# **RESEARCH ARTICLE**

# The Impact of Perceived Platform Interactivity on Customer Value Co-Creation ----Exploring the Mediating effects of Customer Inspiration and the Moderating effects of ethical perceptions

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## ABSTRACT

As the digital economy progresses, community group buying has emerged as a novel social retail model, reshaping traditional business structures. Customers play an increasingly pivotal role in the process of value creation, with their perceived value dictating market orientation and serving as the focal point for corporate value creation. However, effectively fostering customer co-creation of value remains an unresolved critical issue in this field. Diverging from previous studies, this research adopts an individual perception-based approach, employing social cognitive theory to construct an integrated theoretical model that explores how perceived platform interactivity influences customer co-creation behaviors. Data were collected through surveys conducted in Nanchang and Changsha, yielding 557 valid responses. Structural equation modeling was used for empirical analysis. The results indicate that perceived platform interactivity significantly positively affects customer participation behavior ( $\beta$ =0.503, p<0.001) and customer citizenship behavior ( $\beta$ =0.457, p<0.001). Customer inspiration plays a partial mediating role between perceived platform interactivity and value co-creation behaviors. Moreover, moral perception positively moderates the impact of perceived platform interactivity on value co-creation. This study not only enriches the theoretical exploration of customer value co-creation in the platform economy but also confirms that customer inspiration can supplement social cognitive theory's motivational constructs, expanding the theory's applicability in digital marketing. The findings offer practical guidance for optimizing interaction design on community group buying platforms and stimulating creative customer engagement.

*Keywords:* Social Cognitive Theory; Platform Interactivity; Customer Value Co-Creation; Customer Participative Behaviors; Customer Citizenship Behaviors; Customer Inspiration; ethical perceptions

## 1. Introduction

As the digital economy continues to evolve, community group buying has emerged as a new social retail model that is restructuring the traditional business ecosystem. In 2021, China's Ministry of Commerce, along with 11 other departments, released the "Urban 15-Minute Convenience Living Circle Construction Guide," which explicitly aims to standardize the development of community group buying through the "Hundred

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Cities Thousand Circles" project by 2025. This initiative positions community group buying as a crucial component of urban convenience service innovation<sup>[1]</sup>. Community group buying is an innovative business model based on social networks that uses neighborhood relationships as a bond and operates on a "pre-sale + next-day delivery + self-pickup" model, integrating localized and regional consumption demands. This model represents an evolution of traditional e-commerce under the backdrop of digital transformation, not only meeting consumer demands for convenience but also aligning with new trends in socialized and scenario-based consumption. Its distinctive characteristics involve focusing on fresh food and household goods as entry points, employing differentiated operational strategies such as initial fresh food traffic generation followed by the conversion of high-profit products, thus forming a sustainable commercial loop<sup>[2]</sup>.

The evolution of community group buying has transitioned from a decentralized "leader + community" model to a platform-based, scaled transformation. As e-commerce deepens, vertically integrated platforms such as Meituan Select and TaocaiCai have capitalized on their scale economies and supply chain integration capabilities, gradually replacing the earlier fragmented community models and establishing a platform-led new business paradigm<sup>[3]</sup>. However, in a diverse competitive landscape, community group buying platforms must not only contend with the existing competition from traditional retail channels but also face incremental competition among homogeneous platforms. Although current platforms have established a certain market position through traffic advantages and user repurchase, how to build sustainable competitive barriers, enhance user stickiness, and achieve differentiated competitive advantages remains a critical challenge for platform enterprises.

In the community group buying model, the process of value creation advocates for a consumer-centric approach that seamlessly integrates online interactions with offline experiences through social activities, enhancing emotional connections with users. This approach facilitates the construction of a retail ecosystem characterized by co-creation, co-sharing, and coexistence<sup>[4]</sup>. This reflects the current state of business in today's socio-economic development, where enterprises are increasingly shifting from product-value-driven operations to customer-need-driven strategies. The value of a company's products is progressively determined by customers, stemming from their direct experiences and perceived value as they engage in co-creation<sup>[5]</sup>. In the era dominated by customer-centric logic, the focal point of value co-creation has significantly shifted towards customer experience. Yu and Yang argue from a customer-dominant logic that value co-creation in online environments is rooted in customer experience<sup>[6]</sup>. Through deep interaction, it not only better stimulates and expresses customer experiences but also helps businesses to identify and satisfy latent needs, thereby enhancing brand loyalty. Li empirical study further validates the facilitative effect of bidirectional interactions between users and between users and businesses on the formation of experiential value<sup>[7]</sup>. Hu and Hu emphasize that experiential value is a dynamic perception continually formed during the consumption process<sup>[8]</sup>.

However, Paredes through a systematic literature review, found that existing research in e-commerce relies too heavily on the enterprise resource perspective when explaining customer value perception, neglecting the co-creation principle of interaction emphasized in service-dominant logic<sup>[9]</sup>. Similarly, studies on the impact of platform interactivity on customer fit and brand value often remain limited to the perspectives of resource providers or integrators<sup>[10,11,12]</sup>.

This study posits that it is essential to explore the impact of individual interactions with platforms on cocreating value from the consumer's perspective, offering new insights into customer engagement in value cocreation.

This study constructs its research framework based on three theoretical perspectives:

Firstly, under the customer-centric service paradigm, perceived platform interactivity is identified as a key antecedent driving customer value co-creation behaviors. Drawing on the theoretical classifications by Yi and Gong<sup>[13]</sup>, this study categorizes customer value co-creation behaviors into two dimensions: (1) Customer participation behaviors, which are essential for realizing the usage value of a product or service, including information searching, information sharing, responsible behaviors, and interpersonal interactions; (2) Customer citizenship behaviors, which are spontaneously generated by customers and can create additional value for the enterprise, encompassing feedback, advocacy, assistance, and tolerance.

Secondly, this study uses Social Cognitive Theory as the theoretical foundation to explore how individual intrinsic motivations and external environments jointly influence value co-creation behaviors. This theory has been extensively validated in the fields of psychology and education, effectively explaining the mechanisms by which intrinsic motivations affect individual choices, efforts, and perseverance<sup>[14]</sup>. Notably, this study introduces a new variable, customer inspiration, defined as the process by which customers transform intrinsic motivations from receiving marketing stimuli to forming consumption goals<sup>[15]</sup>. According to Social Cognitive Theory, the alignment of external information with consumer needs triggers cognitive associations, thereby inspiring customer inspiration<sup>[16,17]</sup>. Although the motivational variables of Social Cognitive Theory have been empirically supported, their application in the field of marketing remains to be expanded<sup>[18]</sup>. Therefore, validating the mediating role of customer inspiration not only enriches the motivational research agenda of Social Cognitive Theory but also deepens the understanding of the mechanisms by which motivational marketing functions in value co-creation.

Finally, considering the unique characteristics of community group buying as a new social retail model, individual behaviors are more susceptible to social contextual factors<sup>[19]</sup>. This study introduces ethical perceptions as a moderating variable, reflecting consumers' overall assessment of a platform's sense of responsibility and integrity<sup>[20]</sup>. Existing research shows that ethical perceptions affects consumer behavior by influencing their trust in, satisfaction with, and commitment to the platform<sup>[21]</sup>. Incorporating ethical perceptions into the research framework helps to more comprehensively understand the mechanisms between perceived platform interactivity and value co-creation behaviors.

This study employs an empirical research methodology, collecting data through surveys distributed to participants of community group buying, and testing the model hypotheses using linear regression methods. The findings enrich the theoretical exploration of customer value co-creation in the platform economy, confirming that customer inspiration can serve as a supplementary motivational construct within social cognitive theory, thereby extending its applicability in the field of digital marketing. Furthermore, the conclusions provide practical guidance for optimizing the interaction design of community group buying platforms and for stimulating creative customer participation.

## 2. Literature Review

### 2.1. Theoretical Foundations and Applications of Social Cognitive Theory

Social Cognitive Theory (SCT) is a significant theoretical framework for understanding human behavior, central to which is the dynamic interplay between people, their environments, and their behaviors<sup>[22]</sup>. This theory studies the formation of human thoughts, feelings, and behaviors by analyzing the causal relationships among them. It is widely applied across disciplines such as applied psychology, education, healthcare, communication, and technology. In recent years, the application of social cognitive theory in the field of marketing research has been increasing, including studies on online shopping and service marketing<sup>[23]</sup>. For instance, Kang investigated how user customization in online service environments influences their

continued usage intentions, finding that self-customization behaviors enhance users' self-efficacy beliefs and the perceived alignment of the service environment with their desires and needs<sup>[24]</sup>. Ruehl explored how individuals engage with brand pages in terms of consumption, participation, and production behaviors, discovering that consumption behaviors are best explained by activity, self-response novelty, and monetary incentives<sup>[25]</sup>. A review of related literature offers two insights into these dynamics.

Firstly, in the context of community group buying, effective communication between the platform and customers, as well as customers' perceptions of the platform, can be seen as an external environment. Social cognitive theory posits that the environment is not static but is continually updated through individuals' interactions with the platform, which, in turn, motivates proactive participation in value creation.

Secondly, human behavior is influenced by intrinsic motivations, and effective incentives can transform into such motivations, fostering more positive behaviors. Schunk and DiBenedetto also suggest that the motivational research agenda within social cognitive theory needs further development<sup>[18]</sup>.

Based on these insights, this study proposes using social cognitive theory as the theoretical foundation. It constructs a theoretical model for customer value co-creation behavior by considering perceived platform interactivity and moral perception as external environmental factors, and customer inspiration, commonly used in incentive marketing, as an individual motivation. Through communication with the platform, individuals achieve information exchange. As communication frequency increases, this external environment becomes increasingly conducive. Individuals then develop new cognitions, which influence their positive motivational states (customer inspiration), leading to behaviors that align with their consumer beliefs (customer participation behavior and customer citizenship behavior). Such behaviors also help the platform better understand market needs. Ultimately, these behaviors not only enhance the consumer experience but also bring more customers and stronger market competitiveness to the platform, representing a mutually value-creating action. Moreover, the more positively individuals perceive the platform's responsibility and integrity, the greater the facilitation of their behavior generation process.

### 2.2. Research Hypotheses

#### 2.2.1. Perceived Platform Interactivity and Its Theoretical Link to Customer participative behaviors

Platform interactivity is a central construct in the customer-business relationship within the digital platform environment, reflecting the platform's capacity to facilitate multifaceted interactions and the resultant interactive experience<sup>[26]</sup>. Specifically, a high level of platform interactivity manifests through rapid response to customer needs, timely information dissemination, and effective problem resolution, among other dimensions<sup>[27]</sup>. Such positive interactive experiences not only strengthen customers' emotional connections but also deepen their psychological identification with the platform.

From the perspective of Social Cognitive Theory, an individual's cognitive evaluation of the platform influences subsequent behaviors through psychological mechanisms<sup>[22]</sup>. When customers perceive high platform interactivity, they form a more precise matching of needs and information<sup>[28]</sup>, which further enhances their willingness to engage. Existing research has demonstrated that smooth bi-directional communication mechanisms provided by businesses significantly elevate perceived value and interest in participation<sup>[29]</sup>. More importantly, this perceived value may influence customer participative behaviors through both direct and indirect pathways (e.g., via customer loyalty) <sup>[30]</sup>.

Based on the aforementioned theoretical analysis and existing research findings, this study proposes:

H1: Perceived platform interactivity has a significant positive impact on customer participative behaviors.

#### 2.2.2. The Mechanism of Perceived Platform Interactivity on Customer Citizenship Behaviors

In the context of digital transformation, platform interactivity has become a crucial mechanism for connecting businesses with customers and facilitating co-creation of value<sup>[31]</sup>. Particularly in community group buying contexts, platforms have not only achieved user acquisition and value conversion through the creation of high-quality interaction interfaces but have also stimulated proactive value perception among consumers<sup>[32]</sup>. Specifically, through scenario-based product displays and multi-dimensional interaction design, platforms significantly enhance customers' willingness to engage in activities such as evaluations and recommendations<sup>[31]</sup>.

From a mechanistic standpoint, effective platform interactivity is characterized by the dynamic adjustment of content and diversity in information presentation<sup>[33]</sup>. This interactivity influences customer citizenship behaviors via two pathways: first, rich interactive experiences enhance customer understanding of the platform and reduce transactional uncertainty<sup>[34,35]</sup>; second, a quality interactive environment, stable customer connections, and reliable platform performance collectively establish a foundation for customer trust<sup>[36]</sup>. This trust further translates into customer loyalty, ultimately encouraging customers to exhibit more citizenship behaviors, such as actively recommending the platform and tolerating its flaws<sup>[37]</sup>.

Based on the aforementioned theoretical analysis and empirical evidence, this study proposes:

H2: Perceived platform interactivity has a significant positive impact on customer citizenship behaviors.

#### 2.2.3. The Mechanism of Perceived Platform Interactivity in Stimulating Customer Inspiration

Platform interactivity, as a core feature of customer-platform interaction, profoundly influences customers' psychological experiences on a cognitive level through multidimensional manifestations such as responding to needs and collecting feedback<sup>[27]</sup>. Existing research has demonstrated that high-quality platform interaction significantly enhances customer engagement at cognitive, emotional, and behavioral levels<sup>[38]</sup>. Notably, such interactions not only provide opportunities for knowledge acquisition and idea sharing but also stimulate creative ideation by fostering cognitive collisions<sup>[39,40]</sup>.

From the perspective of cognitive transformation, the perception of platform interactivity serves as a preliminary cognitive element, with customer inspiration as a psychological response to this cognitive processing. Specifically, when customers perceive high interactivity, the platform's ability to provide timely responses and solve problems<sup>[26,27]</sup>, yields significant cognitive benefits. In this dynamic interactive process, customers gradually accumulate cognitive resources through continuous information exchange and experience sharing<sup>[41]</sup>, ultimately triggering the emergence of inspiration. This process exemplifies the psychological mechanism by which external stimuli from platform interactivity are transformed into internal inspiration.

Based on the aforementioned theoretical analysis and empirical support, this study proposes:

H3: Perceived platform interactivity has a significant positive impact on customer inspiration.

#### 2.2.4. The Mechanism Driving Customer participative behaviors Through Customer Inspiration

Customer inspiration represents a unique psychological mechanism of motivation, originating from the target-oriented motivational state induced by new ideas or marketing stimuli<sup>[15]</sup>. This psychological state possesses dual characteristics: on one hand, it is a cognitive enlightenment triggered by external stimuli, evident when customers embrace new ideas (such as product purchase plans) leading to psychological activation; on the other hand, it is an internally driven emotional experience that can reshape customers' attitudes towards brands and products<sup>[15]</sup>.

From the perspective of motivational transformation, customer inspiration, as a state of goal pursuit, can effectively activate customers' decision-making intentions and related behaviors<sup>[15]</sup>. When customers are in a highly inspired state, their behavioral imagination is significantly enhanced. This cognitive expansion effect ultimately translates into concrete behavioral manifestations<sup>[42,43]</sup>. Existing research has confirmed that customer inspiration, through intrinsic driving mechanisms, significantly promotes multifaceted participative behaviors such as word-of-mouth recommendations, feedback provision, and knowledge sharing<sup>[44]</sup>.

This transformation process from inspiration to behavior can be understood as a "cognitive-emotionalbehavioral" continuum: firstly, inspiration activates the cognitive system, expanding the boundaries of customer thought; secondly, cognitive activation brings about emotional arousal, enhancing the motivation to engage; finally, strengthened motivation drives the manifestation of specific participative behaviors. This mechanism reveals the unique value of customer inspiration as a behavioral driver.

Based on the aforementioned theoretical analysis and empirical evidence, this study proposes:

H4: Customer inspiration has a significant positive impact on customer participative behaviors.

#### 2.2.5. The Mechanism by Which Customer Inspiration Promotes Customer Citizenship Behaviors

Customer citizenship behavior refers to value creation activities that transcend conventional transactional boundaries, primarily manifested in spontaneous customer actions such as feedback, advocacy, mutual assistance, and tolerance<sup>[13]</sup>. These behaviors include providing constructive suggestions to the platform, assisting other customers, actively recommending, and maintaining the platform's image, all of which are altruistic in nature<sup>[13]</sup>. Studies indicate that such extra-role behaviors are profoundly influenced by customers' psychological states, particularly customer inspiration<sup>[40]</sup>.

Customer inspiration, as a unique psychological mechanism, is fundamentally characterized by the exploration of new possibilities and the realization of new ideas<sup>[15,45]</sup>. This intrinsic drive impacts customer behaviors through multiple pathways: on one hand, it enhances perceived efficacy and brand attachment; on the other hand, it boosts customer satisfaction and loyalty<sup>[15,46,47,48]</sup>. From the perspective of Social Cognitive Theory, inspiration is a product of cognitive processing, reflecting an individual's internal psychological response<sup>[49]</sup>. This psychological state facilitates the transformation of ideas into actions, particularly in promoting extra-role behaviors.

Empirical studies further validate that inspiration-driven consumer experiences significantly enhance the willingness to recommend products and increase visit frequency<sup>[48]</sup>. This finding highlights the unique value of customer inspiration in stimulating citizenship behaviors: when customers are activated by inspiration, they are more likely to transcend personal benefit considerations, demonstrating concern and support for the platform and other customers.

Based on the aforementioned theoretical analysis and empirical support, this study proposes:

H5: Customer inspiration has a significant positive impact on customer citizenship behaviors.

#### 2.2.6. The Mediating Role of Customer Inspiration

Customer inspiration often requires external stimuli, such as information exchange, rather than emerging spontaneously<sup>[50]</sup>. Research indicates that product/brand interactions with customers yield cognitive and learning benefits, such as new product knowledge, brand information, and market-related insights<sup>[39]</sup>. Therefore, robust information exchanges deliver valuable and useful information to customers, potentially sparking their inspiration<sup>[51]</sup>. Platform interactivity has become a crucial bridge for interactions between platforms and customers. This interactivity is not merely a mode of communication but a means to

build relationships and enhance understanding. When customers perceive high platform interactivity, it enhances their sense of involvement and engagement, thereby inspiring them<sup>[27]</sup>.

On the other hand, research suggests that customer inspiration is a significant precursor to customerbrand interaction, civic behavior, and recycling behavior<sup>[52,53,54]</sup>. This implies that once customers are inspired by external stimuli related to platform information, they are more likely to interact with the platform and develop relationships. Therefore, by enhancing customer inspiration, individuals are inclined to express their unique needs for consumer products or services and seek assistance from the platform, potentially stimulating their participation in co-creating value<sup>[55]</sup>.

These dual pathways reveal the central mediating role of customer inspiration in the process by which platform interactivity influences customer behaviors. Therefore, this study proposes:

H6: Customer inspiration plays a significant mediating role in the relationship between perceived platform interactivity and customer participative behaviors.

H7: Customer inspiration plays a significant mediating role in the relationship between perceived platform interactivity and customer citizenship behaviors.

#### 2.2.7. The Moderating Role of Ethical Perception

Ethical perception, as a significant situational variable, reflects consumers' overall assessment of a platform's commitment to social responsibilities and business integrity<sup>[21]</sup>. Existing research indicates that consumers' ethical perception plays a critical moderating role in the platform economy by influencing their trust evaluations and behavioral decisions regarding the platform<sup>[56]</sup>. Specifically, when consumers perceive a platform as fair, responsible, and honest, they form a positive ethical perception, which in turn enhances their trust in the platform<sup>[21]</sup>. This trust, based on ethical perception, serves as an important psychological mechanism that inspires consumers to engage in value co-creation behaviors<sup>[57]</sup>.

From the perspective of Social Cognitive Theory, ethical perception constitutes a crucial environmental factor for value co-creation. When consumers develop a heightened sense of ethical perception, they experience a stronger trust and affinity for the platform<sup>[38]</sup>. This positive psychological state influences value co-creation behaviors through two pathways: first, it enhances consumers' willingness to actively search for information, establish social connections, and share experiences; second, it increases their propensity to exhibit altruistic behaviors such as helping others and recommending the platform<sup>[20,21]</sup>.

Importantly, as a key situational variable, ethical perception moderates the strength of the relationship between perceived platform interactivity and value co-creation behaviors. Specifically, in high ethical perception scenarios, consumers are more likely to translate positive interactive experiences on the platform into actual engagement and citizenship behaviors. This is because strong ethical perception provides a trustworthy environmental foundation for platform interactions, enhancing the efficiency of transforming interactive behaviors into value co-creation activities. Conversely, in scenarios of low ethical perception, even if the platform offers good interactive experiences, consumers may reduce their willingness to engage due to a lack of trust.

Based on the aforementioned theoretical analysis, this study proposes:

H8: Ethical perception positively moderates the impact of perceived platform interactivity on customer participative behaviors; the higher the level of ethical perception, the stronger the positive impact of perceived platform interactivity on customer participative behaviors.

H9: Ethical perception positively moderates the impact of perceived platform interactivity on customer citizenship behaviors; the higher the level of ethical perception, the stronger the positive impact of perceived platform interactivity on customer citizenship behaviors.



Figure 1 Research Framework Diagram.

## 3. Research Design

#### 3.1. Research Subjects and Sampling

This study selected community group-buying users in the second-tier Chinese cities of Nanchang and Changsha as the research subjects. The choice of these cities is based on the following considerations: firstly, existing research indicates that the main user group of community group-buying is concentrated in China's second and third-tier cities<sup>[2]</sup>; secondly, these cities have mature community group-buying ecosystems and diverse user groups, which can well represent the current development of community group-buying in China; finally, these cities are representative in terms of economic development, population structure, and consumer habits.

Data collection was conducted using a survey method from January to February 2024. To ensure data quality, this study employed strict sample screening criteria: initially, samples with significantly shorter completion times than the average were excluded; next, surveys with obvious response patterns (such as consecutive selections of the same options) were eliminated; finally, respondents who had not used community group-buying platforms in the past six months were excluded. After these quality control procedures, a total of 557 valid questionnaires were obtained, with an effective response rate of 63.4%.

The demographic characteristics of the sample are as follows: in terms of gender composition, there were 372 female respondents (66.8%) and 185 male respondents (33.2%), a ratio that aligns with the actual composition of community group-buying users; the age distribution was mainly between 29-38 years old, which matches the core user group characteristics of community group-buying platforms; the educational level was predominantly bachelor's degree; monthly income levels were mainly between 5,001-8,000 yuan, reflecting the medium income characteristics of the sample. Overall, the composition of the sample is representative, providing a reliable data basis for subsequent hypothesis testing.

#### 3.2. Measurement of Variables

This study utilized established scales previously published and validated in international journals, with all scale items rated on a Likert scale from 1 ("strongly disagree") to 5 ("strongly agree"). To ensure the appropriateness of the measures, three experts in the field of marketing were invited to evaluate the content validity of the scales, and a pretest (n=50) was conducted to preliminarily validate and revise the scales.

For measuring perceived platform interactivity, a 4-item scale developed by Gao et al. was used<sup>[58]</sup>, assessing dimensions such as response speed, feedback collection, interaction convenience, and information sharing. Example items include: "The platform can respond quickly to my needs" and "The platform provides convenient channels for feedback." This scale demonstrated good reliability and validity in the original study ( $\alpha = 0.89$ , CR = 0.91).

Customer inspiration was measured using a 5-item scale developed by Cao et al.<sup>[59]</sup>, assessing customers' inspirational thinking and innovative ideas during platform use. Example items include: "Using this platform sparks new ideas for me" and "This platform stimulates my creative thinking." This scale exhibited strong psychometric properties in its original use ( $\alpha = 0.92$ , CR = 0.93).

Customer value co-creation behavior was measured based on a scale developed by Shamim et al.<sup>[60]</sup>, comprising two dimensions: customer participative behaviors (13 items) and customer citizenship behaviors (14 items). Customer participative behaviors included information searching, information sharing, responsible behavior, and interpersonal interaction; customer citizenship behaviors encompassed feedback, advocacy, helping, and tolerance. This scale has shown stable construct validity in cross-cultural contexts (CFI > 0.90, RMSEA < 0.08).

Ethical perception was measured using an 11-item scale developed by Nadeem et al.<sup>[21]</sup>, assessing consumers' moral judgments of platforms in areas such as privacy protection, security assurance, and service reliability. Example items include: "The platform always protects user privacy" and "The platform provides reliable transaction security." This scale demonstrated good construct validity and discriminant validity in e-commerce contexts (AVE > 0.50,  $\sqrt{AVE}$  > correlation coefficients).

To ensure translation equivalence, the study employed a standard back-translation procedure: initially, two bilingual experts translated the English scales into Chinese, followed by another two bilingual experts who back-translated the Chinese versions into English. Finally, the research team compared and corrected any discrepancies to ensure semantic and measurement consistency between the English and Chinese versions.

### **3.3. Data Collection Procedure**

Data were collected using a multi-stage snowball sampling method from January to February 2024. This sampling technique is particularly advantageous in research contexts like community group-buying that are based on social networks<sup>[61]</sup>,enabling effective access to the target population and acquisition of high-quality data. The sampling process was divided into three stages: initially, community group leaders ("group heads") on the platform served as the primary contact points; next, these key informants' networks were utilized to facilitate snowball sampling; finally, new potential respondents were recommended by existing participants, ensuring a reasonable expansion of the sample.

To ensure data quality, the following control measures were implemented by the research team: first, standardized invitation texts were prepared, clearly stating the research objectives, academic nature, and confidentiality commitments; second, attention check items were embedded in the survey design to screen out invalid responses; third, a professional survey platform was used to collect data, with response times and

IP addresses recorded to prevent duplicate responses; fourth, data anonymization was promised and strictly adhered to, protecting respondents' privacy.

The survey was distributed online via social media platforms such as WeChat, with a link to the questionnaire. Each questionnaire began with a research brief, detailing the study's objectives, the value of participation, and privacy protection measures. To enhance participant enthusiasm and the quality of responses, a small monetary incentive was employed, providing a modest electronic red packet (RMB 5) for each completed valid questionnaire. This incentive scheme was approved by the ethics committee during the pilot phase and did not significantly affect the quality of the responses.

The entire data collection process lasted approximately six weeks, during which 879 questionnaires were distributed. Following rigorous data cleaning procedures, 557 valid questionnaires were obtained, resulting in an effective response rate of 63.4%. This sample size meets the minimum requirements for structural equation modeling analysis (n > 200) and the effective response rate is within an acceptable range. No significant systemic bias was detected during the data collection process, providing a reliable data foundation for subsequent analyses.

## 4. Results

#### 4.1. Reliability Test and Assessment of Common Method Bias

To ensure the quality of the measurements, this study first conducted reliability tests on each construct. The results revealed Cronbach's alpha coefficients as follows: perceived platform interactivity ( $\alpha = 0.845$ ), customer inspiration ( $\alpha = 0.883$ ), ethical perception ( $\alpha = 0.922$ ), customer participative behaviors ( $\alpha = 0.939$ ), and customer citizenship behaviors ( $\alpha = 0.944$ ). All constructs' reliability coefficients significantly exceeded the recommended threshold of  $0.7^{[62,63]}$ , indicating good internal consistency reliability of the measurement tools.

Given that this study used a single-source data collection method, to assess the potential impact of Common Method Variance (CMV), the Harman's single-factor test was employed. Specifically, all measurement items were included in an exploratory factor analysis to examine the explanatory power of a single factor without rotation. The results showed that the first principal component accounted for only 28.069% of the total variance, significantly below the 40% threshold<sup>[64]</sup>, suggesting that common method bias is not a severe issue in this study. To further ensure the robustness of the results, a procedure that controls for an unmeasured latent method factor was also employed, and the results similarly supported the reliability of the data quality.

#### 4.2. Confirmatory Factor Analysis

To assess the validity of the measurement model, this study conducted a confirmatory factor analysis (CFA). Perceived platform interactivity, customer inspiration, ethical perception, customer participative behaviors, and customer citizenship behaviors were treated as latent variables to construct a five-factor measurement model. The results demonstrated good model fit:  $\chi^2/df = 1.176$ , GFI = 0.919, AGFI = 0.910, NFI = 0.924, CFI = 0.988, RMSEA = 0.018, SRMR = 0.038. All fit indices met or exceeded recommended thresholds<sup>[65]</sup>, indicating a strong overall fit of the measurement model.

As shown in **Table 1**, in terms of convergent validity, all standardized factor loadings ranged from 0.693 to 0.809, significantly above the recommended threshold of 0.60; Composite Reliability (CR) values ranged from 0.846 to 0.945, well above the critical value of 0.70; Average Variance Extracted (AVE) ranged from 0.518 to 0.603, all above the recommended standard of 0.50<sup>[66]</sup>. These indices collectively indicate good convergent validity of the measurement model.

Variable	Item	Standardized Factor Loadings	CR	AVE
	PI1	.763		
Demonstrad Diatform Interactivity	PI2	.748	Q16	570
Perceived Platform Interactivity	PI3	.754	.846	.578
	PI4	.775		
	CI1	.809		
	CI2	.785		
Customer Inspiration	CI3	.717	.884	.603
	CI4	.791		
	CI5	.778		
	EP1	.749		
	EP2	.705		
	EP3	.721		
	EP4	.741		
	EP5	.728		
Ethical Perception	EP6	.702	.922	.518
	EP7	.693		
	EP8	.732		
	EP9	.724		
	EP10	.713		
	EP11	.708		
	CPB1	.712		
	CPB2	.743		
	CPB3	.731		
	CPB4	.718		
	CPB5	.727		
	CPB6	.723		
Customer Participation Behavior	CPB7	.730	.940	.526
Customer Farticipation Benavior	CPB8	.711	.940	.520
	CPB9	.722		
	CPB10	.730		
	CPB11	.725		
	CPB12	.720		
	CPB13	.740		
	CPB14	.722		
	CCB1	.770		
Customer Citizonshin Dehavior	CCB2	.757	.945	.567
Customer Citizenship Behavior	CCB3 .737		.743	.307
	CCB4	.764		

### Table 1. Factor Loadings, CR, and AVE.

-		
CCB5	.753	
CCB6	.745	
CCB7	.721	
CCB8	.765	
CCB9	.754	
CCB10	.762	
CCB11	.755	
CCB12	.746	
CCB13	.759	

Table 1. (Continued)

For discriminant validity assessment, the square roots of the AVEs for each construct were greater than the correlation coefficients between that construct and all others, meeting the Fornell-Larcker criterion<sup>[67]</sup>. The detailed data is presented in **Table 2**. This confirms that the constructs are sufficiently distinct from one another.

Variable	М	SD	1	2	3	4	5
		~-	7(0)	_	•		•
Perceived Platform Interactivity	3.509	0.926	.760				
Customer Inspiration	3.421	1.051	.361**	.777			
Ethical Perception	3.655	0.867	.251**	.148**	.720		
Customer Participation Behavior	3.700	0.813	.550**	.459**	.305**	.725	
Customer Citizenship Behavior	3.507	0.900	.486**	.411**	.231**	.480**	.753

Table 2 Means, Standard Deviations, and Correlation Analysis.

*Note:* 1. N=557, \*p<0.05, \*\*p<0.01, \*p<0.001.

2. The diagonal represents the square root of the AVE for each variable.

#### 4.3. Correlation Analysis

**Table 2** presents the descriptive statistics and correlation matrix for the main study variables. Results indicate significant but moderate correlations among the constructs (r = 0.148-0.550, p < 0.01). All correlation coefficients were below the critical value of 0.70, suggesting no severe multicollinearity issues, thus suitable for subsequent regression analyses.

#### 4.4. Hypothesis Testing

To test the research hypotheses, multiple regression analysis, Bootstrap mediation tests, and moderation analyses were conducted, controlling for demographic variables (gender, age, educational level, and monthly income).

#### 4.4.1. Testing the Main Effects

Initially, the hypotheses concerning main effects were tested using multiple regression analysis. The results indicate that in Model 2, perceived interactivity of the platform significantly and positively influences customer inspiration ( $\beta = 0.365$ , p < 0.001). The detailed data are presented in **Table 3**. This model accounts for 14.3% of the variance (R<sup>2</sup> = 0.143, F = 18.359, p < 0.001), supporting Hypothesis H3. In Model 4, customer inspiration shows a significant positive effect on customer participative behaviors ( $\beta = 0.465$ , p < 0.001; R<sup>2</sup> = 0.222, F = 31.469, p < 0.001), thereby supporting Hypothesis H4. Model 6 demonstrates that customer inspiration also significantly positively affects customer citizenship behaviors ( $\beta = 0.411$ , p < 0.001;

 $R^2 = 0.177$ , F = 23.756, p < 0.001), supporting Hypothesis H5. The variance inflation factors (VIF) for all models are well below the critical value of 10, indicating no issues of multicollinearity.

Table 3. Analysis of the Impact	of Perceived Platform	Interactivity on Cust	tomer Inspiration,	and Customer	Participation and
Citizenship Behaviors .					

	Custome	r Inspiration		Customer Participation Behavior		zenship Behavior
Model	M1	M2	M3	M4	M5	M6
	β	β	β	β	β	β
	<i>(t)</i>	(t)	(t)	(t)	(t)	(t)
	(VIF)	(VIF)	(VIF)	(VIF)	(VIF)	(VIF)
	089	089	.033	.075	076	040
Gender	(-2.087)	(-2.246)	(0.787)	(1.975)	(-1.800)	(-1.029)
	(1.004)	(1.004)	(1.004)	(1.011)	(1.004)	(1.011)
	030	051	.040	.054	.071	.084
Age	(-0.709)	(-1.274)	(0.942)	(1.434)	(1.675)	(2.154)
	(1.015)	(1.019)	(1.015)	(1.016)	(1.015)	(1.016)
	.043	.040	.067	.047	.003	014
Education	(1.003)	(1.019)	(1.571)	(1.246)	(0.077)	(-0.367)
	(1.005)	(1.005)	(1.005)	(1.007)	(1.005)	(1.007)
	.008	011	.013	.009	011	014
Monthly Income	(0.180)	(-0.269)	(0.302)	(0.247)	(-0.248)	(-0.352)
	(1.011)	(1.013)	(1.011)	(1.011)	(1.011)	(1.011)
Perceived		.365***				
Platform		(9.217)				
Interactivity		(1.006)				
Createring				.465***		.411***
Customer				(12.319)		(10.575)
Inspiration				(1.011)		(1.011)
$R^2$	.011	.143	.008	.222	.010	.177
Adj- <i>R</i> <sup>2</sup>	.003	.135	.001	.215	.003	.170
Change in $\mathbb{R}^2$	.011	.132	.008	.214	.010	.167
<i>F-value</i>	1.485	18.359***	1.097	31.469***	1.448	23.756***

*Note:* N=557, \*p<0.05, \*\*p<0.01, \*\*\*p<0.001.

#### 4.4.2. Testing Mediation Effects

The mediating role of customer inspiration was examined using the Bootstrapping method<sup>[68]</sup>, with 5000 resamples. As shown in **Table 4**, the results show significant mediation effects. In the pathway from perceived platform interactivity to customer participative behacior, the indirect effect is significant (indirect effect = 0.098, 95% CI = [0.066, 0.134]). Both the direct effect ( $\beta$  = 0.385, 95% CI = [0.323, 0.447]) and the total effect ( $\beta$  = 0.483, 95% CI = [0.421, 0.544]) are also significant, supporting Hypothesis H6. Similarly, in the pathway influencing customer citizenship behaviors, the mediation effect (indirect effect = 0.095, 95% CI = [0.401, 0.543]), direct effect ( $\beta$  = 0.376, 95% CI = [0.303, 0.449]), and total effect ( $\beta$  = 0.472, 95% CI = [0.401, 0.543]) are all significant, supporting Hypothesis H7. This suggests that customer inspiration plays a partial mediating role in both pathways.

**Table 4.** Mediation Analysis of Customer Inspiration on the Relationship between Perceived Platform Interactivity and Customer Participation and Citizenship Behaviors .

Path		Effect Value	S.E.	Low LCI	Up LCI
Perceived Platform Interactivity $\rightarrow$	Total effect	.483	.031	.421	.544

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Customer	Direct effect	.385	.032	.323	.447
Inspiration $\rightarrow$ Customer participative behacior	Indirect effect	.098	.017	.066	.134
Perceived Platform Interactivity $\rightarrow$	Total effect	.472	.036	.401	.543
Customer Inspiration $\rightarrow$ Customer Citizenship	Direct effect	.376	.037	.303	.449
Behavior	Indirect effect	.095	.018	.063	.132

Table 4. (Continued)

### 4.4.3. Testing Moderation Effects

The moderating effect of ethical perceptions was assessed using the procedure outlined by Baron and Kenny<sup>[68]</sup>. As shown in **Table 5**, Model 8 and Model 11 confirmed the main effects of perceived platform interactivity on customer participative behavior ( $\beta = 0.503$ , p < 0.001; R<sup>2</sup> = 0.340) and customer citizenship behavior ( $\beta = 0.457$ , p < 0.001; R<sup>2</sup> = 0.257), supporting Hypotheses H1 and H2, respectively.

**Table 5.** Moderation Analysis of Ethical Perception on the Relationship between Perceived Platform Interactivity and Customer Participation and Citizenship Behaviors.

	Custo	omer participative	behacior	Cust	omer Citizenship I	Behavior
Model	M7	<b>M8</b>	M9	M10	M11	M12
	β	β	β	β	β	β
	(t)	(t)	(t)	(t)	(t)	(t)
	(VIF)	(VIF)	(VIF)	(VIF)	(VIF)	(VIF)
	.033	.037	.025	076	074	082
Gender	(0.787)	(1.064)	(0.747)	(-1.800)	(-2.017)	(-2.239)
	(1.004)	(1.004)	(1.008)	(1.004)	(1.004)	(1.008)
	.040	.008	.007	.071	.043	.043
Age	(0.942)	(0.218)	(0.204)	(1.675)	(1.162)	(1.161)
	(1.015)	(1.019)	(1.019)	(1.015)	(1.019)	(1.019)
	.067	.075	.064	.003	.008	.001
Education	(1.571)	(2.159)	(1.894)	(0.077)	(0.204)	(0.013)
	(1.005)	(1.009)	(1.013)	(1.005)	(1.009)	(1.013)
	.013	013	021	011	034	039
Monthly Income	(0.302)	(-0.371)	(-0.629)	(-0.248)	(-0.914)	(-1.072)
	(1.011)	(1.014)	(1.016)	(1.011)	(1.014)	(1.016)
Perceived Platform		.503***	.507***		.457***	.459***
Interactivity		(14.011)	(14.501)		(11.988)	(12.168)
Interactivity		(1.074)	(1.075)		(1.074)	(1.075)
		.184***	.240***		.114***	.151***
ethical perceptions		(5.128)	(6.605)		(2.999)	(3.844)
		(1.073)	(1.164)		(1.073)	(1.164)
Perceived Platform			.197***			.128***
Interactivity×ethical			(5.542)			(3.354)
perceptions			(1.107)			(1.107)
$R^2$	.008	.340	.375	.010	.257	.272
Adj- <i>R</i> <sup>2</sup>	.001	.332	.367	.003	.249	.262
Change in R <sup>2</sup>	.008	.332	.035	.010	.246	.015
F-value	1.097	47.147***	46.982***	1.448	31.676***	29.263***

*Note: N*=557, \**p* <0.05, \*\**p* <0.01, \*\*\**p* <0.001.

More importantly, the interaction term between perceived platform interactivity and ethical perceptions in Model 9 showed a significant positive influence on customer participative behavior ( $\beta = 0.197$ , p < 0.001;

 $\Delta R^2 = 0.035$ ), supporting Hypothesis H8. Similarly, Model 12 also demonstrated a significant positive effect of the interaction term on customer citizenship behavior ( $\beta = 0.128$ , p < 0.001;  $\Delta R^2 = 0.015$ ), supporting Hypothesis H9.

To visually demonstrate the moderation effects, simple slope plots were generated (**Figures 2 and 3**). The results illustrate that the positive impacts of perceived platform interactivity on both customer engagement and citizenship behaviors are more pronounced under conditions of high ethical perceptions; these effects are comparatively weaker under conditions of low ethical perceptions. This further substantiates the enhancing moderating role of ethical perceptions. The variance inflation factors (VIF) for all models were below 1.2, ensuring the reliability of the estimates.



Figure 2. Moderating Effect of Ethical Perception between Perceived Platform Interactivity and Customer Participation Behavior.

## 5. Discussion

The empirical findings of this study elucidate the dual dimensions and formation mechanisms of customer value co-creation behaviors within the context of community group-buying platforms. The study identifies two primary modes of value co-creation: transaction-oriented participative behaviors, characterized by proactive information exchange and interaction with the platform to optimize product selection decisions; and social value-oriented citizenship behaviors, which arise from emotional connections and trust, manifesting in actions beyond transactions, such as recommending the platform within social circles and sharing user experiences<sup>[69]</sup>. The results indicate that perceived interactivity of the platform significantly enhances both types of value co-creation behaviors, consistent with findings by Shen et al. <sup>[58]</sup> Specifically, as the level of platform interactivity increases, consumer interactions with the platform intensify, strengthening their sense of participation and belonging, thereby fostering the formation of value co-creation behaviors. As elucidated in **Figure 4**, the impact of perceived platform interactivity on customer participative behaviors ( $\beta = 0.503$ ) is stronger than its impact on customer citizenship behaviors ( $\beta = 0.457$ ). This difference may

reflect the developmental phases of community group-buying platforms, where user interaction is still primarily focused on functional value exchanges—maximizing personal utility through active participation—while there remains room for improvement in cultivating emotional attachment and social value co-creation. This finding not only validates the fundamental assertions of existing research but also further reveals the distinct mechanisms forming different types of value co-creation behaviors.



Figure 3. Moderating Effect of Ethical Perception between Perceived Platform Interactivity and Customer Citizenship Behavior.



Figure 4. Analysis Results.

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This study reveals a significant mediating role of customer inspiration in the relationship between platform interactivity and value co-creation behaviors, deepening our understanding of customer psychological transformation mechanisms. Specifically, customer inspiration is a cognitive state induced by external environmental stimuli<sup>[15]</sup>. In the context of community group-buying, the provision of new product information, market dynamics, and functional features by the platform constitutes key touchpoints that ignite customer inspiration. When customers receive these informational stimuli during interactions with the platform, it triggers new cognitive connections and intrinsic motivations, which in turn translate into creative behavioral tendencies. The empirical results indicate that this cognitive-motivation-behavior transformation chain significantly affects customer participative behaviors (indirect effect = 0.098, p < 0.001) and citizenship behaviors (indirect effect = 0.095, p < 0.001). This finding not only resonates with existing research on how customer inspiration fosters creative behaviors but also unveils the intrinsic psychological mechanisms of customer value co-creation in the platform economy<sup>[44,50]</sup>. Platform interactivity, by stimulating customer inspiration, effectively facilitates the transition from passive information receivers to active value creators.

This study's analysis of the moderating effect of ethical perceptions reveals an important sociopsychological mechanism in the platform economy. The robust growth of the platform economy deeply relies on a broad base of social trust, which stems from the explicit or implicit promises made by platforms in areas such as efficiency enhancement, openness, and security<sup>[70]</sup>. The empirical results indicate that ethical perceptions significantly moderates the impact of platform interactivity on value co-creation behaviors (customer participative behavior:  $\beta = 0.197$ , p < 0.001; customer citizenship behavior:  $\beta = 0.128$ , p < 0.001). This finding resonates with the research by Nadeem et al.<sup>[21]</sup>, showing that when consumers hold a high moral evaluation of a platform, the facilitative effect of platform interactivity on value co-creation behaviors is significantly strengthened. Specifically, robust ethical perceptions enhances user satisfaction and trust, intensifying positive responses to the platform's interactive mechanisms and thus accelerating the transformation from interactive experiences to value co-creation behaviors. This moderating mechanism highlights a key focus for platform governance: while enhancing technological interactivity, platforms must also build moral capital by practicing social responsibility and safeguarding user rights to activate the intrinsic motivation of users to participate in value co-creation.

## 6. Conclusion

Building on this backdrop, this study has developed an integrative theoretical framework and empirically tested the mechanisms through which platform interactivity influences customer value cocreation behaviors. The findings reveal three key mechanisms:

Firstly, perceived platform interactivity serves as a fundamental driver of value co-creation. High levels of platform interactivity enhance the frequency and depth of customer interactions, improve information acquisition, and build trust, thereby stimulating customer engagement and citizenship behaviors.

Secondly, customer inspiration acts as a critical psychological mediator, transforming platform interactivity into concrete value co-creation behaviors. This motivation, based on cognitive activation, effectively drives the transition from passive receivers to active creators.

Thirdly, ethical perceptions plays a key moderating role in the value co-creation process. Higher ethical perceptions not only enhances the facilitative effects of platform interactivity on value co-creation behaviors but also establishes a foundation of trust for long-term collaboration between platforms and customers.

These findings not only enrich the theory of value co-creation in the platform economy but also provide important insights for the practical development of new retail models like community group-buying.

## 7. Theoretical Contributions and Practical Implications

### 7.1. Theoretical Contributions

This study makes three significant contributions to the existing literature:

First, this study explores customer value co-creation behavior dimensionally, confirming that its multidimensional characteristics can lead to new outcomes in value creation<sup>[71]</sup>, thus providing theoretical support for research in value co-creation. The study categorizes customer value co-creation behavior into customer participation behavior and customer citizenship behavior. Customer participation behavior primarily involves role-specific actions, such as communication, feedback, and evaluation with the platform, driven by customers seeking to assert their own value propositions. In contrast, customer citizenship behavior reflects customers' social and emotional needs, where satisfied and trusting customers proactively share information with family and friends. Such sharing and recommendations by customers can rapidly disseminate information, helping to enhance the platform's reputation and visibility. Therefore, the multidimensional discussion highlights the multifaceted nature of customer participation in value co-creation under current conditions.

Secondly, this study reevaluates the previously posited view in value co-creation research that primarily focused on corporate value propositions with active customer involvement<sup>[72]</sup>. From the perspective of customer resources, it is found that customer resources (perceived platform interactivity, customer inspiration, and moral perception) now play a leading role in value co-creation. This shift aligns with the current trend in business development, transitioning from a focus on product value to one centered on customer needs<sup>[5]</sup>.

Thirdly, drawing on social cognitive theory, this study introduces customer inspiration into the value cocreation research framework for the first time. The research finds that customer inspiration, as a unique intrinsic motivational mechanism, plays a significant mediating role in the process through which platform interactivity influences value co-creation behaviors. This not only addresses gaps in social cognitive theory regarding cognitive-motivational transformation<sup>[18]</sup> but also extends its application boundaries within the digital marketing field.

#### 7.2. Practical Implications

Based on the findings, enterprises should prioritize effectively integrating customer resources to enhance their competitiveness. This paper offers the following practical insights for the operational management of platform enterprises:

Firstly, platforms should prioritize the optimization of interaction mechanisms. By providing personalized interfaces, convenient access to information, and diversified interaction tools, platforms can enhance user engagement and emotional connection, thus building a lasting competitive advantage. This optimization should focus not only on functional improvements but also on the creation of emotional value.

Secondly, platforms need to systematically design touchpoints that inspire user creativity. Innovative content displays, social interaction mechanisms, and gamification elements can be employed to stimulate users' creativity and enthusiasm for participation. These designs should aim to enhance users' cognitive engagement and emotional involvement.

Thirdly, platform operations should place moral integrity at the core of their strategy. This includes maintaining operational transparency, strictly enforcing quality controls, improving service standards, and enhancing ethical perceptions through effective information disclosure. These measures are not only conducive to building trust among users but also promote the formation and sustainability of value co-creation behaviors.

## 8. Research Limitations and Future Outlook

Despite achieving certain findings at both theoretical and practical levels, this study has limitations that should be addressed in future research.

### 8.1. Research Limitations

This study has three primary limitations:

Firstly, the representativeness of the sample requires enhancement. The data for this research was sourced exclusively from community group buying users in Nanchang and Changsha, limiting the geographical scope which may affect the external validity of the results. While the chosen cities do offer a degree of representativeness, variations in economic development, consumer habits, and cultural characteristics across different regions may influence the patterns of value co-creation behavior among users.

Secondly, the temporal dimension of the research design is constrained. The employment of crosssectional data collection restricts the study to capturing relationships between variables at a specific point in time, making it challenging to reveal the dynamic evolution of value co-creation behaviors. This static analytical framework might overlook significant temporal effects and causal sequences.

Thirdly, the completeness of the theoretical framework requires further enhancement. Although this study has verified the mediating role of customer inspiration, the mechanisms underlying value co-creation behaviors may involve a more complex network of psychological and social factors. The current theoretical model may not fully capture this complexity.

### **8.2.** Future Research Directions

In light of the aforementioned limitations, future research could be advanced in the following directions:

Firstly, expand the geographical and cultural scope of the study. Future research could employ a comparative design across multiple countries and regions to systematically examine the similarities and differences in value co-creation behaviors under various socio-cultural backgrounds. This approach would not only enhance the generalizability of the findings but also reveal the moderating role of cultural factors in the value co-creation process.

Secondly, utilize a longitudinal research design. By establishing panel data or conducting multitimepoint tracking surveys, future studies could delve deeper into the dynamic evolution patterns of value co-creation behaviors. Such a design would more effectively reveal the causal relationships and temporal effects among variables, providing more reliable evidence for understanding the long-term mechanisms of value co-creation.

Thirdly, enrich the explanatory dimensions of the theoretical framework. Future research could introduce more potential mediating variables, such as user innovation capabilities and perceived service quality<sup>[73]</sup>, to construct a more comprehensive theoretical model. Additionally, the moderating effects of situational factors, such as platform type and product category, could be explored to gain more comprehensive theoretical insights<sup>[74,75,76]</sup>.

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