



# Analysis on the QCA of User Value Co-creation Participation Willingness in the Virtual Brand Community

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**Abstract.** Businesses are increasingly focused on creating value through user participation in virtual brand communities, emphasizing the need to understand factors influencing users' willingness. Challenges like low participation intentions and interference with others' engagement highlight the necessity for researching factors affecting user participation intentions. This study used social ecosystem theory to analyze 258 valid data sets and identify conditions for high/low intention towards participating in value creation. Key findings include: (1) Asymmetrical antecedents of high/low intentions; (2) Three high-intention patterns—motivation stimulation, vision-led, atmosphere shaping; (3) Two low-intention patterns—core loss, auxiliary loss. These findings enhance our understanding of how virtual brand communities impact users' readiness for engaging in value creation activities while offering practical insights for businesses aiming at stimulating active involvement.

**Keywords:** Value Co-creation; Virtual Brand Community; Participation Willingness; fsQCA.

## 1 Introduction

The internet's rapid development has greatly reduced the distance between interacting entities, allowing enterprises to connect with customers conveniently. By establishing virtual brand communities online, enterprises can directly engage with users and co-create value[1]. Xiaomi has effectively utilized its community advantage to build momentum, starting from engaging 100 enthusiasts in discussions for its first product, MIUI system, and now boasting a community of nearly 100 million members. This shared economy model not only enhances user engagement and loyalty but also provides sustained innovation momentum and market competitive advantages for enterprises[2][3]. However, despite thriving growth within these communities, they face challenges such as low user engagement and negative sentiments that disrupt other users' experiences.

Current research often relies on traditional statistical methods like linear regression to study individual influencing factors on user participation and overlooks interactions

between these factors across multiple levels[4-8]. Drawing upon social ecosystem systems theory, this paper constructs a causal model for understanding user engagement in virtual brand community activities using fuzzy set qualitative comparative analysis (fsQCA). It provides practical insights for enterprise managers aiming to enhance user involvement in value creation within virtual brand communities.

## **2 Theoretical Foundation and Model Construction**

### **2.1 Theoretical Foundation**

The theory of social ecosystems is a fundamental concept in social work and widely applied in analyzing human behavior within their surroundings. It emphasizes both individual agency and environmental impact by categorizing ecosystems into three levels: micro (individual), meso (small-scale groups), and macro (overall societal context)[9]. These interconnected systems mutually influence each other for a synergistic effect[10].

Virtual brand communities, formed by platform brands and users within the social network environment, create a complex ecosystem. Users' willingness to participate in value co-creation is influenced by their own characteristics, the community, and the broader social environment. Therefore, examining the synergistic effects of these factors from a social ecosystem perspective can provide a more comprehensive understanding of how user participation impacts value co-creation in virtual brand communities.

### **2.2 Model Construction**

#### **Micro-system.**

In the virtual brand community ecosystem, the micro-system mainly refers to individual users. Their participation in value co-creation activities involves leveraging their skills and knowledge. User's ability to participate in these activities and perceive their importance are crucial considerations.

Self-efficacy refers to individuals' belief in their ability to organize and carry out actions to achieve specific results [11]. Engaging in value co-creation activities within virtual brand communities involves sharing one's knowledge and skills. A person's perceived capability to participate in these activities is crucial for users [5]. Previous studies show that self-efficacy significantly influences users' willingness to take part in virtual community settings [12] and is positively related to their readiness to engage in value co-creation within virtual brand communities [5].

Revised sentence: "Network centrality refers to an actor's important position and perceived value in a social network, influencing user behavior participation. Research shows that it has a positive impact on informal knowledge transfer [13]. When users perceive themselves as centrally influential, they are more willing to share [14].

Based on this, we choose self-efficacy and network centrality as the two influencing factors."

**Micro-level System.**

The meso-system primarily refers to the virtual brand community, where users are influenced by the community environment[4] and the formation of new social groups involving other users and brands[15], impacting their willingness to participate.

At the community level, social relationships in virtual brand communities can influence individual behavioral intentions. Trust is crucial for interpersonal relationships, referring to users' confidence in the community and other users during communication and cooperation. Research shows that trust positively impacts users' contribution behavior and sharing intentions [11][16]. Shared vision is important for virtual brand communities at the relationship level, encouraging active knowledge sharing and value co-creation to achieve common goals [17].

At the community level, current research suggests that users' behavioral intentions are mainly influenced by two environmental factors: community atmosphere and incentive mechanisms. A positive community atmosphere promotes stronger interaction and connection between members of virtual brand communities and between enterprises and users, directly impacting users' willingness to contribute knowledge and ultimately achieving high-quality value co-creation[18-19]. Enterprise-led incentive mechanisms, such as material rewards, can influence users' enthusiasm for participating in community interactions[20]; reputation rewards and brand feedback also play significant roles in motivating user participation in value co-creation activities[21].

Based on this, trust, shared vision, community atmosphere, and incentive mechanisms are identified as the four influencing factors.

**Macro-system.**

The macro system, including cultural, institutional, and technological factors, influences user participation in value co-creation activities within virtual brand communities. Culture, particularly collectivism/individualism, plays a crucial role in shaping user behavior intentions[22][23]. Research suggests that collectivism has a greater impact on users' willingness to share knowledge than individualism[24]. Therefore, at the macro-cultural level, collectivism/individualism is identified as an influential factor.

This study applies social ecosystem theory to investigate the virtual brand community at micro, meso, and macro levels using both deductive and inductive methods. It develops a theoretical model considering individual users' self-efficacy network centrality trust shared vision community atmosphere incentive mechanisms and individualism/collectivism within different system contexts. The research model is shown in Figure 1.

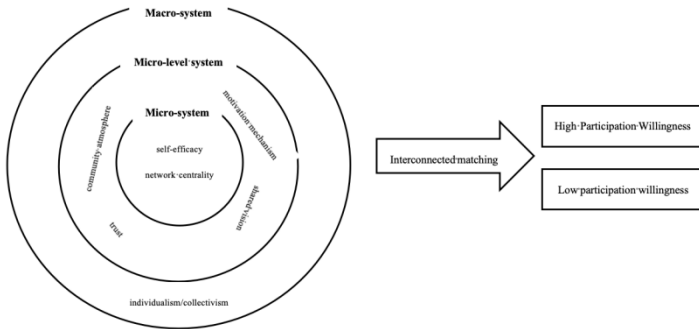


Fig. 1. Research Model

### 3 Research Methods and Design

#### 3.1 Research Methods

The fsQCA method, developed by Ragin, is an analytical approach for examining the interrelated matching of research factors. It allows for joint examination of antecedent variables' matching to outcome variables based on continuous statistical data processing and can calculate configuration results for both outcome and counter-outcome variable groups. In the context of user value co-creation participation intention in virtual brand communities, it is evident that this phenomenon is influenced by multiple factors rather than a single factor alone. The application of fsQCA aligns with social ecosystem theory, emphasizing interactive effects among various levels of factors. It provides a configurational perspective on how different combinations of influencing factors impact outcomes and also facilitates exploration into "the same destination through different paths" and "causal asymmetry" [25].

#### 3.2 Study Objectives

The study focuses on registered members of virtual brand communities. Based on relevant literature and specific research conditions, the following criteria were used to select the virtual brand communities for investigation: (1) The community should be visible and belong to a popular industry; (2) It should have over 500,000 registered members; (3) There should be frequent interaction among members with over 1 million posts; (4) The community should involve user participation in value co-creation activities. Three representative types of virtual brand communities were identified based on these criteria: enterprise-built types (Xiaomi Community, NIO Community), third-party-built types (AutoHome and DongcheDi), and user-built types (Weifeng.com and Xiaomi Baidu Bar).

### 3.3 Questionnaire Design and Distribution

This study utilized questionnaires based on established scales and specific research contexts, employing the Likert five-point scale to enhance the model's reliability and validity. Self-efficacy was primarily assessed using Hsu et al.'s [26] scale, network centrality drew mainly from Chiu et al.'s [27] scale, trust was primarily measured using Wu & Tsang's [28] scale, shared vision was mainly assessed with Tsai & Ghoshal's [29] scale, community atmosphere was largely influenced by Shang Yonghui et al.'s [20] scale, motivation mechanism relied heavily on Sheth et al.'s [30] scale, and collectivism/individualism were predominantly informed by Edwin et al.'s [31] scales.

Revised sentence: The questionnaire was distributed to active community participants via private messages, through friends and classmates known for their engagement in community discussions, and using user information accumulated from case development by the author. Prior to completing the questionnaire, users were briefed on fundamental concepts of virtual brand communities and value co-creation activities within such communities. A total of 338 questionnaires were collected. Cases demonstrating dual inclinations (i.e., both individualistic and collective tendencies) were excluded as they did not fit into either category exclusively, resulting in 258 valid questionnaires selected based on community categorization: enterprise-built type accounted for 112 responses (43.4%), third-party built type for 69 responses (26.7%), and user-built type for 77 responses (29.9%).

## 4 Data Analysis and Results

### 4.1 Validity and Reliability Testing

Using SPSS software, we first conducted consistency tests on the eight variables of self-efficacy, network centrality, trust, shared vision, community atmosphere, motivation mechanism, collectivism, individualism, and user value co-creation participation intention, with standardized Cronbach's Alpha values of 0.880, 0.895, 0.912, 0.920, 0.920, 0.891, 0.893, 0.980, 0.969, and 0.917 all above 0.8, indicating high reliability. Secondly, we conducted exploratory factor analysis on these eight variables separately, with KMO values of 0.809, 0.822, 0.839, 0.827, 0.714, 0.830, 0.962, 0.955, and 0.817 all above 0.7, and Bartlett's sphericity test significance levels of all variables being 0.000, indicating that confirmatory factor analysis can be conducted. The confirmatory factor analysis factor loadings show that the standardized loading coefficients Std. Estimate for each variable are 0.827-0.975, which are greater than the standard value, and the composite reliability CR is 0.895-0.980, which is greater than the standard value, and the average variance extracted AVE values are 0.682-0.862, which are greater than the standard value, indicating that the sample data in this study has good convergent validity; the discriminant validity test results show that the square roots of AVE are all greater than the correlation coefficients of the questionnaire variables, verifying the validity of the variables in this study.

## 4.2 Variable Calibration

Firstly, this study applied Ragin's standards of fully in (95%), crossover point (50%), and fully out (5%) [32]. Using the PERCENTILE(array, percentage) function in Excel, statistical calculations were performed to determine different degrees of membership for each continuous variable. The results are presented in Table 1. Secondly, a dichotomous approach was used to assign values to collectivism and individualism. By calculating the mean values and using the difference between them as the basis for assessment, individualism was assigned a value of 0 while collectivism was assigned a value of 1 [33]. This method allowed for a clear qualitative comparison analysis.

**Table 1.** Variable calibration quantile membership

Frequency	SE	NV	TR	NV	SV	CA	MM	IE	
Per-centile	5	1.7125	1.7500	2.0000	1.7500	1.4625	1.6667	1.7500	1.5000
	50	4.0000	3.7500	4.0000	3.7500	3.5000	4.0000	3.7500	3.5000
	95	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000

## 4.3 Necessity Test

According to the necessary condition test criterion, the consistency of all antecedent conditions for high and low willingness to participate in value co-creation is lower than 0.9, indicating that a single condition variable is not sufficient to explain the high or low willingness of users to participate in value co-creation [34]. The willingness of users to participate in value co-creation is determined by multiple factors; therefore, further comprehensive conditional configuration analysis is needed to determine the condition configuration that influences the willingness of users to participate in value co-creation [35]. The test results are presented in Table 2.

**Table 2.** Necessity Test Consistency and Coverage

Condition variable	High motivation		Low motivation	
	Consistency	Coverage	Consistency	Coverage
SE	0.705483	0.708464	0.570410	0.524909
~SE	0.526908	0.572374	0.683191	0.680069
NV	0.729757	0.741798	0.562619	0.524067
~NV	0.531793	0.570232	0.722804	0.710224
TR	0.660241	0.672986	0.589797	0.550899
~TR	0.559404	0.598103	0.649895	0.636736
SV	0.731936	0.764632	0.505096	0.483526
~SV	0.505611	0.527161	0.754133	0.720511
CA	0.703604	0.744740	0.538425	0.522237
~CA	0.548627	0.564667	0.736828	0.694939
MM	0.717657	0.707187	0.589158	0.532003
~MM	0.525075	0.582411	0.675728	0.686826
CC	0.626950	0.574908	0.506785	0.425849
IC	0.373878	0.452725	0.494115	0.548276

Note: ~ indicates the absence of a factor, e.g., "SE" represents self-efficacy and "~SE" represents its absence."

### 4.4 Analysis of Sufficiency

This study utilized the fsQCA software to construct a truth table with calibrated data. Initially, in setting the original consistency threshold, the study referenced Fiss' viewpoint and established the consistency threshold at 0.8 [34]. As for the frequency threshold, this study adopted Du Yunzhou's perspective that the number of cases covered by selected instances should encompass 75% of high and low-value co-creation intentions. The frequency threshold for users exhibiting high willingness to participate in value co-creation was set at 3, while for those with low willingness it was set at 4 [35]. Subsequently, PRI consistency underwent screening; here, a value of 0 was manually assigned to cases with PRI consistency below 0.5 [36], after setting PRI consistency to be 0.5. These procedures were implemented to mitigate any potential impact from extreme cases on the analysis results. Ultimately, as depicted in Table 3, the configuration and running results were obtained.

**Table 3.** High/low engagement value co-creation intent configuration operating results

	Pattern A		Pattern B			Pattern C	Pattern a		Pattern b	
	A <sub>1</sub>	A <sub>2</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	C	a <sub>1</sub>	a <sub>2</sub>	b <sub>1</sub>	b <sub>2</sub>
SE	●	●	•	⊗		●	⊗	⊗	•	⊗
NV	●	●	●	●	●	⊗		⊗	⊗	⊗
TR		•		•		•	⊗	⊗	⊗	⊗
SV	•	⊗	●	●	●	⊗	⊗	•		⊗
CA	•		•		•	●	⊗		⊗	⊗
MM	●	●		•	•	•	⊗	⊗	⊗	
CC		⊗	●	●	●	⊗	⊗	⊗	•	•
Consistency	0.915	0.892	0.933	0.942	0.922	0.922	0.897	0.921	0.872	0.898
Coverage	0.378	0.151	0.264	0.170	0.262	0.018	0.399	0.183	0.255	0.253
The only coverage	0.045	0.034	0.046	0.010	0.026	0.011	0.094	0.122	0.016	0.014
Total Coverage				0.532					0.545	
Consistency in general				0.892					0.873	

Note: ● denotes the presence of the core condition, • indicates the presence of an auxiliary condition, ⊗ signifies the absence of the core condition, ⊗ represents a missing auxiliary condition, and blank indicates that the condition is optional.

### 4.5 Configuration for Longitudinal Analysis

#### High Willingness to Configure.

Motivation-driven model: Pattern A(SE\*NV\*MM) describes the state of high willingness to participate among users driven by self-efficacy, network centrality, and motivation mechanisms. Pattern A comprises two configuration types, A1 and A2. In A1(SE\*NV\*sv\*ca\*MM), the auxiliary conditions of a shared vision and community atmosphere work in conjunction with core conditions to generate high willingness for

user participation in value co-creation. In contrast, A2 (SE\*NV\*tr~sv\*MM\*ic) involves trust as an additional core condition when users are in a collectivist environment and lack a shared vision.

In a collectivist environment, users prioritize community trust when the shared vision is absent, provided that core conditions such as self-efficacy, network centrality, and incentive mechanisms are present. Additionally, when the shared vision is accompanied by auxiliary support, it should be complemented with a conducive community atmosphere to effectively stimulate users' strong willingness to participate in value co-creation.

Vision-led model: Pattern B (NV\*SV\*CC) describes a high level of user participation driven by network centrality, shared vision, and collectivism. Pattern B consists of three configuration types: B1, B2, and B3. B1 (se\*NV\*SV\*ca\*CC) has the auxiliary condition that self-efficacy and community atmosphere exist. This indicates that when the core of network centrality exists in a collectivist environment, it can stimulate users to have a high willingness to participate in value co-creation. B2 (~se\*NV\*tr\*SV\*mm\*CC) has the auxiliary condition of the absence of self-efficacy but trust and incentive mechanisms exist. This suggests that in a collectivist cultural background, trust and incentive mechanisms can be used to stimulate users to have a high willingness to participate in value co-creation even when self-efficacy is lacking. B3 (NV\*SV\*ca\*mm\*CC) has the auxiliary condition of the existence of community atmosphere and incentive mechanisms. This indicates that in a collectivist cultural background, community atmosphere and incentive mechanisms can be used to stimulate users to have a high willingness to participate in value co-creation when both network centrality and shared vision are present.

By comparing these three configurations, it was found that in situations where self-efficacy support is lacking, users tend to focus on the joint assistance provided by trust and motivation mechanisms when network centrality, shared vision, and collectivism are present. A supportive community atmosphere can serve as a substitute for self-efficacy and motivation mechanisms.

Atmosphere Shaping Model: Pattern C (SE\*~NV~SV\*CA) describes the state of high willingness to participate among users driven by self-efficacy, community atmosphere, network centrality, and a lack of shared vision. Pattern C includes configuration C1, which is characterized by the presence of trust, individualism, and incentive mechanisms C1(SE\*~NV\*tr\*~SV\*CA\*mm\*ic). This suggests that users in an individualistic cultural context with high self-efficacy may lack a certain status within the community and a shared vision. In such cases, a positive community atmosphere combined with trust and incentive mechanisms can stimulate high willingness to participate among users.

### Low Willingness to Configure.

Core Deficiency Type: Pattern a (~SE\*~MM) explains low user participation due to insufficient self-efficacy and motivation mechanisms. It consists of two configurations: a1 and a2. In a1(~SE\*~tr\*~sv\*~ca\*~MM\*ic), there is inadequate trust, shared vision, and community atmosphere in an individualistic setting. This shows that when users



perceive low self-efficacy without adequate motivation mechanisms or supportive environment elements like trust or shared vision in an individualistic culture; they are less willing to engage in value co-creation efforts. In a2( $\sim$ SE\* $\sim$ nv\* $\sim$ tr\*sv\* $\sim$ MM\*ic)'s case includes having shared visions but also facing network centrality issues along with trust deficits within an individualistic setting. Even with existing shared visions under these circumstances where users feel undervalued without sufficient motivational support or trust; their willingness for participating diminishes.

Assisted Total Loss Type: Pattern b ( $\sim$ NV) describes low user participation when network centrality is absent. It includes two configurations: b1 (se\* $\sim$ NV\* $\sim$ tr\* $\sim$ ca\* $\sim$ mm\*cc), where there's no trust or community support but self-efficacy and collectivism exist; indicating users have some capability but aren't valued; leading to low participation due to lack of trust and shared vision; and b2( $\sim$ se\* $\sim$ NV\* $\sim$ tr\* $\sim$ sv\* $\sim$ ca\*cc) is associated with the absence of self-efficacy, trust, shared vision, and community atmosphere. This indicates that users lack assertiveness and adequate recognition within the community, leading to reduced user engagement.

## 5 Conclusions and Implications

### 5.1 Conclusions

This study is based on social-ecological system theory and has developed a comprehensive model of antecedent influences. It gathered 258 valid research samples from three types of virtual brand communities: self-built, third-party platform-built, and user-built. Using the fuzzy set qualitative comparative analysis (fsQCA) method, it thoroughly explored the combined effects of self-efficacy, network centrality, trust, shared vision, community atmosphere, incentive mechanisms, and collectivism/individualism on users' willingness to engage in value co-creation within virtual brand communities. The following conclusions were drawn:

(1) User willingness to co-create value in virtual brand communities exhibits characteristics of 'multiple concurrency' and 'converging paths', with no single factor unilaterally leading to high or low participation. The impact of any antecedent on user participation is only valid under specific circumstances. This study has identified various configurations of antecedents resulting in both high and low user willingness, demonstrating 'multiple concurrency'. Different combinations of antecedent elements across system levels can lead to distinct patterns, illustrating 'converging paths'.

(2) Three high-participation value co-creation modes are: "motivation-stimulating", "vision-leading", and "atmosphere-shaping". The incentive mechanism plays a significant role when user characteristics include self-efficacy and network centrality. It needs to be combined with trust and a common vision to stimulate high willingness for user participation. In a collectivist cultural context, the common vision is important when users exhibit network centrality. This mechanism also requires combination with trust and incentive mechanisms to achieve high willingness for user participation. In an individualistic cultural context where community common vision is lacking, the community atmosphere is important when users exhibit self-efficacy and network centrality.

This mechanism needs to be combined with incentive mechanisms to stimulate high willingness for user participation.

(3)The factors driving users to have high participation value co-creation intentions and low intentions exhibit asymmetric characteristics. For instance, the user's involvement in the low-intent pattern indicates that the absence of network centrality, when combined with other factors, leads to a low willingness for value co-creation. Conversely, the user's involvement in the high-intent pattern suggests that the absence of network centrality, along with other factors, results in a high willingness for value co-creation. This exploration reveals two user participation value co-creation low-intent configuration patterns: "core missing type" and "supportive all-lost type."

## 5.2 Management Insights

(1)To encourage greater collaboration among users, managers should shift from focusing solely on local optimization to embracing configurational coordination. Pursuing only local optimization can prevent managers from addressing underlying issues and lead to overly general solutions. In contrast, configurational coordination based on user characteristics and the broader cultural environment allows for more tailored and effective measures.

(2)The management's control over the community is crucial, but it should be tailored to the user characteristics and the macro-cultural environment. If a company lacks specific knowledge of its target users, it is most prudent to prioritize comprehensive development of shared vision, incentive mechanisms, and community atmosphere. For users with high self-efficacy and network centrality, particular emphasis should be placed on developing community incentive mechanisms through implementing a combination model of "self-efficacy + network centrality + motivation mechanism.

(3)Managers should take targeted measures at the community level to prevent users from developing a low willingness to participate in value co-creation within virtual brand communities, based on individual user characteristics, macro-cultural environment, and the low willingness configuration identified in this study.

(4)Trust is crucial for encouraging user participation in value co-creation. While it may not directly drive high levels of engagement, its absence significantly reduces users' willingness to participate. Therefore, managers should focus on preventing the erosion of trust rather than just enhancing it, by addressing user concerns and resolving issues of mistrust among community members to create a positive environment.

## 5.3 Insufficient Research and Prospects

There is still room for exploring additional influencing factors affecting users' willingness to participate in value co-creation activities. While this study has identified various influencing factors for different levels of user participation based on social ecosystem theory, it's acknowledged that QCA research presents endless possibilities for antecedent conditions, indicating numerous areas warranting further exploration.

Furthermore, deeper analysis can enhance the comprehensiveness of our findings. Although we've examined enterprise-built, third-party-built, and user-built communities comprehensively without distinguishing their differences regarding antecedent configurations related to user participation in value co-creation activities; future studies should supplement questionnaire data and conduct comparative analyses across these community types.

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