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Investigating Antecedent Factors' Mediating and Moderating Effects on the Pathway between Gamification's Emotional Mechanics and Value Co-Creation Behavior – A Case Study of the Chinese Mobile Banking Industry

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Abstract

Aim/Purpose: Despite the growing significance of mobile banking (M-banking) in the financial industry of emerging economies such as China, market penetration rates have declined due to increased competition from financial technology firms. While existing research has primarily concentrated on M-banking adoption, there is a notable lack of studies examining customers' post-adoption behaviors, particularly regarding Customer Value Co-Creation Behavior (CVCCB) and its psycho-emotive antecedents. Furthermore, the role of Gamification's Emotional Mechanics (GEM) in influencing customer engagement (CE) and CVCCB within the Chinese M-banking context remains unexplored.

Introduction/Background: This research addressed this gap by examining the influence of GEM on CVCCB in the Chinese M-banking sector. Additionally, it investigated the mediating role of CE and the moderating effect of generational differences, using Stimulus-Organism-Response theory and generational theory. This study provides important insights for financial institutions seeking to enhance customer engagement and maintain competitiveness in evolving digital financial landscapes.

Methodology: This study utilized structural equation modeling, path analysis, moderation and mediation analysis, with SPSS and AMOS statistical software. The target population comprised Chinese M-banking users, estimated to exceed 1.01 billion. A total of 550 usable survey responses were collected, surpassing the minimum required sample size of 399. Participants were recruited from a large public university in Shenyang using purposive sampling. Snowballing sampling technique was employed to extend participation to individuals residing in various Chinese provinces, thus enhancing sample representativeness.

The research used an online self-administered questionnaire that incorporated validated measurement scales adapted from existing literature. To ensure the accuracy of translated text, the survey instrument underwent a back-to-back translation process between English and Chinese by bilingual specialists. Statistical analysis commenced with assessments of normality, reliability, validity, common method bias, and multi-collinearity, followed by structural equation modeling, path analysis, and moderation and mediation testing.

Findings: Research findings indicated that customers' affective engagement had a significant influence on CVCCB, which is consistent with earlier studies highlighting the role of affective emotional responses as a critical antecedent of CVCCB. Moreover, results supported the positive effect of GEM on CVCCB, aligning with previous research. Additionally, the study found that affective engagement played a significant mediating role in the relationship between GEM and CVCCB, which was in line with prior studies suggesting that GEM indirectly influences CVCCB through CE.

Furthermore, research highlighted that generational differences significantly moderated the relationship between affective engagement and CVCCB, but did not moderate the relationship between GEM and affective engagement. This finding is consistent with prior research indicating that customers from different generational groups exhibit distinct patterns of CVCCB, while emotional mechanisms in gamification do not differ in impact across generations.

Contribution/Impact on Society: This study contributes to the existing body of knowledge by providing a deeper understanding of antecedents that influence CVCCB. By examining the impact of demographic factors such as gender and age on CVCCB, the research revealed how these variables shape CE in collaborative activities, such as information sharing and seeking. The findings emphasize the importance of understanding the nuances of customer behavior, particularly in the context of digital finance, and how these behaviors impact the effectiveness of M-banking services.

The broader implications of the study's findings extend to both academic research and practical applications in digital finance and M-banking. For researchers, the study provides valuable evidence that contributes to the relatively underexplored literature on customer behavior in digital platforms, particularly within a Chinese context. This research enhances the understanding of several antecedent factors that affect CE in M-banking and their subsequent contributions to the value co-creation process. From a practical standpoint, the identification of key factors influencing customer behavior can help financial institutions design effective strategies and personalized services that cater to diverse customer needs, leading to more effective customer retention and improved service design.

Recommendations: The study suggests that practitioners in mobile banking should tailor their marketing strategies to specific demographic factors, including age, gender, income, and education. Younger customers, who are typically more engaged with innovative features, may respond well to promotions that highlight advanced functionalities, while female customers may prefer more collaborative engagement strategies. It is essential for practitioners to design personalized customer experiences that cater to diverse preferences and enhance communication and collaboration.

Research Limitation: Several limitations were addressed in this research. The sample was primarily drawn from Shenyang, China, which limited the generalizability of the findings to other regions or countries. Additionally, the study relied on self-reported data, which may introduce biases such as social desirability or inaccuracies in self-perception. Furthermore, the cross-sectional design of the study prevented causal inferences, as the data represented only a snapshot in time.

Future Research: Future research should employ longitudinal designs to investigate the causal relationships between customer characteristics and their engagement in CVCCB activities. Expanding the study to encompass diverse cultural and economic contexts would enhance its generalizability. Additionally, investigating the influence of emerging technologies, such as artificial intelligence (AI), and exploring moderating factors, such as trust and security, could provide deeper insights into mobile banking customer behavior. These future research directions would enrich the findings and contribute to the further development of knowledge in this field.

Keywords: *Chinese mobile-banking, gamification emotional mechanics, value co-creation behavior*

Introduction

In the post-pandemic digital boom, the World Health Organization strongly recommended minimizing direct human contact and maintaining social distancing. Thus, customers worldwide have been driven to conduct daily activity and financial transactions by increasingly adopting contactless technology such as M-banking, which are banking services offered on mobile devices such as mobile phones and tablets. M-banking enables users to conduct financial transactions remotely, providing prompt solutions to various user needs and demands through self-service technologies. It also assists banks in expanding service scope, reaching rural customers in distant regions, lowering business expenses, and improving economic performance (Al-Bashayreh et al., 2022).

M-banking's global market size reached $1.3 billion in 2024, and estimate predict that it will exceed $4 billion by 2032 (Market Research Future, 2024). Among all countries, China ranks first in the number of M-banking users, already surpassing 970 million (Bankmycell, 2025) since the introduction of the service in 2016. Meanwhile, advances in digital technology have also spawned financial technology firms (Fintechs) and their innovative digital services, such as the third-party payment systems that have developed swiftly. Such systems exceeded $2,276 billion in market size by

2023, which is equivalent to over 1,300 times the size of M-banking. Similarly, Chinese state-owned banks are also being dominated by leading Chinese Fintechs, such as Alipay and WeChat Pay, who jointly have nearly 2 billion users and a continued high growth rate (Yang et al., 2023), which has led to decline of Chinese M-banking penetration rates (Sina Finance, 2024).

Due to M-banking's important role in the financial industry and the rising competition it faces, M-banking has become a significant research topic. Nonetheless, contemporary M-banking research has primarily focused on exploring service adoption aspects, with inadequate studies examining customers' post-adoption behaviors or the psycho-emotive aspects of service consumption (Dabare et al., 2023). This narrow focus leaves a critical discrepancy in comprehending how users engage with M-banking services during post-adoption in terms of continuous participation, emotive experience, and co-creation behaviors that influence long-run competitiveness. To fill this void, researchers have attempted to inspect several M-banking services' post-adoption behaviors, including continual intention, loyalty, and relationship quality (Dabare et al., 2023). However, no study could be found that probed CVCCB or its psycho-emotive antecedent factors' effects on M-banking services in a Chinese context. This oversight is significant considering the scale and strategic prominence of the Chinese M-banking market, which presents a unique experimental site for emerging service marketing theories such as value co-creation and emotional gamification.

As an innovative marketing practice, value co-creation (VCC) emphasizes the integration of resources during service encounters between companies and customers to create mutual value, fostering loyalty and serenity that spur additional ideas and knowledge sharing (Vargo & Lusch, 2004). As M-banking has reformed the ways in which banking services are offered and consumed in the digital era, customers are increasingly recognized as co-producers of service and value, rather than passive service users. Thus, VCC is imperative for maintaining customer loyalty, improving overall business performance, and surviving among competition (Hijazi, 2022).

Early studies advocated that Customer Engagement (CE) was one antecedent factor of Customer Value Co-creation Behavior (CVCCB), as engagement behaviors often lead to vigorous involvement, collaboration, information sharing, and other value creation behaviors on digital platforms in the form of online content generation, product and service co-design, and reviews and feedback (Czeszejko & Öfverström, 2021). Still, CE's effects on both antecedent and outcome factors of CVCCB in M-banking settings has remained inconclusive (Hijazi, 2022).

Moreover, researchers suggested that another key element to ensuring positive interactive and collaborative experiences in CVCCB is emotion management (Malone et al., 2018). This is because understanding the emotions that customers experience during their participation in service creation is imperative in guiding them through VCC processes (Biercewicz & Wiścicka-Fernando, 2023). However, the mechanisms through which these emotions are experienced, especially those embedded via gamified systems and translated into noticeable value co-creation behaviors, remain understudied both theoretically and practically.

As digital technology has enabled simultaneous collaborations among multiple customers and service providers (Spagnoletti et al., 2015), gamification in mobile applications has become a prevalent marketing practice for companies to interact with customers, creating memorable experiences and mutual value (Babb et al., 2013). Accordingly, investments in gamification worldwide have flourished and are projected to exceed $32 billion by 2025 (Czeszejko & Öfverström, 2021). However, the underlying effects of gamification's emotional mechanics on customer engagement and CVCCB still remains untapped in the Chinese M-banking context. This reveals a significant theoretical discrepancy, especially considering the commercial scale of gamification investment and significance of emotion-driven engagement in digital environments. Furthermore, researchers have found that generational differences in reactions to gamified features on CE and CVCCB in digital services, due to customers' physical abilities, cognitive functions, unique life experiences, and value beliefs (Zhou et al., 2022). The aging population phenomenon has led to older generations becoming the pillar customer group in the world economy due to their large size and affluence, so their consumption preferences and behavior differences must not be overlooked by policy makers (Alhassan & Adam, 2021).

For the above reasons, the objectives of this research were three-fold: firstly, it attempted to pragmatically investigate Gamification's Emotional Mechanics' (GEM) effects on CVCCB in a Chinese M-banking context, which to the author's knowledge had not been previously examined. Secondly, this research adopted Stimulus-Organism-Response theory and examined the mediation effect of CE imposed on the relationship between GEM and CVCCB in M-banking service. Thirdly, this study also adopted generational theory and scrutinized the moderation effect generational differences played in customers' responses to GEM, engagement behaviors, and CVCCB in the Chinese context.

Several limitations were grappled with in this study, such as using a lower-order CVCCB conceptual construct, a cross-sectional design, and self-reported data from university-affiliated users, which may affect the generalizability of its findings. However, it offers a significant and novel contribution by being among the first to scrutinize the role of GEM in shaping CE and value co-creation behavior within the context of M-banking. The findings can offer applicable insights for both marketing scholars and professionals aiming to augment digital engagement strategies through emotional design and intergenerational customization. By establishing empirical insights in a technologically advanced and dynamic financial environment, the study lays a critical foundation for future research both within China and in other digital service settings.

Literature Review

Customer Value Co-Creation Behavior, Customer Engagement, Gamification's Emotional Mechanics, and Generational Cohorts

The CVCCB concept was derived from service-dominant logic explaining that all parties in service processes can cooperate and share resources, such as information or knowledge, for creating resolutions that meet market demands. Companies need to provide opportunities or foster environments to motivate customers to partake and create joint value, for instance, through methods of adopting innovative technology or products (Grönroos, 2008). The CVCCB concept has been studied using various conjectural and pragmatic frameworks in the literature, including the Dialog, Access, Risk Assessment and Transparency (DART) model, the supplier-customer mapping model, the consumer value co-creation styles model, and so on (Leroy et al., 2013).

In particular, one multidimensional CVCCB framework was developed by Yi and Gong (2013) which aimed to emphasize service users' resource integration activities during service encounters. It is comprised of eight dimensions: information seeking, information sharing, personal interactions, responsible behavior, helping, advocacy, feedback, and tolerance. This model has been applied and validated in various contexts. Thus, this study adopted the CVCCB framework to investigate its application in M-banking. In addition, prior research has suggested that personal interaction was relatively irrelevant to self-serving service provided on human-machine digital platforms (Mostafa, 2020), so CVCCB was conceptualized using seven dimensions, excluding the personal interaction dimension to avoid possible controversy.

Customer Engagement can be described as the psychological status that occurs through collective consumer efforts to integrate resources, where contributing players act with cooperative accountabilities (Van Doorn et al., 2010). CE can be theorized using different constructs: for example, Bowden (2009) conceptualized engagement from three aspects, including emotional, cognitive, and behavioral mechanisms. Van Doorn et al. (2010) proposed using five behavioral components, including valence, modality, impact nature, scope, and objectives, to measure CE. Among various conceptual frameworks, Bowden's (2009) construct consisting of emotional, cognitive, and behavioral dimensions has been widely applied by many early researchers in various settings. Moreover, as scholars have contended that the behavioral aspect of CE was not inherently explicit due to several underlying factors (Hijazi, 2022), this current study excluded it from the original model to assess CE in the Chinese M-banking context.

Gamification's Emotional Mechanics' (GEM) main notions have been fundamentally established by motivational and emotional theories, such as Self-Determination Theory and intrinsic and extrinsic motivation theory. These are relevant to human motivation and the desire to fulfill intrinsic emotional

needs (Seaborn & Fels, 2015). GEM emphasizes the role that emotional arousal plays when gamification is used to engage customers; it can be measured using various frameworks. For instance, Robson et al. (2015) developed the Mechanics-Dynamics–Emotions model to demonstrate how emotions in gamification can be applied to enhance experiences, while Conaway and Garay (2014) suggested using external rewards and internal fun dimensions to conceptualize gamification's emotion aspects. García-Magro et al. (2023) theorized GEM with a three-factor model including utilitarian, social, and hedonic dimensions.

Based on the established motivational theories, emotions can be categorized into two types, where intrinsic emotions arise from within individuals and are driven by subjective experiences and values, while extrinsic emotions stem from exterior influences, such as prizes, penalties, or environmental cues that are tied to events or situations (Deci & Ryan, 1985). Therefore, as a universally accepted GEM model has not been identified in literature, this research adopted an adjusted ad hoc GEM model based on previous studies (García-Magro et al., 2023; Conaway & Garay, 2014). It conceptualized GEM as consisting of both extrinsic and intrinsic motivations to evaluate GEM's effect on CE and CVCCB in a Chinese M-banking service context.

Generational cohort refers to a collection of individuals born during a specific time period who share similar life experiences, beliefs, and attitudes that persist throughout their life course, often resulting in shared behavioral differences among all of them. In the literature, four frequently mentioned generational cohorts are Baby Boomers, Generation X, Generation Y, and Generation Z. Baby Boomers were born approximately between 1946 and 1960. They are considered faithful, dedicated to collective values, and possess excellent communication skills, although they lack knowledge about modern technology (Gardiner et al., 2015). Generation X were born roughly between 1961 and 1980. While growing up with the advent of the Internet and globalization, they are considered discerning and less loyal to brands than earlier generations due to mass marketing schemes and broader selection of market offerings (Gardiner et al., 2015).

Generation Y were born between 1980 and 1995; they are acquisitive and have unique product preferences and tastes that motivate them to pursue high levels of individualism in their purchases. They have higher social awareness, and often stay connected to seek inspiration to fulfill their needs via the Internet (Bolton et al., 2013). Generation Z were born roughly between 1996 and 2010; they are technologically savvy, knowledgeable about social media, seek social recognition and attachment, and thus are easily influenced by peers in their purchasing. As they grew up in uncertain economic and social circumstances, security and privacy are more valued by this generation (West, 2014).

Theoretical Support

In this study, Stimulus-Organism-Response (SOR) theory was adopted to explain the relationships among GEM, CE, and CVCCB. In the late twentieth century, Mehrabian and Russell (1974) proposed the SOR theory, aiming to elucidate the intricate relationships between external environmental stimuli, internal cognitive and emotional conditions, and subsequent behavioral responses.

"Stimulus" refers to the external environmental factors that individuals pinpoint through their physical senses including visual, auditory, and perceptible elements, which serve as the causes to trigger cognitive and emotional processing in minds. "Organism" refers to the inner status of individuals including rational appraisals, emotional responses, and subjective comprehension of the stimuli. "Response" means the exhibited behavioral acts caused by the "Organism" component, ranging from subtle attitudes to manifested behaviors.

In this study, GEM can be viewed as the "Stimulus" that activates a customer's inner rational and emotional processing based on subjective assessments of the extent to which individual motivations were met (Zhu et al., 2020). The cognitive and affective processing in CE can be considered as the "Organism" component as a response to the subjective evaluation of extrinsic and intrinsic motivations in GEM, respectively (Streukens et al., 2019). Subsequently, CE will lead to the "Response", or the manifested volitional reciprocal CVCCB such as information sharing, product design, or self-development (Leclercq et al., 2018).

Generational theory explains that repetitive generational patterns shape social tendencies by viewing time intermittently, highlighting the impact of historical events on generational experiences. The generational archetypes identified in theory often relate to behavioral differences among various age cohorts (Robb, 1998). In this research, customers from each generation cohort frequently share similar experiences, beliefs, and attitudes that inevitably influence their motivation, judgments, and behavioral differences in service consumption (Hansen & Leuty, 2012). For instance, due to their deteriorated physical condition, limited knowledge, and less curiosity about novel technology, older generations such as Baby Boomers and Generation X (Harris et al., 2016) have been reported to be less engaged by digital services. The younger generations, however, were found to be more predisposed to adopt and purchase gamified products and services, which were judged as more valuable and enjoyable (Bittner & Shipper, 2014).

Hypotheses Development

GEM and CVCCB**.** This study hypothesized that GEM in M-banking positively influences CVCCB in the Chinese context. In the VCC context, CVCCB was primarily driven by external motivation, including anticipated reciprocity and societal acknowledgement, or internal motivations such as amusement and interest (Stock et al., 2015); thus, GEM can be considered as an essential antecedent of CVCCB (Chagas & Aguiar, 2020). For example, García-Magro et al. (2023) found that customers' perceived emotions in gamification positively impacted their CVCCB in service, which was consistent with the results found in another empirical study conducted by Czeszejko and Öfverström (2021), who claimed that gamification and its emotional mechanics significantly improved customers' participation behaviors in the VCC process. Similarly, Cheng (2024) carried out research in Taiwan, and his research findings disclosed consistent results, indicating that customers' perceived inherent emotions in gamification can positively impact related CVCCB during service encounters. Therefore, the researcher posited the following hypotheses.

H_1: GEM in M-banking service in China positively influences CVCCB.

Mediation Role of Customer Engagement (CE). This study also proposed that CE has a mediating effect on the relationship between GEM and CVCCB in mobile banking within the Chinese context. In the VCC context, CE is also often driven by utilitarian incentives such as rewards, or hedonic inspirations including fun, knowledge, or ability development (Stock et al., 2015); thus, GEM is also an antecedent factor of CE (de Oliveira Santini et al., 2020), which can lead to CVCCB (Doğan-Südaş et al., 2023).

For example, by applying SOR theory, Thomas and Baral (2023) suggested that service users' perceived emotions in gamification that significantly affected CE in service, which was in line with the findings of another similar study. Tseng et al. (2021) examined 296 customers of branded application services in Taiwan, and found that intrinsic and extrinsic emotions inherent in gamified services could positively enhance customer's brand engagement. Additionally, Doğan-Südaş et al. (2023) concluded that GEM significantly improved affective response in CE and subsequently led to CVCCB, which was congruent with the results found in another study. De Canio et al. (2021) examined 893 Chinese mobile shopping application users and concluded that gamification features and their induced emotions positively affected customer shopping engagement and post-purchase behaviors. Therefore, based on the above-mentioned study results from the literature, the following hypotheses were proposed.

H_2: GEM in M-banking services in China positively influences CE.

H_3: CE in M-banking service in China positively influences CVCCB.

Moderating Role of Generation Cohorts

Generational cohort differences among customers were hypothesized as having moderating effects on both the relationship between GEM and CE, as well as the one between CE and CVCCB. Study results have shown that GEM had dissimilar effects on customers from different generational

cohorts, with younger generations favoring intrinsic and extrinsic motivations more highly than older generations in gamified market offerings (Bittner and Shipper, 2014). Zhang et al. (2021) found that GEM, including enjoyment, rewards, and social interaction, varied between young and older customer groups. Additionally, Vayghan et al. (2023) conducted pragmatic research by examining 506 customers of a digital application service in the United States, and found that CE and CVCCB varied across different generations due to their dissimilar perceived values regarding the service.

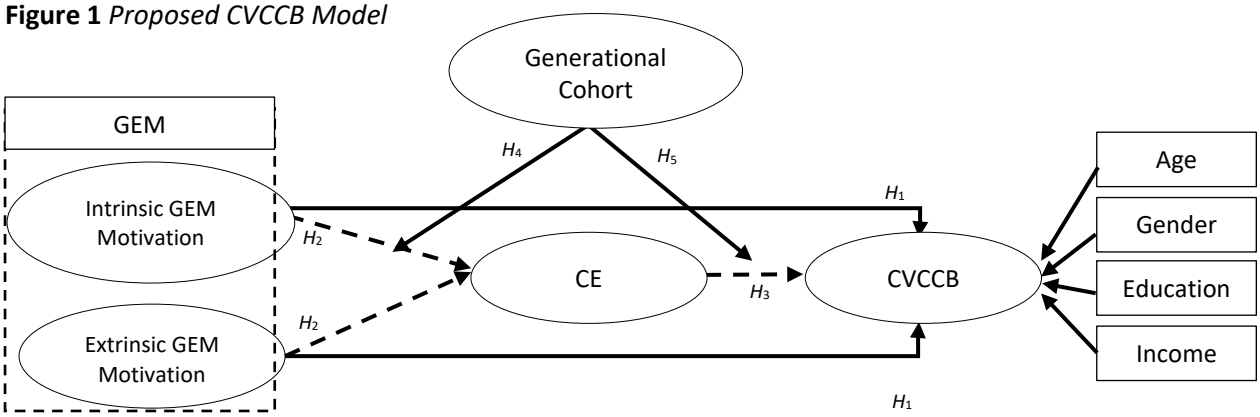
Other studies also found that digital services were more effective in engaging young generations, such as Generations Y and Z, who enjoyed communicating with brands by giving feedback and comments (Moise et al., 2020). Declining physical and cognitive conditions often hindered older customers from interacting and engaging with new technologies (Harris et al., 2016). Therefore, in this research the following hypotheses were suggested.

H_4: Generational differences moderate the relationship between GEM and CE in Chinese M-banking contexts.

H_5: Generational differences moderate the relationship between CE and CVCCB in Chinese M-banking contexts.

The proposed CVCCB model that includes all hypotheses is shown below in Figure 1.

Figure 1 *Proposed CVCCB Model*



Note. Solid line–direct relationship; dashed line–indirect relationship

Methodology

Participants and Data Collection

The target population of this research consisted of Chinese customers with experience using M-banking services, estimated to be over 1.01 billion and distributed across China. As a relatively larger percentage of M-banking users are from new first-tier cities (22%) (Yifan, 2023), the largest new first-tier city in northeastern China (Shenyang city) was selected as the initial sample selection site in this study owing to its equal male/female ratio (.99), high level of economic development (6%), and high level of migrants from other Chinese provinces (22%) (Hongheiku, 2025; Shenyang Statistics Bureau, 2024). Participants born in different provinces were initially engaged utilizing a purposive sampling approach from the local university in Shenyang City with the highest number of currently enrolled students and working staff that totalled more than 50,188. Then a snowball method was applied in the next phase of data collection to request participants to share survey questionnaires with their social contacts who currently resided in other provinces in China to augment data representativeness. To gather a minimum required sample size of 400 for statistical analysis (Yamane, 1973), 500 questionnaires were distributed to students and staff from the chosen university. After conducting a pilot study using 100 collected responses, reliability and validity tests for adopted measurement scales' results were satisfactory, suggesting that a larger scale study was appropriate, and unclear wording of the translated Chinese questionnaires had also been corrected. After receiving approval from the university's management to collect data, university students and staff from different

provinces were engaged and informed about the research objectives. Then, online survey links were provided to them via email or WeChat.

The data collection process lasted three weeks and yielded 550 usable responses from a total of 26 provinces, municipalities, and autonomous regions in China. While this research aimed to achieve geographic diversity through its sampling strategy, the inherent limitations must be recognized. Initially, the recruitment process was confined to university students and staff, which may have led to a bias favoring younger, highly educated, and technologically adept respondents. Although the use of snowball sampling facilitated access to participants from diverse regions, the sample may still have lacked sufficient representation of seniors or less digitally proficient customers. Furthermore, since the survey was conducted online and relied on voluntary participation, it likely excluded customers with limited familiarity with digital survey tools, potentially biasing the findings towards participants who are more active in the digital realm. Future research should consider extending sampling efforts beyond academic settings to include older demographics and individuals from lower-income areas to enhance the generalizability of the results.

Measures and Data Analysis

Research measurement scales and items in this study were adopted from existing literature, which includes the impromptu GEM scale that was adopted from García-Magro et al. (2023) and Conaway and Garay (2014), comprising two dimensions and seven items. The CE scale was developed by Brodie (2014) consisting of two dimensions and six items, and CVCCB scale was adopted from Yi and Gong (2013), including seven dimensions and 24 items. All scale items were measured on a 7-point Likert scale ranging from 1 (*Totally Disagree*) to 7 (*Totally Agree*) for evaluating respondent agreement levels.

Results

Respondents' demographic information is summarized in Table 1, indicating that participants were slightly male dominated (54.9%) and aged between 27 and 58 (50.8%). It can also be observed that most sampled participants had a Bachelor's or higher education background (57.3%), and income level between 6,000 and 10,000 Renminbi (RMB) (41.8%).

Table 1 *Sample Respondents' Profile*

Variable	Category	Frequency	Percent
Gender			
	Female	248	45.1
	Male	302	54.9
Age			
	18–26	89	16.2
	27–42	128	23.3
	43–58	151	27.5
	59 or above	182	33.1
Educational Level			
	Below Bachelor	142	25.8
	Bachelor	185	33.6
	Master	107	19.5
	Doctoral	23	4.2
	Above Doctoral	93	16.9
Monthly Income Level (in RMB)			
	Below 3,000	44	8.0
	3,000–5,000	204	37.1
	6,000–10,000	230	41.8
	Above 10,000	72	13.1

The statistics analysis began with a normality test, validity and reliability assessment, common method bias test, and multi-collinearity testing, followed by structural equation modeling (SEM), path analysis, moderation, and mediation effects testing using SPSS and AMOS software. The control variables included in this study that may influence CVCCB were participants' gender, age, education, and income levels. For instance, Kennedy et al. (2022) advocated that customers' gender influenced communication disposition, with females preferring collaborating and support seeking in CVCCB. Laukkanen (2016) suggested that younger customers were usually early users of complex and state-of-the-art features in M-banking, which were more likely to engage in CVCCB activities such as information sharing and helping. Additionally, Zhu et al. (2020) suggested that higher education levels were associated with enhanced communication competences such as providing comments and help in CVCCB under an M-banking setting. Mohan and Potnis, 2015 found that high income was usually interrelated with ample economic resources, along with extensive financial knowledge and information, which stimulated customers' enthusiasm towards CVCCB in M-banking.

Normality test results revealed that skewness and kurtosis values for all scale items ranged from .062 to -.896 and from .036 to -1.961, respectively, indicating that the sample data were normally distributed (Hair et al., 2019). The convergent validity test was performed by using measurement items' factor loadings and excluding items with a value lower than the threshold of .50 (see Table 2).

Cronbach's alpha coefficient was also calculated to test scales' reliability, with all outcomes being above the threshold level of .60 (Henseler et al., 2015), meaning the scale's reliability was confirmed (see Table 2). A multi-collinearity test was performed using the variance inflation factor values of all indicator variables, including GEM (1.133) and Affect (1.133), which were both less than the maximum acceptable value of 3.30 (Petter et al., 2007), indicating that the multi-collinearity issue was absent in this study. The common method bias (CMB) test using Harman's one-factor method showed that the most significant loading of a single dimension was 32.63%, which was less than the threshold value (50%), indicating that CMB was also absent in this research.

Table 2 *Convergent Validity and Reliability Testing*

Items	**Affect**	**EE**	**IE**			**Cronbach's α**
Affect_1	(.797)					.880
Affect_2	(.759)					
Affect_3	(.819)					
EE_1		(.810)				.904
EE_2		(.729)				
EE_3		(.868)				.891
EE_4		(.877)				
IE_1			(.840)			
IE_2			(.881)			
IE_3			(.914)			
	ISR	**RB**	**FEB**	**HEP**	**TOL**	
ISR_1	(.772)					.850
ISR_3	(.803)					
ISR_4	(.828)					
RB_1		(.679)				.784
RB_2		(.599)				
RB_3		(.745)				
RB_4		(.828)				
FEB_1			(.726)			.783
FEB_2			(.683)			
FEB_3			(.849)			
HEP_1				(.733)		.808
HEP_2				(.539)		
HEP_3				(.797)		
HEP_4				(.825)		

TOL_1	(.844)	.865
TOL_2	(.752)	
TOL_3	(.821)	

Note. EE: Extrinsic Motivation; IE: Intrinsic Motivation; ISR: Information Sharing; RB: Responsible Behavior; FEB: Feedback; HEP: Helping; TOL: Tolerance.

The Composite Reliability (CR) and Average Variance Extracted (AVE) were at satisfactory levels, although the Customer Engagement (CE) dimension was relatively problematic (Table 3).

Table 3 *Discriminant Validity Testing Original Proposed CVCCB Framework*

	CR	AVE	CE	GEM	CVCCB
CE	.562	.398	.631		
GEM	.581	.421	.946	.649	
CVCCB	.824	.484	.906	.650	.696

Note. CR: Composite Reliability; AVE: Average Variance Extracted; CE: Customer Engagement; GEM: Gamification Emotional Mechanics; CVCCB: Customer's Value Co-Creation Behavior.

The discriminant validity test compared the latent variables' square roots average variance with their correlations, using Heterotrait-Monotrait test ratios (see Table 4). Both showed concern for the Customer Engagement dimension (Henseler et al., 2015), as the square root of AVE for CE construct (.631) was not greater than its correlations with either GEM (.946) or CVCCB constructs (.906).

Table 4 *Heterotrait Monotrait Ratio*

	GEM	CE	CVCCB
GEM	1.00		
CE	.760	1.00	
CVCCB	.668	.921	1.00

After model adjustment by removing second-order indicators with low factor loading (cognitive processing), the validity test results were all satisfactory (see Table 5); thus, the measurement scale's discriminant validity was confirmed.

Table 5 *Discriminant Validity Testing for Modified CVCCB Framework*

	CR	AVE	AFF	GEM	CVCCB
AFF (Affect)	.886	.723	.850		
GEM	.588	.432	.672	.657	
CVCCB	.829	.493	.664	.637	.702

The SEM test outcomes summarized in Table 6 indicated that the proposed research model's fit indices, including Chi-square to degrees of freedom ratio, comparative fit index (CFI), goodness-of-fit Index (GFI), and root mean square error of approximation (RMSEA) were all at satisfactory levels, signifying that the proposed research framework had good model fit (Kline, 2011). Table 6 also revealed that all independent factors had significant effects on dependent variables except for GEM and education, which did not show significant impacts on CVCCB. Thus, Hypothesis 1 was rejected.

Table 6 *Regression Weight Estimate*

			Estimate	*SE*	CR	*p*
AFF	<---	GEM	.896	.119	7.55	***
CVCCB	<---	GEM	.094	.054	1.75	.081
CVCCB	<---	AFF	.239	.041	5.90	***
CVCCB	<---	GENDER	.164	.046	3.55	***
CVCCB	<---	AGE	-.073	.022	-3.32	***
CVCCB	<---	EDUCATION_LEVEL	.018	.017	1.08	.282
CVCCB	<---	INCOME_LEVEL	.201	.032	6.35	***

Note. CVCCB–Customer's value co-creation behavior; AFF–Affect; GEM–Gamification emotional mechanics. Model fit indices: χ2 = 719.945 (*p* = .000), *df* = 408, χ2/*df* = 1.765, CFI = .965, GFI = .921, NFI = .924, TLI =. 960, RMSEA = .037, *** = .001 significance level.

Moreover, the bootstrapping results in Table 7 showed that GEM's direct effect on CVCCB was insignificant. However, indirect effects were significant, meaning that affective CE had a full mediation effect on the relationship between GEM and CVCCB. Thus, Hypotheses 2 and 3 were supported.

Table 7 *Mediating Effect of Affective Customer Engagement*

Relationship	Estimate	Bootstrapping Bias-Corrected 95% CI		2 Tailed Significance
Direct Effects		LB	UB	
AFF–GEM	.896	.662	1.19	.001
CVCCB–GEM	.094	-.005	.227	.060
AFF–CVCCB	.239	.143	.343	.001
Indirect Effects				
CVCCB–GEM	.214	. 132	.346	.001

Note. AFF: Affect; GEM: Gamification emotional mechanics, CVCCB: Customer's value co-creation behavior.

The test results in Table 8 indicated that after inputting a centralized interactions factor (GEM _CC*GEN_CC), Model 2 was statistically insignificant. However, Model 4 became significant after adding the interactions term (AFF _CC*GEN_CC), with a 4.6 percent increase in *R*-squared. This has confirmed the generational differences' various moderating effects on CE and CVCCB. Therefore, Hypothesis 4 was rejected, and Hypothesis 5 was supported.

Table 8 *Summary of Hierarchical Regression Analysis*

Model	*R*	R^2	Adjusted R^2	Std. Error of Estimate	Change Statistics		
					R^2 Change	*F* Change	Sig. *F* Change
1	.343a	.118	.116	1.24	.118	73.0	.000
2	.346b	.120	.116	1.24	.002	1.27	.260
3	.336c	.113	.111	.754	.113	69.8	.000
4	.399d	.159	.156	.735	.046	30.0	.000

a. Predictors: (Constant), GEM_CC
b. Predictors: (Constant), GEM _CC, GEM _CC*GEN_CC
c. Predictors: (Constant), AFF_CC
d. Predictors: (Constant), AFF _CC, AFF _CC*GEN_CC

Discussion

Findings of this study confirmed that customers' affective engagement significantly influenced CVCCB in M-banking service, which was congruent with the findings in related research in the USA regarding mobile application settings, advocating that customers' affective emotional response was an essential antecedent factor of CVCCB in mobile application service (Doğan-Südaş et al., 2023). Consistent with the results of another study in Spain with 304 participants (García-Magro et al., 2023),

this study provided evidence to support that GEM positively influenced CVCCB in M-banking services, although this effect was moderately significant. Moreover, results from this research also confirmed that customers' affective engagement had a significant mediating effect on the relationship between GEM and CVCCB, which supported the findings of prior studies claiming that GEM had an indirect influence on CVCCB through CE (Doğan-Südaş et al., 2023).

For instance, Cheng (2024) conducted research in a Taiwanese educational setting using 331 participants, and suggested that learners' engagement can be positively affected by gamification and the inherent emotions in Massive Open Online Courses. Furthermore, this study also found that generational differences had a significant moderating effect on the relationship between affective CE and CVCCB, but not on the relationship between affective GEM and CE. These findings were also supported by the results of previous studies, which claimed that customers from various generational groups frequently exhibited dissimilar CVCCB (Moise et al., 2020). However, the emotional mechanisms in gamification did not influence customers from various generation groups differently (Ebermann et al., 2016), as emotive stimuli in gamification were often embedded in fundamental psychosomatic triggers that went beyond generational boundaries, such as human desires for accomplishment, respect, and playfulness. Therefore, the emotional mechanisms within gamification are likely to activate affective CE in ways that are not substantially altered by age-related dissimilarities in values or technology use (Ebermann et al., 2016).

Conclusion and Recommendations

This research extends the body of knowledge on GEM and CVCCB by bridging several gaps in the current literature. Theoretically, it offers pragmatic evidence for confirming the dissimilar impacts of three acknowledged antecedent factors on CVCCB in a proposed conceptual model. It also validated the application of SOR theory in explaining the mediating effects that CE exerted on the relationship between GEM and CVCCB in M-banking service, which had not yet been explored in the literature. Moreover, this study validated the use of generational theory to explain CVCCB differences among various generational cohorts within the Chinese M-Banking context.

This study also contributes practically to policymakers for improving overall business performance. First, owing to GEM's positive impact on both CE and CVCCB, bank management in China should try to incorporate emotional mechanisms when designing gamification features in M-banking; these would include intrinsic motivation (enjoyment, achievement, socialization) and extrinsic motivation (rewards, points, competition) that can direct customers' behavior towards CE and CVCCB in M-banking service. Second, given that generational differences exert a significant moderating impact on CVCCB, Chinese bank management and government should take into account this effect when motivating CVCCB in the M-banking context, because CVCCB differences can be attributed to both customers' physical functions and psycho-emotional factors, such as the perceived GEM in M-banking services. Thus, policymakers at various levels should consider applying generational-friendly approaches, such as age-friendly interfaces and personalized information, to customize the precise customer needs for each generational cohort, thereby encouraging CVCCB.

Limitations and Suggestions for Future Studies

Although this study presents several significant implications, it also had a few limitations that need to be addressed in future studies. First, the findings of this study were based on the analysis of a rather limited size of Chinese M-banking users recruited in this cross-sectional research, which means that the generalization of these results to a larger scale is rather limited. Second, adopting a survey questionnaire as the research tool cannot avoid introducing various bias during research process. Third, this research theorized CVCCB with lower-order dimensional constructs, which may have neglected subtle differences between CVCCB's sub-dimensions when using higher order constructs to conceptualize this notion, as proposed in other studies. Fourth, as this study was cross-sectional in nature, the underlying relationships among variables require further validation through longitudinal studies owing to the dynamic environment in the Chinese finance industry. Lastly, in order to develop

an improved and robust CVCCB framework, future studies should consider introducing more relevant antecedent factors of CVCCB and demographic variables to the proposed framework in this study.

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