification in the mobile payment context has not been adequately studied, and it is still unclear how gamification influences behavioral intention in a predominantly utilitarian context. Prior research has examined the impact of gamification in various contexts, such as mobile commerce (Yu and Huang, 2022, Malfouz et al., 2020), online shopping (Hsu et al., 2013), and mobile social network service (Gao and Bai, 2014), and gamification exerted a positive influence on sustained use directly or indirectly through users' value perceptions, attitude, satisfaction. While there is still a lack of research in the context of mobile payment, particularly there is a notable research gap in investigating the impact of flow experience on the relationship between gamification and behavioral intention. In addition, socially benevolent and environmentally friendly activities in sustainable marketing have become a significant area of study (Whittaker et al., 2021), and have a growing impact on the competitiveness and vision of businesses (Kotler and Armstrong, 2013). However, existing literature in the context of mobile payment has rarely explored this topic. Since the audience for mobile payment is comprised of mass consumers, it is possible that socially beneficent activities and a selfless image of mobile payment services could foster positive brand perceptions and increase repeated use. Therefore, the focus of this paper is on Alipay's Ant Forest, a mobile payment game that promotes public welfare. Furthermore, existing research has predominantly examined individual innovativeness as a consolidated construct (e.g., Liébana-Cabanillas et al., 2018; Yang et al., 2012), with limited attention given to the influence of specific personality traits on the acceptance of new information technology (Zhou and Lu, 2011). Therefore, this study seeks to bridge this gap in the literature by addressing the following research questions:

RQ1: Based on the value perspective, what are the gamification elements in the context of mobile payment and how does gamification in mobile payment influence continuous use?

RQ2: From the experiential perspective, how does flow experience affect the relationship between gamification and continuous use?

RQ3: How does the heterogeneity of users' personality traits affect the above relationships?

This study aims to establish a research model that examines the correlation between gamification and the continuous use of mobile payment, while also exploring the impact of flow experience and personality traits. Through this research, we contribute to both the theoretical and practical aspects of mobile payment's continuous use and shed light on the impact of gamification on mobile payment adoption and the significance of flow experience in promoting long-term engagement. These findings can assist service providers in optimizing their product and service offerings by catering to the needs of the general public, retaining existing customers, and ensuring sustained growth.

Literature Review

Recent Mobile Payment Studies

The current body of literature on mobile payment adoption primarily relies on theoretical models of Information Systems (IS) adoption. Numerous studies have demonstrated the positive impact of mobile payment attributes on adoption (Dahlberg et al., 2015; Gao and Waechter, 2017; Yuan et al., 2020). In line with Cocosila and Trabelsi (2016), the perceived value of mobile payments encompasses utilitarian, hedonic, and social values. The utilitarian value not only provides convenience by liberating consumers from temporal and spatial restrictions and allowing them to shop and process payment transactions anytime and anywhere (Zhou, 2013a; Schierz et al., 2010), but it also replaces coins, which increases

payment speed, saves time, and greatly simplifies the payment process (Chen, 2008). While social value refers to the connectivity provided by mobile payment apps, which facilitates the sharing of shopping-related information, experiences, opinions, and feedback (Stone, 2012). Hedonic value refers to the perceived enjoyment derived from the user experience, such as the games embedded in mobile payment apps and the interactivity between users, which enhances the gaming experience.

Prior research has distinguished two distinct phases of mobile payment adoption: initial adoption and continuous use (Humbani and Wiese, 2019). Initial adoption refers to the period when consumers accept mobile payment for the first time and have their first experience with it, whereas continuous use refers to the period after adoption when consumers use it repeatedly (Cao et al., 2018). Dahlberg et al. (2015) found that during the early stages of mobile payment adoption, users prioritize utilitarian values. Specifically, the perceived ease of use (PEOU) and perceived usefulness (PU) from the Technology Acceptance Model (TAM) (Davis, 1989) were identified as the top two influential factors. This suggests that users place significant importance on the practicality and functionality of mobile payment services when initially engaging with them. Although initial adoption is regarded as the premise for continuous use, the two are conceptually different because they correspond to two distinct usage periods. Furthermore, according to Yang et al. (2012) and Khayer and Bao (2020), the primary motivating factors for initial users are ease of use, compatibility, safety, and cost, whereas current users are more concerned with the usefulness of payment services and have higher risk perceptions, such as security and privacy concerns, due to the value-added services (Yang et al., 2012; Zhang et al., 2019). However, Wu et al. (2017) suggested that users' perception of utilitarian value could lead to a significant reduction in their risk perceptions during continuous use.

Extant literature has abundant studies on the initial use of mobile payments, while there is still a lack of studies on continuous use. Although PU and PEOU are still commonly used in studies on continuous use (e.g., Bae et al. 2021; Wong et al. 2022; Yang et al. 2017), and trust remains a key factor, users have higher expectations for value-added features, service quality, and experiences. Gao and Bai (2014), Ashraf et al. (2019), and Yang and Han (2021) examined the continuous use of mobile applications, and their findings suggested that hedonic values had a greater influence on continuous use than utilitarian values. Previous studies by Zhou (2013a), Khayer and Bao (2020), Humbani and Wiese (2019), and Cao et al. (2018) underscored the importance of satisfaction and its role in moderating continuous use. Additionally, Gao and Bai (2014) and Jamshidi et al. (2018) highlighted the influence of flow experience on trust, satisfaction, and its direct impact on continuous use. However, current research on the continuous use of mobile payment remains limited to utilitarian values, with a scarcity of studies on the hedonic and social values and their interactive effects.

Gamification

The concept of gamification was first introduced by Zichermann and Linder (2010) and is framed as "the art and science of transforming customer's daily interactions into games that serve your business purpose. (p. 20)" Prior literature has conceptualized the key elements of gamification, but with various distinguishing criteria. Palmer et al. (2012) proposed four different elements of gamification: (1) a state of progression that includes rules, difficulty, and complexity; (2) feedback and rewards; (3) social connections that promote group dynamics; and (4) interfaces and user experiences driven by aesthetics, integration, usability, and fun. Particularly, prior literature highlighted that the reward elements of gamification consist of two dimensions: self-directed reward and altruistic reward. Self-directed reward is designed to benefit the user themselves, whereas in contrast; altruistic reward is designed to benefit others. In addition, looking through the lens of service quality, Hu et al. (2021) conceptualized gamification with content quality and system quality in the context of social live streaming services (SLSS).

Since 2010, gamification has gained research attention in various scenarios (Yang et al., 2017), such as advertising (Bittner and Shipper, 2014), mobile banking (Çera et al., 2020; Baptista and Oliveira, 2017), retail marketing (Hwang and Choi, 2020), service marketing (Yang et al., 2017), and sustainable marketing (Wang and Yao, 2020; Whittaker et al., 2021), while current knowledge is still quite limited with regard to the impact of gamification in the context of mobile payment. Gamification in mobile payment refers to the application of game-design mechanics and elements to mobile payment systems in order to engage users and increase their frequency of use and satisfaction. Zhang et al. (2023) identified four gamification elements (rewards, competition, feedback, and cooperation) and found that they have direct and positive effect on user engagement. Furthermore, Putri et al. (2019) introduced three types of gratifications associated with gamified mobile payment: hedonic gratification (e.g., enjoyment, time passing), utilitarian

gratification (e.g., ease of use, self-presentation, information quality, financial rewards), and social gratification (e.g., socialization value). They further posited that utilitarian gratification holds the greatest significance among these factors.

Flow Experience

The concept of flow refers to a highly engaging experience characterized by complete immersion in an activity (Csikszentmihalyi and Csikszentmihaly, 1990). According to Flow theory (Csikszentmihaly and Csikszentmihaly, 1990; Csikszentmihalyi, 1996), this state requires an individual's concentration, interest, and enjoyment in a given activity. In the context of mobile payment, concentration pertains to users' focused attention when engaging with games integrated within the app. Interest refers to the appeal of games integrated within payment applications, providing the foundation for continuous motivation (Deci and Ryan, 1987). Perceived enjoyment defines user's pleasure generated by integrating games into the mobile payment application. Flow experience has garnered considerable research interest in the study of continuous behavior, as it is intrinsically rewarding and people endeavor to replicate such immersive experiences (Nakamura and Csikszentmihalyi, 2002). Zhou's (2013a) research on the continuous use of mobile payment revealed that flow acted as a mediator between perceived information and service quality and continuous use. Similarly, Jamshidi et al. (2018) found that flow mediated the relationship between utilitarian and hedonic values and the continuous use of mobile banking. However, other studies have reached contradictory conclusions, with McLean et al. (2021) observing that flow may induce negative attitudes toward continuous use due to time-wasting. Mahfouz et al. (2020) also concluded that the flow experience might contribute to procrastination and time-wasting on the Internet, which could delay purchase decisions and reduce purchase likelihood.

Personality Traits

The Five Factor Model (FFM) (Digman, 1990; Goldberg, 1992) is widely used to analyze individual personality traits. FFM divides personality into five dimensions: extraversion, agreeableness, openness, conscientiousness, and neuroticism. Previous research has explored the influence of these traits on gamification and usage behavior across different contexts. In the online environment, extraverted individuals were found to enjoy online games (Buckley and Doyle, 2016), but they were negatively associated with smartphone addiction (Cho et al., 2017). Agreeableness emerged as a significant personality trait in terms of the frequency and duration of using mobile games (Seok and DaCosta, 2015). Openness to novel experiences was positively linked to the use of gamified online services and mobile gaming behavior (Triantoro et al., 2020; Seok and DaCosta, 2015). Conversely, individuals with higher conscientiousness scores were found to be less driven by gamification elements in online learning environments (Buckley and Doyle, 2016). Additionally, conscientious users of mobile payment platforms prioritized security and expressed greater scrutiny of game interface and feedback design (Zhang et al., 2019). Neuroticism positively moderated the effect of gamification on perceived enjoyment and concentration (Triantoro et al., 2020), and individuals with higher neuroticism tendencies were more prone to smartphone addiction (Cho et al., 2017). While previous research has explored the impact of personality traits in various contexts, limited knowledge exists regarding the influence of these traits on the continuous use of mobile payment.

Research Model and Hypotheses Development

This study integrates Flow theory, gamification concepts by Palmer et al. (2012) and Hu et al. (2021), and the FFM model to propose a research model. Figure 1 illustrates that gamification in mobile payment has a direct impact on users' intentions to continue using mobile payment services. Flow experience mediates the relationship between gamification and continuous use. The two personality traits, namely agreeableness and openness, moderate the influence of gamification on the flow experience and continuous use.

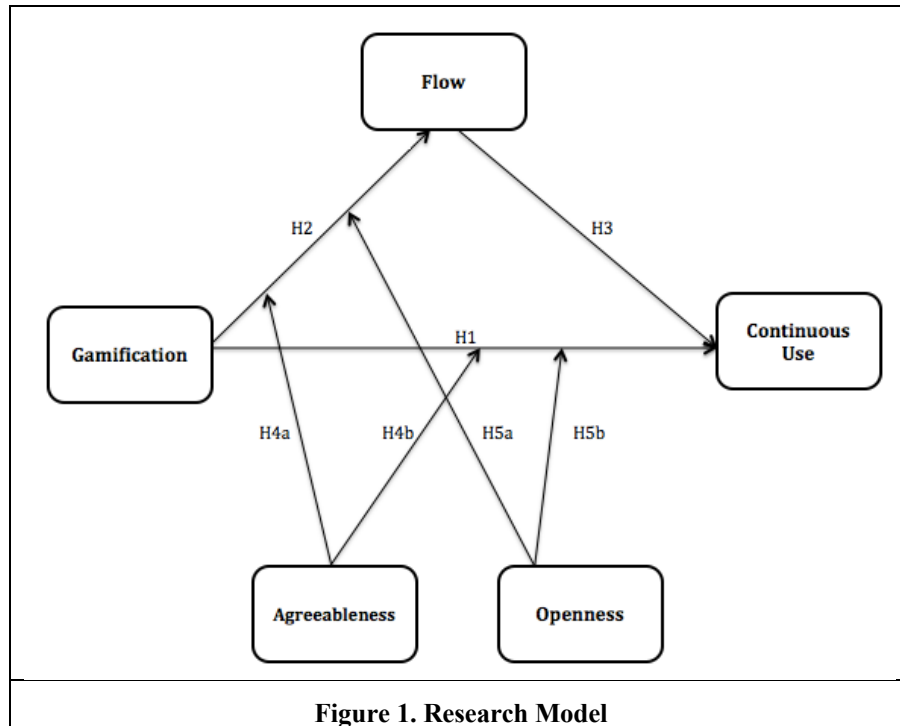


Figure 1. Research Model

Gamification and Continuous use

In this study, gamification of mobile payment app is conceptualized with four dimensions: content quality, system quality, social interaction, and altruistic reward. Content quality pertains to the degree to which game design principles and techniques are effectively employed to create engaging, meaningful, and useful mobile payment stream content, fostering interactive and immersive experiences. System quality, as defined by Hu et al. (2021), encompasses the overall performance and functionality of a system, as perceived by individual users. Social interaction refers to the extent to which players of Ant Forest engage in communication, cooperation, and competition within the game (Liu et al., 2011; Miller et al., 2016). Altruistic reward signifies that users can convert and donate reward points provided by service providers to public welfare programs, promoting benevolent activities through mobile payment participation. It is evident that a mobile payment app with gamification features can enhance user engagement by fulfilling their hedonic and social desires through interactive content, exciting challenges, rewarding experiences, and incentives. Baptista and Oliveira (2017) found that gamification increased engagement and satisfaction with mobile banking, while Dzandu et al. (2022) highlighted the social value that gamification brings to mobile payment. Other literature also supports the positive impact of gamification on user engagement and behavioral intention for mobile payment (Wong et al., 2022; Putri et al., 2019). Therefore, we propose:

H1: Gamification in mobile payment applications is positively associated with the intention of continuous use of mobile payment.

Gamification and Flow Experience

Extant literature demonstrates that the hedonic features of mobile banking services can create a flow experience for users, and that this effect is augmented by interactivity (Jamshidi et al., 2018; Koufaris, 2002). Moreover, the direct impact of gamification on flow experience is supported by additional evidence. For instance, Jamshidi et al. (2018) investigated the effects of flow experience on mobile banking and found that hedonic value had a direct influence on the occurrence of flow experience. Similarly, Triantoro et al. (2020) found that gamification was strongly associated with perceived enjoyment and attention focus - two critical dimensions of flow experience. High-quality game content and system design play a pivotal role in determining users' interest in the gamified mobile payment apps and enhancing the fluency and enjoyment of user experience. Additionally, the interactivity and rewards offered by gamification can increase users' interest, concentration, and enjoyment, which are essential factors for flow experience to emerge. Therefore, we hypothesize that:

H2: *Gamification in mobile payment applications positively influences users' flow experience.*

Flow Experience and Continuous use

Previous research has generally supported a positive relationship between flow and continuous use (Mahfouz et al., 2020), as flow has a direct effect on customer engagement. A gamified app makes users more engaged and focused when using it, which increases their cognitive and emotional engagement with the app and, as a result, increases the app's user stickiness relative to competing alternatives. Whittaker et al. (2021) investigated the effect of gamification on sustainable marketing, and their findings provided substantial evidence that flow significantly influenced customer engagement. Gao and Bai (2014) conducted a study on the continuous adoption of mobile social network services in China, finding that flow experience had a substantial influence on sustained use. Lastly, Hsu et al. (2013) investigated the e-loyalty behavior in Taiwan, revealing that the flow experience had a notable impact on both customer satisfaction and engagement. Integrating gamification into a payment app can therefore considerably enhance user engagement and loyalty by increasing cognitive and emotional involvement. However, users may become too absorbed in the game and overlook the primary purpose of the app as well, leading to potential delays in payment processing. In our study, it is assumed that the flow experience exerts a positive impact on continuous use. Therefore, we predict the following:

H3: *Flow experience positively influences users' intentions to continue using mobile payment.*

Moderating Roles of Agreeableness and Openness

Considering the impact of individual personality variations on consumer behavior, it is expected that users with diverse personality traits will have distinct perceptions of gamified mobile payment, consequently influencing their level of engagement and overall experience (Triantoro et al., 2020). Our model is based on the two dimensions of the FFM model, namely agreeableness and openness, and excludes the other three because they are less likely to influence the utilization of gamified mobile payment. The agreeableness of a person reflects their care for society as a whole. We hypothesize that individuals with a greater level of agreeableness are more optimistic, sociable, friendly, cooperative, and caring (Digman, 1990; Goldberg, 1992). As a result, they are more likely to be interested in and appreciate the benevolent games embedded in mobile payment. In contrast, individuals with lower agreeableness tend to be more antagonistic, sardonic, and callous, and are perceived as more self-centered (Digman, 1990; Goldberg, 1992). As a consequence, their experience and engagement with mobile payment games may be negatively impacted. Therefore, we suggest the following:

H4a: *User's agreeableness personality positively moderates the effect of gamification in mobile payment on flow experience.*

H4b: *User's agreeableness personality positively moderates the effect of gamification on the intention to continue using mobile payment.*

Likewise, users with a higher level of openness personality tend to be more imaginative, aesthetic, emotionally intelligent, and inquisitive, as well as more creative and inquisitive in their pursuit of new experiences (Digman, 1990; Goldberg, 1992). As a result, they are more likely to attempt the games and become immersed in them, leading to an increase in the use of mobile payment apps. Users with a reduced level of openness are more reluctant to use new technological products (Digman, 1990; Goldberg, 1992). As a result, we anticipate that they will be less interested in mobile payment games, which will have an effect on their experience and intention to engage. Therefore, we hypothesize:

H5a: *Users' openness to new experiences positively moderates the effect of gamification in mobile payment on flow experience.*

H5b: *Users' openness to new experiences positively moderates the effect of gamification on the intention to continue using mobile payment.*

Research Method

Research Context

This study focused on Ant Forest, a charity-based mobile game released by the Alipay mobile app in August 2016. In this game, users who complete specific task assignments such as low-carbon travel, online payment of daily utility bills, online booking and shopping, etc. are rewarded with virtual "green energy" that can be

redeemed to plant a virtual tree in their games. The Ant Forest game also incorporates social elements that allow users to interact with each other. For instance, users can "give" or "steal" green energy with friends or plant virtual trees together with their peers (Wang and Yao, 2020). Alipay and its partners in public welfare plant real trees in the desert areas or secure corresponding natural reserves as an incentive for users to practice low-carbon environmental behavior. By May 2020, Ant Forest boasted more than 550 million participants and had successfully planted and sustained over 200 million real trees, spanning across approximately 2.74 million acres in China's northwestern region.

Survey Design

To measure the constructs in our study, we utilized a 7-point scale that was adapted from previous research. Participants were required to rate their responses on a scale of 1 (representing "strongly disagree") to 7 (representing "strongly agree"). Gamification comprises four dimensions: content quality, system quality, social interaction, and altruistic rewards, while flow is a second-order construct measured reflectively through three dimensions: enjoyment, concentration, and interest. Items for measuring content quality, system quality, social interactions, and altruistic rewards are from Hu et al. (2021), Zhou et al. (2010), and Lin (2008), whereas items for measuring social interactions and altruistic rewards are from Wang and Yao (2020). Items referencing Venkatesh et al. (2012) are utilized to measure continuous use. Finally, in order to ensure the accuracy of the translation, a third-party translation service performed a back translation on the questionnaires that were originally created in English.

Sampling and Data Collection

To evaluate our research model, empirical data were collected through Questionnaire Star, one of the most reputable and widely used online survey platforms in China, during the week beginning April 18, 2022. To ensure the sample representativeness of Ant Forest Game users, the simple random sampling method was used to select participants from 31 administrative regions in China. In order to encourage participation, a small incentive was offered to each respondent who completed the survey. Subsequent to data filtering, we obtained 323 valid responses. Prior research has recommended that for PLS-SEM analysis, the sample size should be at least ten times greater than the number of indicators of the most complex formative construct or the number of paths leading to the endogenous construct with the most predictors (Chin, 1998). Additionally, Hoelter (1983) suggests a minimum sample size of 200 for hypothesis test. Our model has 21 indicators for the formative construct of gamification; therefore, the minimum sample size should be above 210. With 323 valid questionnaires collected, our sample size meets both criteria.

Data Analysis

Demographic Analysis

Table 1 displays the sample's demographic profile. Specifically, the majority of respondents were between the ages of 21 and 30 (67.18%) or 31 and 40 (25.70%). In addition, 62.85% of Ant Forest users were female, compared to 37.15 % of male users. The majority of respondents possess either a two- or three-year associate's degree (13%) or a bachelor's degree (77.71%). In terms of usage frequency, the majority of users (67.49%) play Ant Forest daily, including those who play multiple times per day (18.88%) and those who play once per day (48.61%). The percentage of users who play Ant Forest two or three times per week is 29.71%, while a small percentage of users play it very infrequently, with 1.55% of users playing it two or three times per month and 1.24% of users who have not played Ant Forest in a long time.

Measure	Items	Frequency	Percentage %
Gender	Male	120	37.15%
	Female	203	62.85%
	Total	323	100.00%
Age	20 or below	7	2.17%
	21-30	217	67.18%
	31-40	83	25.70%
	41-50	10	3.10%

	50 or above	6	1.85%
	Total	323	100.00%
Education	High School	6	1.86%
	College (two or three years)	42	13.00%
	Bachelor's	251	77.71%
	Master and above	24	7.43%
	Total	323	100.00%
Frequency of use	Several times a day	61	18.88%
	One time a day	157	48.61%
	Two or three time a week	96	29.71%
	Two or three time a month	5	1.55%
	I haven't played Ant Forest since long time.	4	1.24%
	Total	323	100.00%
Table 1 Demographic Profile of the Sample			

Measurement Model

To analyze the data for this study, we utilized SEM with Smart-PLS 3.0 (Ringle et al., 2015) since our proposed higher-order structural model encompasses both reflective and formative indicators. According to Hair et al. (2019), the PLS method is appropriate for complex models involving multiple constructs. To measure and validate the high-order constructs, we employed the disjoint two-stage approach recommended by Becker et al. (2012) and Sarstedt et al. (2019). In the first stage, the standard model was utilized to estimate the lower-order components, which involved establishing direct relationships between four antecedent constructs (content quality, system quality, social interaction, and altruistic rewards), three dimensions of flow (concentration, perceived enjoyment, and interest), and continuous use. In the second stage, latent variable scores from the first stage were used to calculate and estimate the measurement model depicted in Figure 1 (Sarstedt et al., 2019).

Initially, we conducted PLS bootstrapping to check for multicollinearity of the first-order constructs. The results revealed that all variance inflation factor (VIF) values were less than 3.0, indicating no multicollinearity issues between the constructs. In order to ensure item loading validity, we also confirmed that the outer weight index of formative constructs was significantly lower than 0.05, and the loadings of reflective constructs exceeded 0.708, as suggested by Hair et al. (2019). Items which did not meet these criteria were removed. Table 2 presents the reliability and validity assessment for all first-order variables in the first model. We assessed internal reliability using Cronbach Alpha values, all of which significantly exceeded the threshold value of 0.7 (Hair et al., 2019). Next, we evaluated construct validity through composite validity (CR) and convergent validity (AVE), with the findings indicating that AVE values for all constructs were substantially greater than the threshold value of 0.5, while CR values were above 0.7 (Barclay et al., 1995; Hair et al., 2019; Urbach and Ahlemann, 2010), further confirming the construct validity.

Constructs	Cronbach's Alpha	Composite Reliability	(AVE)
Agreeableness	0.782	0.851	0.534
Altruistic Reward	0.808	0.866	0.563
Concentration	0.858	0.904	0.701
Content Quality	0.767	0.841	0.515

Continuous Use	0.777	0.870	0.692
Interest	0.783	0.873	0.697
Openness to new experience	0.736	0.834	0.557
Perceive Enjoyment	0.739	0.851	0.657
Social Interaction	0.740	0.833	0.555
System Quality	0.707	0.820	0.532
Table 2. Reliability and Validity of First-Order Reflective Constructs			

We utilized the cross-loading method and the Fornell-Larcker method (Fornell and Larcker, 1981; Hair et al., 2019) to evaluate the discriminant validity of all first-order constructs. Firstly, the cross-loading method analysis demonstrated that all item loadings for each construct were higher than the coefficients between those items and other constructs. Table 3 provides further evidence supporting the conceptual distinctiveness of first-order constructs. Specifically, the diagonal of the table displays the square root of the average variance extracted (AVE) for each construct, which is higher than its correlation with other constructs, as recommended by Fornell and Larcker (1981) and Hair et al. (2019). These results indicate that the constructs were measuring their unique underlying concepts and were not heavily influenced by other constructs in the study. Thus, the measures used to evaluate these constructs are not only reliable and valid but also appropriately distinguished from one another.

Constructs	1	2	3	4	5	6	7	8	9	10
Agreeableness (AG)	0.731									
Altruistic Reward (RW)	0.389	0.751								
Concentration (CN)	0.383	0.222	0.837							
Content Quality (CQ)	0.405	0.621	0.415	0.718						
Continuous Use (CU)	0.486	0.605	0.246	0.468	0.832					
Interest (IT)	0.457	0.351	0.707	0.536	0.434	0.835				
Openness (OP)	0.647	0.348	0.374	0.353	0.422	0.411	0.746			
Perceived Enjoyment (PE)	0.421	0.476	0.656	0.646	0.426	0.679	0.401	0.811		
Social Interaction (SI)	0.388	0.728	0.326	0.671	0.517	0.447	0.338	0.517	0.745	
System Quality (SQ)	0.443	0.642	0.385	0.671	0.498	0.467	0.438	0.550	0.592	0.730
Table 3. Discriminant Validity of the First-Order Reflective Constructs										

Note: Bolded elements are the square roots of average variance extracted (AVE)

In the second stage, we evaluated the reliability and validity of gamification as a higher-order formative construct and flow as a reflective construct. To assess the validity of the formative construct, we utilized the first-order latent variable scores as indicators of the second-order constructs. We performed multicollinearity test and verified the significance of weight indicators. Table 4 and 5 display the results of our analysis, which indicated that all four formative indicators had VIF values lower than the threshold of 3.0, indicating no significant issues with multicollinearity (Hair et al., 2019). PLS bootstrapping with 2,000 replications revealed that three out of four formative weights were statistically significant. Specifically, content quality ($\beta = 0.403$, $p < 0.001$), system quality ($\beta = 0.306$, $p = 0.002$), and social interaction ($\beta = 0.215$, $p < 0.027$) displayed T-values greater than 1.96 at a significance level of $p < 0.05$. Although altruistic rewards did not have a significant weight, its factor loading was 0.838 ($p < 0.001$), significantly exceeding the threshold of 0.708 (Hair et al., 2019). Therefore, we concluded that altruistic rewards should be considered an essential component of gamification. Thus, the four formative indicators of gamification were empirically verified and confirmed. Furthermore, we examined the construct reliability and validity of the second-order reflective construct (flow) using the PLS algorithm. All values (Cronbach Alpha = 0.865,

Composite Reliability = 0.915, and AVE = 0.775) exceeded recommended thresholds, and as shown in Table 6, no discriminant validity issue was identified (Hair et al., 2019). PLS bootstrapping with 2,000 replications confirmed that the loadings for all three reflective indicators of flow (concentration, interest, and perceived enjoyment) were significantly higher than the threshold of 0.708. Hence, we concluded that all reflective and formative indicators in our structural model were examined and validated for reliability and validity.

Outer Weights	Statistical Weight	T Statistics	P Values	VIF
Altruistic Reward -> Gamification	0.235	1.772	0.077	2.518
Content Quality -> Gamification	0.403	3.498	0.000	2.331
Social Interaction -> Gamification	0.215	2.215	0.027	2.560
System Quality -> Gamification	0.306	3.086	0.002	2.151

Table 4. Assessment of Validity for the Second-Order Formative Constructs

Outer Loadings	Original Sample	T Statistics	P Values
Altruistic Reward -> Gamification	0.838	14.160	0.000
Content Quality -> Gamification	0.898	23.547	0.000
Social Interaction -> Gamification	0.837	16.787	0.000
System Quality -> Gamification	0.854	20.748	0.000
Concentration <- Flow	0.852	34.442	0.000
Interest <- Flow	0.899	45.785	0.000
Perceive Enjoyment <- Flow	0.902	67.533	0.000

Table 5. Outer Loadings of the Second-Order Constructs

Construct	AG	CU	FL	GM	OP
Agreement (AG)	0.731				
Continuous Use (CU)	0.487	0.832			
Flow (FL)	0.474	0.428	0.886		
Gamification (GM)	0.474	0.595	0.613	N/A	
Openness (OP)	0.644	0.429	0.443	0.434	0.746

Table 6. Discriminant Validity of the Second-Order Reflective Construct

Structural Model

We conducted the PLS path analysis (see Table 7 for details), and as expected, we found that gamification had a significant and direct effect on continuous use ($\beta = 0.532$, $p < 0.001$) and a significant and positive effect on flow experience ($\beta = 0.620$, $p < 0.001$). Therefore, H1 and H2 are confirmed. It was surprising to find that flow did not significantly affect continuous use ($\beta = 0.102$, $p = 0.203$), thus hypothesis H3 are not supported. Further, the mediating role of flow experience between gamification and continuous use is rejected, giving that the relationship between the two is not significant.

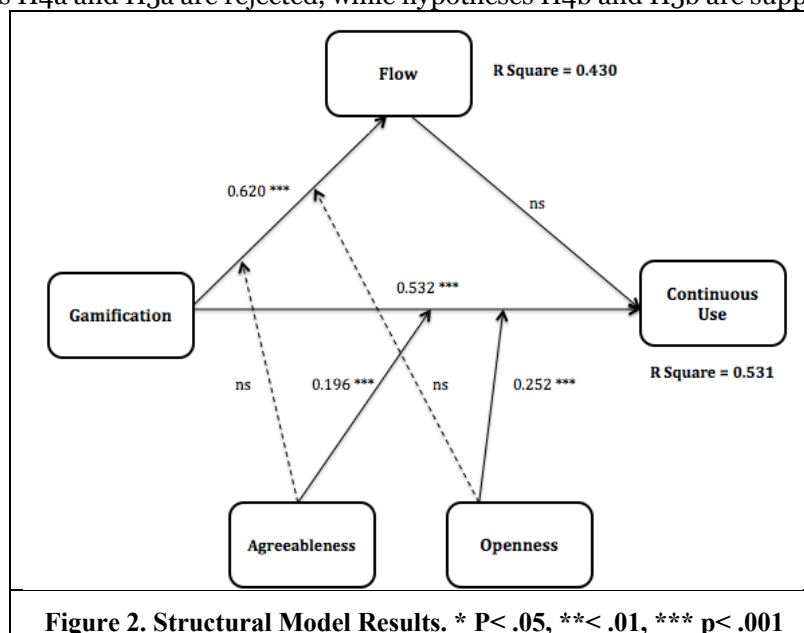
Hypotheses	Path	Standard Coefficient	T Statistics	P Values	Results
H1	GM -> CU	0.532	5.434	0.000	Accepted
H2	GM -> FL	0.620	13.725	0.000	Accepted

H3	FL -> CU	0.102	1.288	0.203	Rejected
H4a	AG * GM-> FL	0.001	0.035	0.972	Rejected
H4b	AG * GM -> CU	0.196	4.755	0.000	Accepted
H5a	OP * GM -> FL	0.002	0.062	0.951	Rejected
H5b	OP * GM -> CU	0.252	5.630	0.000	Accepted

Table 7. Results of Hypotheses Test of the Structural Model

In the final stage, we assessed the explanatory and predictive power of the structural model. R-square is an important reference indicator of the extent to which the constructs in the inner model are explained. According to Hair et al. (2019), R-square values of 0.25, 0.50, and 0.70 indicate weak, moderate, and strong explanatory strength, respectively. As depicted in Figure 2, R-square value is 0.430 for flow experience and 0.531 for continuous use, indicating a moderate capacity for explanation. Finally, we utilized PLS Blindfolding to test the Q-square value, a metric used to evaluate the predictive ability of the model. When the Q-square value exceeds zero, it provides evidence supporting the predictive power of the structural model. Additionally, values of 0, 0.25, and 0.50 correspond to low, moderate, and high levels of predictive accuracy (Hair et al., 2019). The Q-square values in this model is 0.332 for continuous use and 0.307 for flow experience, indicating a moderate predictive accuracy.

Following the analysis of the interrelationships among the constructs in the primary structural model, the moderating effects of agreeableness and openness to new experience were sequentially plotted using PLS Bootstrapping with 2,000 replications., the potential moderating effects of agreeableness and openness to new experiences were analyzed using PLS Bootstrapping with 2,000 replications. Interestingly, neither agreeableness ($\beta = 0.001$, $p = 0.972$) nor openness to new experiences ($\beta = 0.002$, $p = 0.951$) moderated the effect of gamification on flow; however, as predicted, both agreeableness ($\beta = 0.196$, $p < 0.001$) and openness to new experience ($\beta = 0.252$, $p < 0.001$) moderated the effect of gamification on continuous use. Hence, hypotheses H4a and H5a are rejected, while hypotheses H4b and H5b are supported.



Discussions

Theoretical Implications

This paper extends and complements existing research on the continuous use of mobile payment by examining the triangular relationships between gamification, flow, and behavioral intention, as well as the interactive effect of personality traits. First, this study conceptualized gamification in mobile payment on the basis of the four dimensions proposed by (Palmer et al., 2012), with a focus on altruistic reward.

Evidence from this study suggests that content quality, system quality and social interaction are the three most important elements of gamification in mobile payment apps, while altruistic reward, as specific reward type, cannot stand alone as a significant formative indicator of gamification. This is consistent with the findings of Hwang and Choi (2020) who pointed out that altruistic reward may not be as effective as self-directed rewards, which implicates that a complete and effective game reward mechanism should include both altruistic and self-directed dimensions.

Second, we identified the strong impact of gamification in mobile payment on continuous use, which is inconsistent with the extant literature, since previously most researchers have found that such impact is relatively weak (Baptista and Oliveira, 2017; Hu et al., 2021;), or not significant (Çera et al., 2020) in the context of mobile banking or e-commerce, whereas in the present study, we surprisingly found this impact coefficient is much stronger than expected, which is probably due to the novel and interesting content design of the Ant Forest game, the reasonably challenging game design, and the smoothness of the game system, thus ensuring its high quality from content design to system design. In addition, the game's interactivity enhances user engagement and facilitates the widespread dissemination of the game. Lastly, the Ant Forest game encourages participation by providing rewards for ecological activities, environmental protection, and other public welfare initiatives. Games with a charitable objective may serve as a motivating factor and promote the sustainable adoption of mobile payment systems on a broader scale.

Third, the results shed light on the effect of flow experience on continuous use in the context of mobile payment. On the one hand, this study shows that gamification has a positive and statistically significant effect on flow experience, which is in line with previous studies. On the other hand, in contrast to the findings previous studies (e.g., Gao and Bai, 2014; Hsu et al., 2013), our study suggested that the mediating effect of flow between gamification and continuous use is not confirmed, as flow experience has no significant effect on continuous use. This may implicate that users of mobile payment applications may prioritize dependability, security, and convenience over the hedonistic experience of flow as they continue to use the application. It is possible that perceived usefulness, perceived simplicity of use, and trust influence continuous use more than flow experience. Flow experience might not have a direct influence on continuous use, but it could be mediated through satisfaction or attitude. This is consistent with the findings of Liu and Li's (2011) study on the proliferation of mobile gaming in China, which discovered that perceived enjoyment had no direct effect on behavioral intention, but influenced indirectly through attitude. Another possible explanation is that gamification enhances the hedonic qualities of mobile payment applications by enabling users to enter a flow state while playing the game. However, the act of becoming engrossed in the game, leading to concentration, procrastination, and time waste, may have a negative effect on continuous use. This is because users may become so engrossed in the game that they overlook the app's primary utilitarian value. In the case of Alipay Ant Forest, it is possible for users to frequently access the Alipay application for the sole purpose of playing Ant Forest games, as opposed to conducting financial transactions. The above analysis shows that utilitarian value, convenience, security, and multi-scenario use continue to be the primary drivers of sustained usage, with gamification only serving as one of the contributing factors.

Finally, this study explored how personality attributes affect the relationship between gamification and continuous use, and the relationship with flow experience. According to the findings, neither agreeableness nor openness had a significant impact on the relationship between gamification and flow experience. This suggests that the flow experience is determined more by the design and content of mobile payment games than by users' personalities, and that the impact of personality traits on flow experience can vary across game types, and in the case of Ant Forest, this moderating effect is insignificant. However, agreeableness and openness personalities strengthened the positive association between gamification and continuous use, indicating that users with higher levels of these traits are more likely to be influenced by gamification to engage in continuous use. These results demonstrate the significance of personality traits in determining long-term engagement with mobile payment systems.

Practical implications

This study provides service providers with valuable insights to inform their management practices. Improving the content and system quality of mobile payment games is essential for creating an engaging, challenging, and user-friendly experience. Social features that facilitate communication and interaction between participants should also be incorporated, while altruistic rewards are essential aspects of gamification that can increase user engagement through charitable activities. Self-directed rewards may be

more effective, and service providers can incorporate substantial rewards into their activities. Consequently, the gamification concept presented in this paper functions as strategic guidance for game planners, designers, and platform decision-makers, particularly with regard to product and marketing strategies and resource allocation. These insights provide guidelines for enhancing user experiences and promoting long-term engagement with mobile payment games. The findings also imply that while gamification in mobile payment can improve the flow experience for users, it may cause them to overlook the primary utilitarian values of mobile payment. This indicates that hedonic value has a limited influence on the continuous use of a specific app such as mobile payments. Therefore, service providers should concentrate on expanding the versatility of their applications while maintaining their security and usability. In addition, service providers could integrate games with mobile payments and provide incentives to promote continuous use. For example, users could earn points by completing payment transactions and playing games, and then redeem these points for substantial rewards. Lastly, findings regarding the impact of personality traits suggest that user personalities and their varying degrees moderate the effect of gamification on continuous use. According to the findings, the characteristics of gamers influence their gaming preferences. Those with a higher level of agreeableness may favor team-based games, whereas those with a higher level of openness may prefer creative games. This means that companies can use this information to offer a variety of game options to suit the preferences of users. By doing so, they can improve their gamification efforts and increase the likelihood of positive user experiences and long-term engagement with mobile payment applications.

Limitations and Future Research.

This study has limitations that offer opportunities for future research. First, our sample is limited to one type of mobile payment game and primarily consists of younger individuals. Therefore, generalizing findings with this specific game and age group should be done cautiously. Future studies should include a wider range of mobile payment games and a more diverse demographic representation to enhance the validity and applicability of the findings. To enhance the generalizability of the results, it is also essential for future research to replicate the findings using larger population and more diverse samples. Second, our sample is only representative of one nation, and future research could be conducted in various nations and cultural contexts. Third, future research could also investigate the relationships between the four gamification elements, flow and its three dimensions, and adoption behavior in greater detail, as well as the impact of other mediating variables such as trust and satisfaction, or adding other direct influences to the current model, such as convenience, perceived risk, and social influence. In future studies, it would be also valuable to explore the influence of additional personality traits, including neuroticism, conscientiousness, and extraversion, as well as other individual differences such as age and gender. Investigating these factors can provide a more comprehensive understanding of how they may interact with the variables examined in the current study. By incorporating these variables into future research, we can further elucidate the complexity of the subject and enhance the validity and applicability of the findings. Finally, this study drew its conclusions using an online questionnaire. We acknowledge the limitations associated with this method, such as the variability of responses, the small sample size, and the inability to collect deeper and context-specific data. Future research may employ qualitative research methods to draw conclusions.

Conclusion

This study examined the effect of gamification in mobile payment apps on continuous use by investigating the mediating role of flow experience and the moderating function of personality traits. The empirical findings revealed that gamification in mobile payment considerably affects both the continuous use and flow experiences, whereas flow does not influence continuous use. In addition, agreeableness and openness were found to moderate the impact of gamification on continuous use. Overall, the findings enhanced our comprehension of how the hedonic and social values of mobile payment applications influence behavioral intention.

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