The Effect of User Collectivity on Lead Userness in Online Brand Community

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Abstract: In the context of open innovation, online communities have become the key place for enterprises to obtain user innovation. Exploring the path between user collectivity and lead userness in online communities will help enterprises cultivate user innovation ability, and absorb user innovation. Building a chain intermediary model between social capital and the number of user innovation between user collectivity and lead userness, while using data mining to obtain user data from online brand communities for the research. It is found that user collectivity significantly promote user userness. The number of user innovation plays an intermediary role between user collectivity and lead userness. Social capital and the number of user innovation play the intermediary role in the chain mediation between user collectivity and lead userness. It further explains the differences between social users and lead users in the community, providing a reference for enterprises to identify lead users and manage users.

1. Introduction

Along with the impact of multiple major forces such as the acceleration of digital transformation, which results in the uncertainty and complexity of the business environment faced by enterprises significantly increasing. In this context, it is not enough for enterprises to rely on their own vertically integrated innovation system, they need to open their own borders and absorb more external innovations[3]. In external innovation, user innovation plays an important role in the development of new products[2].At the same time, many enterprises develop online brand communities to absorb user innovation, such as Lego and Dell[12][13]. However, the source of user innovation is uneven, mainly from the scarce lead user group.

Lead users not only lead the market trend,have more product using experience and professional knowledge[20], but also have a high sense of collectivity and participate more in collective activities. These studies focus on the direct impact of collectivity on lead userness, but there are few studies on the impact path. At the same time, the lead users can perform through lead userness, so studying its impact path can provide reference for enterprises to manage communities and obtain innovation.

Social capital is the sum of resources embedded in the social relationship network. Because of the existence of interpersonal relationships, it can be embedded in the relationship between users and communities[5]. User innovation embedded in the community is largely affected by goals

which social capital builds.The number of innovation contributions of lead users in the community is significantly different from non-lead users[11]. Therefore, the chain intermediary composed of user social capital and the number of innovation may become a potential factor in explaining the impact of collectivity on lead userness. Therefore, according to the number of users' social capital and innovation, a chain intermediary model is formed to identify the impact path of online brand community collectivity on lead userness.

2. Literature Review

2.1 Brand community and lead userness

With the development of user innovation, more and more enterprises, including Lego and Dell, have established online brand communities[12][13]. Enterprises can absorb user innovation in the community, transforming it into enterprise competitive advantage and also distributing work to users in a crowdsourcing way,to reduce enterprise R&D costs[12]. This article focuses on the online brand community.

The lead user was first proposed by von Hipple in 1986. He argues that the user who has the market trend and expects high income is the lead user. Lead users are defined as user innovators in the leading position of market trends[14].The brand community is aimed at end consumers and users rarely have the design and technical ability to develop complete innovative prototypes. For most consumers, it is easier to make small changes or innovations to products than to make comprehensive innovations[19]. Therefore, in order to achieve the research purpose, the lead userness is selected.

2.2 Collectivity

Lead users also have collectivity. In online communities, user collectivity refers to the collective intention of users, which is the intention of individual users to belong to the collectivity and willing to participate in the community collective activities, including the behavior of individual direct participation and the "joint responsibility" of collective members at a certain time or state. The connotation of collectivity includes three aspects: First, users' high recognition of the community. Secondly, users have the spirit of sharing. Finally, mutual assistance among users[17].

2.3 Social capital theory

Bourdieu first put forward the theory of social capital, arguing that social capital is the collection of actual and potential resources, which is the result of the institutionalized long-term relationship network that people recognize[4]. Later, other scholars divides social capital into three dimensions: Structural,cognition and relational dimension[24].Because the research is about community users, the structural dimension is understood as the interaction between users. The cognitive dimension can be understood as the common language among users. The relational capital mainly refers to the trust between users. The interaction, common language and trust between users fully reflect the dynamics of users in the community[22].

3. Research hypothesis

3.1 User collectivity and lead userness

Lead users will share more knowledge and innovations, whose quality is very high[16]. Users

with collectivity are willing to share their knowledge and innovation in the community. If users share knowledge and innovation for altruistic motives, they will not seek rewards,but which let them share inadvertently discovers that innovations can help others and may have the potential of market, which boosts to discover the future development trend of the market. However, based on reciprocity norms, users expect to get feedback from others while sharing knowledge and innovation or hope to get corresponding help in the future, which ensures the sustainability of communication in the community and allows users to find that sharing knowledge will be rewarded[17]. Therefore, other users are willing to give feedbacks on their suggestions or feelings about innovation. These feedbacks are true, which makes it easier for users sharing innovation to find the needs and development trends in the market. So users with collectivity are more likely to be at the forefront of the market development trend and have higher lead userness. Therefore, hypothesis 1 is proposed:

Hypothesis 1 User collectivity is positively related to lead userness.

3.2 The intermediary role of social capital

Users with collectivity increase their social capital in the community, meanwhile having more social capital help users find the leading trend of the market. Users with collectivity in the community will have more communication with other users to discuss the use experience or innovation suggestions of the product due to the frequent sharing of knowledge and innovation. More communications increase the social interaction between users, which changes the structure of interpersonal knowledge exchange[1]and expands users' social network,also help increase the common language and reach consensus among users[6][15]. The social interaction realized by communication will also increase mutual trust among users, making users willing to take more risks. Over all, the social capital of users in the community has been increased. When users with more social capital have direct contact with other users, it is easier to invite users to participate in the innovation experience, then to obtain users' real feedback and suggestions on innovation, which is unique and cannot be obtained by manufacturers outside the community, that ultimately forms an advantage in information compared with external manufacturers. Meanwhile, the feedback and suggestions realizes information asymmetry, which enables users to find the real market demand or future development trend,to further modify the innovation prototype or suggestions and carry out leading innovation. Therefore, hypothesis 2 is proposed:

Hypothesis 2 Social capital plays an intermediary role between user collectivity and lead userness.

3.3 The intermediary role of the number of user innovation

Users with collectivity will put forward more innovations in the community, at the same time, the more users innovate, the higher the level of lead userness will be[11]. Users who have the spirit of sharing and the high recognition of the community will share more knowledge and innovation, participate more in discussions and activities, get direct help from other users in the community, or other users will recommend innovators to people they know, which promotes them to realize the diffusion of innovation[10]. Thus, this kind of users will obtain more new knowledge from the community, which enhances the ability of knowledge reorganization, ultimately improves the level of user innovation and increases the number of user innovation[24]. Meanwhile, users share more innovative suggestions or prototypes in the community, spend more time to participate in the flow of knowledge and information in the community, and obtain more knowledge and skills, from which it is easier to detect the future market needs and preferences; Besides, more innovations can also get the user feedback from the community. Because each user's background in the community

is different, the information that each user feeds back to other users is based on local information, which help users who share innovation to jump out of the original perspective and find market frontier trends and innovation needs. Therefore, hypothesis 3 is proposed:

Hypothesis 3 The number of user innovations plays an intermediary role between user collectivity and lead userness.

3.4 The chain intermediary role of social capital and the number of user innovation

Users with collectivity will actively share knowledge or innovation in the community, actively participating in various activities and discussions, so they will have more communications and exchanges with other users. More communications consolidate the user's relationship network in the community[1], increase the common language among users, promote the consensus among users[6][15], and strengthen the trust relationship between users, which improve the social capital of users in the community. Therefore, users have a more consolidated relationship network, in which individual connections provide channels for the knowledge transfer, the overall structure of the network provides preconditions for flexible exchange of knowledge, more common languages improve the level of contact between users[24], and trust relations promote cooperation between users[8]. Finally, over all factors promote the realization of more innovations[24]. As the number of innovations increases, user innovators will conduct more discussions or exchanges on knowledge and innovation with other users through the community, meanwhile obtaining users' help or feedback and achieving the diffusion of innovation[10]. So that it is easier to find market development trends, put forward more innovations that can be accepted by the public and enterprises, and the lead userness will be higher[11].

To sum up, users with collectivity increase the social capital in their communities, meanwhile more social capital increase the number of users' innovation, which ultimately improve the lead userness. That is, there is a chain mechanism of "User collectivity→Social Capital→Number of Users' Innovation→Lead Userness". Therefore, hypothesis 4 is proposed:

Hypothesis 4 Social capital and the number of user innovations play a chain intermediary role between user collectivity and lead userness.

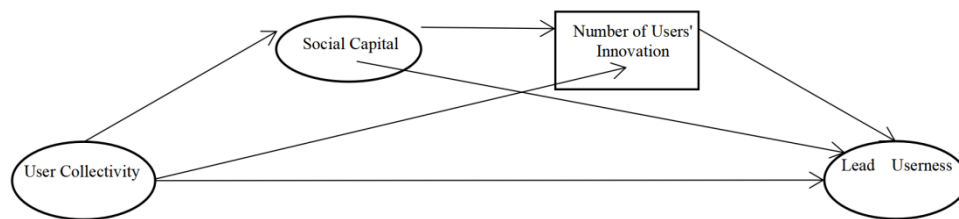Based on the hypothesis Hypothesis1-4, the theoretical model is constructed, as shown in Figure 1:

Figure 1.Theoretical model of the impact path of collectivity on lead userness

4. Research design

4.1 Data sources

Xiaomi community is selected to analysis for end users. The MIUI discussion circle in Xiaomi Community is the most active topic circle in the community, with a total number of posts over 6 million, providing sufficient data sources for the research. Research team members register to join the community and collect user data of the community. The collected objective data mainly includes user-generated content information data and user behavior data. The user-generated

content information data mainly refers to the content of users' posts in the community, while the user behavior data includes the number of theme circles that users have joined, the number of people who have followed, the number of people who have followed, the number of people who have liked, the number of theme posts published (including suggestions, feedbacks, questions and other theme posts), and the regions which they belong to. The specific steps of data collection are as follows: first, randomly select 365 users who have posted suggestions in the MIUI discussion circle for a period of time and count them as samples. Secondly, users with less than 2 theme posts published in this sample and unknown region are determined as inactive users, who are removed from the sample and 269 users are finally determined.

4.2 Variables measurement

Measurement of user collectivity. Since previous studies have shown that the broad use of the concept of user collectivity will lead to a non-significant regression result with lead userness. Hence, the user sharing spirit is selected as a measure of user collectivity. Specifically, the user sharing spirit is measured by the user sharing spirit language style in the content information data. Because the language expresses people's cognition, preference and personality, the type and frequency of words used are able to reflect a person's characteristics[23]. First, we use the jieba database to segment 269 users' topic posts in Chinese and sort the segmentation results to confirm the top 300 high-frequency words. According to the interpretation of the spirit of sharing, 15 words representing the spirit of sharing were selected to form a dictionary. According to the dictionary, the word frequency-inverse document frequency(TF-IDF) algorithm is used to measure user sharing spirit(SP). This indicator is directly proportional to the number of words appearing in the post set and inversely proportional to the frequency of words appearing. The higher the indicator, the stronger the sharing spirit of users.

Measurement of social capital. Social capital is the collection of interaction, common language and trust in the community. In the context of Xiaomi Community, first of all, users can form an interactive relationship by joining the community circle and paying attention to each other. Therefore, it can be measured by the number of topic circles in the user behavior characteristic data, the number of users who pay attention to other users and the number of users who pay attention to others. Second, the common language is measured by the number of users followed by others and the number of likes[7]. Finally, the trust relationship are able to be measured by the number of question posts in the number of user's topic posts. Because of trust in other users and communities, questions will be asked in the community[21]. To sum up, social capital can be measured by the number of theme circles(TC) that users join, the number of other users that users follow(UF), the number of users that others follow (OF), the number of likes (NL), and the number of question posts (QP). After that, the data of these five indicators are standardized to obtain the sum of each user's indicators, representing the social capital(SC) owned by each user.

Measurement of the number of user innovations. In Xiaomi Community, users choose to publish a theme post with product suggestion label and put forward their own innovative ideas and improvement suggestions. Therefore, it is suggested that the number of theme posts(TP) measures the number of user innovations.

Measurement of lead userness. User innovation adopted by enterprises can be obtained through statistics to show lead user. In Xiaomi Community, if a user's proposal is officially included in the process of project approval, development or optimization, it means that the proposal is adopted by the enterprise and show the lead userness(LU). If a user has an innovation proposal that is adopted, the lead userness will be scored 1 point and each more adopted proposal will be scored 1 point. If there is no innovation proposal, it will be scored 0.

Measurement of control variables. Previous studies have indicated that user dissatisfaction with products will affect user innovation and marketization[9], so user dissatisfaction is selected as the control variable. Similarly, after the Chinese word segmentation of the user's topic post, the overall emotion expressed in the user's post content is calculated using SentiWordNet's public emotion dictionary with reference to the FLUID method. In this paper, the emotional vocabulary ontology database of Dalian University of Technology[3]is used. Select the words that represent the user's dissatisfaction from the dictionary item bank to form a dictionary. According to the dictionary, the TF-IDF algorithm is used to measure the user's dissatisfaction(UD) in the content information data.

All the above variables will eventually be normalized using the min-max method to eliminate the unit impact of each variable. Descriptive statistics were made for each variable before standardization, whose results are shown in Table 1.

Table 1 Descriptive statistics of variables before standardization

Variables	Mode	Median	Average	Maximum	Minimum
SP	0.000	0.106	0.155	1.004	0.000
TC	2	4	8.926	203	0
UF	0	1	5.803	156	0
OF	0	1	8.182	293	0
NL	2	28	170.532	6502	0
QP	0	0	1.063	40	0
SC	0.015	0.270	0.379	2.403	0.000
TP	1	2	6.413	128	1
LU	0	0	0.323	14	0
UD	0	0.124	0.157	0.725	0

5. Empirical analysis

5.1 Variable correlation test

Table 2 Correlation analysis

	UD	SP	SC	JY	JS
UD	1.000				
SP	0.257**	1.000			
SC	0.352**	0.441**	1.000		
TP	0.191**	0.567**	0.540**	1.000	
LU	0.136*	0.332**	0.207**	0.637**	1.000

Note: * and * * respectively represent $p < 0.05$ and $p < 0.01$, the same below.

In order to observe the degree of mutual influence between variables and prevent multiple collinearity among variables, the correlation analysis is conducted on the samples. The correlation analysis is shown in Table 2, which can be found that user collectivity has a significantly positive impact on social capital ($r=0.441$, $p<0.01$), the number of user innovation ($r=0.567$, $p<0.01$) and lead userness ($r=0.332$, $p<0.01$). Social capital has a positive impact on the number of user innovation ($r=0.540$, $p<0.01$) and lead userness ($r=0.207$, $p<0.01$). The number of user innovations has a significantly positive impact on lead userness ($r=0.637$, $p<0.01$). To sum up, the user collectivity, social capital, user innovation quantity and lead userness are significantly positively correlated, which provides conditions for the later test of intermediary effect. In addition, all the correlation coefficients are less than 0.7, meanwhile according to the variance expansion coefficient (VIF) among the variables, they are less than 5, with the mean value of 2.02, indicating that the

multicollinearity is within the acceptable range.

5.2 Hypothesis test

The hypothesis is divided into two stages. The first stage is the exploratory test stage, which tests the hypothesis 1. If hypothesis 1 is established, it will enter the second stage, which tests hypothesis1, 2, 3 and 4 simultaneously, that is, tests the intermediary effect.

5.2.1 Test of the relationship between user collectivity and lead userness

With user collectivity as the independent variable, user dissatisfaction as the control variable, while lead userness as the dependent variable, the linear regression analysis method is used to test, whose results are shown in Table 3. It can be seen from Table 3 that when there is only control variable user dissatisfaction, it is significantly positive correlated with lead userness. However, after adding the independent variable user sharing spirit, it is no longer significant. Model 2 indicates that the significance of user collectivity on lead userness. Hypothesis1 is established, the path coefficient is 0.148, and the significance level is less than 0.01.

5.2.2 Mediation effect test

First, the initial model is built. According to Figure 1, the initial path model includes four variables: user collectivity, social capital, user innovation quantity and lead userness. Then AMOS software is used to fit the path model. At the same time, the Bootstrap method is used to test the intermediary effect. The number of repeated samples is set to 1000 and the confidence level is 95%. The intermediary test results are shown in Table 4, which finds that the initial model M1 does not converge and needs to be corrected. The specific correction process is shown in Table 5.

Table 3 Regression analysis of user collectivity and lead userness

Model	Constant Term	Control Variable	Independent Variable	R^2	Adj-R^2
Model1	0.012	0.052*		0.019	0.015
Model2	-0.004	0.021	0.148**	0.113	0.107

In M1, it is found that the positive impact of social capital on lead userness is not significant (-0.192). According to Table 4, it is found that the intermediary effect of social capital between user sharing spirit and lead userness is tested. The results indicate that the intermediary effect of social capital is -0.038 and the 95% confidence interval is from -0.174 to 0.002, including 0, which indicates that there is no intermediary effect between social capital and user sharing spirit and lead userness. Hypothesis2 is not tenable. Therefore, delete the path of "social capital → lead userness" and get the model M2, which converges.

Table 4.M1 mediation effect test of path initial model

Mediation Path	Effect Value	95%CI	
		lower limit	upper limit
①User Collectivity→Social Capital →Number of Users' Innovation→Lead Userness	0.049**	0.037	0.196
②User Collectivity→Social Capital→Lead Userness	-0.038	-0.174	0.002
③User Collectivity→Number of Users' Innovation →Lead Userness	0.144**	0.121	0.521

In M2, it is found that the positive impact of user sharing spirit on lead userness is not significant (-0.042). There are similar results in the existing papers that use the language style or language in

user content information to represent the user collectivity. Empirical research indicates that the collectivity has no significant impact on lead userness. This means that the influence of user collectivity on lead userness will be affected by intermediary factors, such as complete intermediary effect or masking effect. For other intermediary effects other than the chain intermediary, the intermediary effect test can be used to identify its intermediary type. Therefore, in order to improve the fitting of the model, we delete the path of "user sharing spirit → lead userness" to get the model M3. M3 is the final modified model, which is shown in Figure 2.

Table 5 Revision of the path model

| Model	Initial Path	
M1	User Collectivity→Social Capital, Number of Users' Innovation, Lead Userness Social Capital→Number of Users' Innovation, Lead Userness Number of Users' Innovation→Lead Userness	
	Deleted Path	Reason for deletion
M2	Social Capital→Lead Userness	The model does not converge and the path coefficient is not significant(-0.192)
M3	User Collectivity→Lead Userness	The path coefficient is not significant(-0.042)
M3 fitting index	p=0.002; X^2/df=12.223; GFI=0.974; RMR=0.001; CFI=0.995; NFI=0.966; NNFI=0.913	
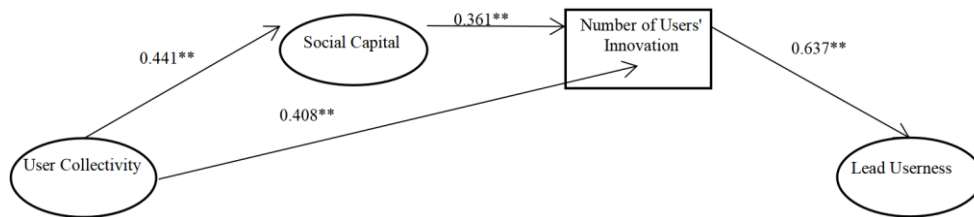
Figure 2 M3 path analysis

According to the above research results and the intermediary effect test procedure, the intermediary effect other than the chain intermediary effect is tested in order to clearly distinguish the types of these intermediary effects. The analysis results are shown in Table 6, where c represents the regression coefficient of X to Y when there is no intermediary variable M in the model, which is called the total effect; a is the regression coefficient of X to M, b is the regression coefficient of M to Y and a* b is the product of a and b, which is the intermediary effect; c represents the regression coefficient of X versus Y when there is an intermediate variable M in the model, which is named as the direct effect. It can be found that the total effect of the path of "user collectivity → the number of user innovation → lead userness" is significant (0.148**), meanwhile a and b are also significant (0.344**, 0.495**), but the direct effect c' is not significant (-0.022). The intermediary effect of user innovation quantity between user collectivity and lead userness is a complete intermediary effect, so it is assumed that hypothetical3 is established. At the same time, the complete mediation effect also explains why the user collectivity in the model has no significant impact on lead userness.

The Bootstrap method is still used to test the chain mediation effect, whose results are consistent with the results of path ① in the initial model in Table 1. According to Table 1, the chain intermediary effect between social capital and user innovation between user sharing spirit and lead userness is significant, the effect value is 0.049 and the 95% confidence interval is (0.037, 0.196), excluding 0, so it is assumed that H4 is valid. Meanwhile, according to Table 6, it can be found that in the path ④ and ⑤ included in the chain intermediary, social capital plays a part of the intermediary role between the user sharing spirit and the number of user innovation, but the number

of user innovation plays a masking role between social capital and lead userness, which is not consistent with the deduction of hypothetical4. Through the exploration of the community, it is found that this is because there are similar users in the community, who have a lot of social capital and a certain number of innovations, but lead userness are low. Such users like to participate in social activities in the community very much and will put forward topics with discussion lines or attractive photos, which causes them to have more social capital. This kind of users are social users, who also carries out innovation, but most innovations are not leading. The more innovations, the less lead userness will be reduced. The existence of such users leads to the masking effect.

Table 6 M3 intermediary effect test

Mediation Path	c	a	b	a*b	c'	Inspection results
③ User Collectivity→Number of Users' Innovation→Lead Userness	0.148**	0.344**	0.495**	0.170	-0.022	Complete intermediation
④ User Collectivity→Social Capital→Number of Users' Innovation	0.344**	0.330**	0.264**	0.087	0.257**	Partial intermediation
⑤ Social Collectivity→Number of Users' Innovation→Lead Userness	0.096**	0.381**	0.556**	0.221	-0.115**	masking effect

5.3 Endogenous treatment

Considering that there may be endogenous problems between user collectivity and lead userness. Thus, the instrumental variable method is selected to test the endogencity between variables. The satisfaction of users in the community is selected as the tool variable, because the satisfaction of users in the community and products promotes the communication, enhance the collectivity of users and have a strong relationship with the collectivity of users. The relationship with lead userness is weak and rarely direct affect lead userness, so it conforms to the characteristics of the tool variable. Also referring to the FLUID method, which uses the public emotion dictionary to calculate the emotion of the posted content, this paper uses the emotional vocabulary ontology database of Dalian University of Technology to form the corresponding dictionary, while using the word frequency-inverse document frequency(TF-IDF) algorithm to measure the user's satisfaction and adding the regression model. The results indicate that the significance of the explanatory variables did not change except for the slight change in the regression coefficient.

6. Conclusion and discussion

6.1 Research conclusion

Based on the lead user theory and social capital theory, a chain research model of user collectivity, social capital, the number of user innovation and lead userness is constructed. Meanwhile empirical tests are conducted by using data and text mining technology. The following main research conclusions are obtained.

First, user collectivity has a significantly positive impact on lead userness, which indicates lead users have collectivity. Previous studies have focused on the impact of collectivity on user innovation, while few have used the collective language of users to explore the collectivity of lead users. Taking the user collectivity as the independent variable, it shows that the higher the collectivity of lead users, the more likely they are to be lead users. In addition, the text mining method is used to express the collectivity of the lead user through the user's language and the TF-IDF algorithm is introduced to calculate the collective strength of each user, which is of exploratory significance for the integration of artificial intelligence and business management

disciplines.

Second, user collectivity directly affect lead userness through the number of user innovations, but not through social capital. The number of user innovations and social capital are included in the impact path of user collectivity on lead userness. The empirical research indicates that the number of user innovations plays a completely intermediary role between user sharing spirit and lead userness, which implies that users have a high collective consciousness, which can be fully reflected by the number of user innovations. Therefore, the level of user collective consciousness is determined by counting the number of user innovations. However, the intermediary role of social capital between user collectivity and lead userness is not significant. Users have higher collective awareness and have more embedded resources of this kind, but higher social capital does not promote the improvement of lead userness, which is a reference for further research on lead user integration.

Third, the user collectivity improves the lead userness through the continuous role of social capital and the number of user innovations. This study constructs a chain intermediary influence process of "user collectivity → social capital → user innovation quantity → lead userness". It is found that users have the stronger sharing spirit, which promotes the increase of users' social capital, thus boosting the number of users' innovation. However, users with more social capital make more innovation, which ultimately leads to the decline of lead userness. The in-depth exploration of the community found that this was caused by social users, which further explains the differences between social users and lead users in the community.

Social users prefer to participate in social activities, but they are not innovative[11]. According to the further exploration of the model, social users have the collectivity of lead users and accelerate their innovation through social capital, but whose social capital comes from not only collectivity but also other sources, including social users' personal endowment, such as the ability to raise more interesting or more controversial topics, release more attractive pictures, etc., which causes more social capital. More social capital promotes the knowledge reorganization and innovation of social users, but in general, the number of their innovations is still less than those of lead users, at the same time, the more innovative they are, the lower lead userness will be. Because only a few of the innovation of social users are accepted by the public and enterprises, the more innovative they are, the lower the proportion of innovation with lead userness will be, meanwhile the lower lead userness will be. Therefore, it can be further concluded that social users have social endowment, some of which coincide with the collectivity of lead users, who have accumulated more social capital through a large number of social activities and boosted their innovation ability under the role of social capital, but their innovation leading level is very low, which also indicates that lead userness has an important relationship with personal endowment, while lead users' participation in more collective activities is beneficial to their innovation.

6.2 Management inspiration

Based on the above research conclusions, the following management implications are obtained:

First, when enterprises look for lead users in the community, they involve the collective indicators of lead users. If it is possible to find and count the number of users' innovation, enterprises should first count the number of users' innovation in the community through artificial intelligence and other technologies.

Second, enterprises do not need to encourage all users to participate in the collective activities of the community, only need to pay close attention to users who have shown high priority before. Through big data technology, enterprises observe the degree of their participation in the community.If the degree decrease, they should actively contact and ask for reasons.

Third, social users have more social capital, but less innovation compared with lead users. Because of the characteristics of social users, enterprises can spread some important information that does not involve product innovation, but affects users more widely and quickly through social users.

6.3 Limitation and prospect

Although the chain influence path of the collectivity on lead userness has been constructed, there are still limitations: First, only the sharing spirit dimension of collectivity is used, while the next research can be performed from other dimensions, or use the structural equation method to discuss from multiple dimensions at the same time. Second, the content of user social capital has limitations. Future researches are able to select user communities with more information to carry out data mining and better display the social capital owned by users in all aspects. Finally, the impact path of collectivity on lead users is based on brand communities, which can be extended to non-brand communities in the future.

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