

Research on User's Interaction Participation in Virtual Communities Based on the Information Ecology Theory

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Abstract. Based on the theory of information ecology, this paper explores factors that influence users' interaction participation behavior in virtual communities. It combines three core elements in information ecology: information, information man, and information environment. Using data collected from 401 users in virtual communities to conduct a hypothesis testing, the empirical results show that usefulness, trust and security have direct positive impact on interaction participation.

Keywords: interaction participation; virtual communities; information ecology theory; empirical study

AMS Mathematics Subject Classification (2010): 62P25

1. Introduction

With the advance of information technology, virtual communities have become important places in this information ecology. Nowadays, different types of virtual communities appear in our networks, such as interest-specific, relationship, entertainment, and commerce communities, among many others. Virtual communities, as indispensable platforms for information flowing and sharing, have enhanced the social contact of users [4], and realized users' self-efficacy [8].

Interaction participation can be understood as comprising of two parts—"interaction" and "participation." Interaction means "being in contact" with two or more partners regardless of the activities that attract them together [19]. Community members interact on a regular basis online; they have exchanges in order to form a mutual relationship [19]. Participation means that volunteers and members may share no prior organizational affiliation [19]. It is shown in aspects like users being integrated in organizations and activities, their frequent involvement in assessments, and their conduction into user communications, among others. Participation in communities has been regarded as a measurement of the community's gain because it displays member satisfaction, while, simultaneously promoting important community goals [25].

Interaction participation is one of the users' most important behaviors in virtual communities in their mutual promotion and action. In the human-centered virtual communities, users' interaction participation allows users to meet their needs and realize their values; it forms the core of virtual communities as well. However, influencing factors of interaction participation need further exploration. Therefore, this paper is of important theoretical and practical significance.

Previous studies have researched interaction participation from different perspectives. Mai and Olsen investigated how personal values and personality jointly influence consumers' attitudes and behaviors towards their participation in virtual communities [15]; Shen et al. investigated virtual community loyalty from the perspective of interpersonal interaction among group members, treating interpersonal attraction and influence as antecedents to loyalty [20]; Yang et al. distinguished active and passive social interactions in the learning community with a conceptual framework [26]; Yoo et al. explored the factors that enhance member participation in business-to-customer virtual communities [25]; Zhao et al., from the perspective of social capital, elaborated factors for the development of the virtual communication members' sense of belonging [27].

Most studies focus on users' interaction participation in virtual communities without considering three core elements: information, user, environment. However, for interaction participation behaviors, information is the object, the user is the subject, and environment is the place. These three elements have important influence on interaction participation, making it necessary to study them together. Unlike extant literature, our research 1) considers the virtual community a situation, thereby providing a clear explanation of users' interaction participation; 2) discusses factors influencing user's interaction participation in the virtual community using three elements—information, information man, and information environment—based on the information ecology theory; and 3) establishes a research model from the perspective of information ecology and conducts an empirical test.

2. Background

Nardi and O'Day defined information ecology as a system composed of people, practices, values, and technology in a certain environment [17]. They discussed the relationship between IT and human beings in this environment, noting that the human activity served by technology is more important than the technology itself. Other scholars claim that information is the sum of ecological factors and their relationship to each other within a certain range of information resources [5]; the sum of the relationship between information, people, and the environment [2]; and an integrity formed by the process of communication and circulation of information between people, organizations, and communities in a certain space [11]. As per the systematic perspective, the information ecosystem is composed of information, information man, and information environment—key elements that create the ecosystem [22]. Information is an object of ecology [12], including information content and information resources; information man is a subject [12], that utilizes and controls information ecology; and the information environment is not only an ecological background and place, but also the sum of all external factors related to the information [12]. This paper argues that, under the information ecology theory, information, information man, and information environment are correlated and

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balanced. On one hand, information environment affects and restricts the information man; it plays an important role in their activities and the development of their relation. On the other hand, the information man's emotions and cognitions of information are critical to its quality and value.

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3. Hypotheses

From the perspective of information ecology, interaction participation is influenced by information, information man, and information environment. This paper argues that the most important factor of information is usefulness, the most important factor of information man is trust, and the most important factor of information environment is security.

3.1. Information

From the angle of information elements, this paper emphasizes the usefulness of information. This usefulness means the integrity and accuracy of information that can be exploited by users toward producing good results. The usefulness, reflecting the value of information [23], is a primary factor to attract and retain users. Useful information can allow users to perceive the value of information and more willingly exchange information in order to improve the frequency and intensity of their interaction participation. Therefore, this paper puts forward the following hypothesis:

H1: The usefulness has a positive effect on interaction participation.

3.2. Information man

Information man in this paper refers to users in virtual communities. From the angle of information man, trust among information men is emphasized. Trust, reflecting users' comprehensive evaluation to another user's behavior and ability, can usually be regarded as a decision-support tool. It is used for the analysis of relevantly reliable information sources, especially from a reliable source to seek advices and make decisions [16,28]. In a virtual community centered on people, behaviors and activities of users are built on the basis of trust. The higher degree of trust there is between users, the more willing they are to community activities, like commenting, sharing information, joining in interest groups. This then further strengthens the interaction participation among them. Therefore, this paper proposes the following hypothesis:

H2: Trust has a positive effect on interaction participation.

3.3. Information Environment

As for information environment, this paper emphasizes the security of information environment. Security, including network security, information security, and users'

security, means users' privacy and sensitive content in the virtual community are under protection. They are protected from various internal and external dangers, threats, harm, and misleading information. The security of information environment is a basic guarantee of interaction participation. In the process of interaction participation, users need to get protection in privacy, information, and systems. Interaction between users will not be effective and smooth if people fail to realize the above. Therefore, the following hypothesis is presented in this paper:

H3: Security has a positive effect on interaction participation.

4. Methods

4.1. Measures

We measured interaction participation with four items. The interaction participation scale is partly sourced from Lu [13]'s scale, and the other part sourced from Fan [6]'s scale. Responses were marked on a 5-point Likert scale ranging from 1 = very inconsistent to 5 = very consistent, and all items were reverse scored.

As for information factors, the usefulness scale (three items) was sourced from Cheung [3]'s scale. In terms of the factors of the information man, we measured trust (three items) using scales that were sourced from Gefen et al. [7], Luo [14], and Chiu et al. [4]. With respect to factors of information environment, the security scale (three items) was sourced from Wang et al. [24]'s scale.

In addition, gender, age, and level of education were used as control variables, following Hsu and Walter [9] and Seyedghorban et al. [21]. We also controlled for Internet experience and occupation. Since Internet experience has an impact on users' online behavior [18], their occupation might also influence their online behavior.

The first draft of the questionnaire was discussed multiple times by members of the research group; relevant experts were also consulted. A revised version is used for the formal survey.

4.2. Sample

Using a computer program, we randomly selected 2,580 users from among 2.6 million people in the sample bank of a professional online survey firm chosen by many Chinese research institutes and firms. We sent users an online questionnaire through email, push notifications, and other similar distribution methods. Before beginning the survey, participants were informed of the purpose of the study and method of data usage. They were then able to exit the survey if they were not willing to take part in this study. Four hundred and forty-nine surveys were returned (the return rate is 17.40%) after a rejection of invalid responses (such as insufficiency in answer time, wrong keys in a trap question, obvious regularities in responses, and low frequencies in using a virtual community), and eventually 401 valid responses were collected (validity rate is 89.31%). Of them, with 195 respondents, men account for 38.63%, and with 206 respondents, women accounted for 51.37%. In terms of age, there were 40 respondents in the age group of 19-25, accounting for 9.98%; 285 respondents in the group of 26-35, accounting for 71.07%; 68 respondents in the group of 36-45, accounting for 16.96%; and eight respondents above 45, accounting for 2.00%. Among all popular virtual communities, the usage rates of Baidu Tieba and Weibo were relatively high: 79.05% and 77.81%, respectively. The usage rates of other common virtual communities, including QQCLUB, Tianya

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Community, Douban, and Zhihu were 47.88%, 46.63%, 36.91%, and 34.41%, respectively. Furthermore, 93.02% of the respondents had more than one year of experience in using virtual communities. As for the usage frequency, most respondents used them once a day, with a percentage of 52.37%.

5. Results

We conducted a reliability analysis to confirm the scale's reliability, CFA to examine the rationality of the expected model, and multiple regression analysis to test the hypotheses.

5.1. Reliability and validity

Cronbach's α coefficient of the five variables (usefulness, trust, security, and interaction participation) can be calculated through SPSS 22.0, which is 0.618, 0.701, 0.765 and 0.695 respectively. Hair, et al. [10] noted that, when the measure indices of variable are less than 6, the scale is reliable on the premise of $\alpha > 0.6$, while it is acceptable in exploratory researches even if $\alpha > 0.5$. Therefore, the scale is equipped with relatively satisfying internal consistency reliability. Confirmatory Factor Analysis (CFA) results show that all the fit indexes are acceptable. The standard factor loading achieves comparatively high significance level ($p < 0.01$), and manifests comparatively good convergent validity. The 95% confidence interval of the pairwise-related coefficients between factors does not contain 1 or -1; therefore, it has good discriminate validity.

There is a significant difference between the fitting result of Harman single-factor model and the fitting result of the five factors model, which implies that not all factors can be explained by one latent variable. Thus, common method variance bias is not serious.

In addition, variance inflation factors (VIF) of each variable in all of the models are far less than 10, which imply that there is no serious multicollinearity among variables, and the analysis result is reliable. Following the common method, we have used the mean value of scores gotten from the items' subordinating variables to represent the scores gained by variables.

Simultaneously, following the common method, we centralize the variables scores (subtracting the mean value of variables) to reduce the multicollinearity effect, before calculating interaction terms [1]. Table 1 shows the mean values, standard deviations, and correlation coefficients of variables.

Table 1: Mean, Standard Deviation and Correlation

Variables	1	2	3	4
1. Interaction Participation	1			
2. Usefulness	.582**	1		
3. Trust	.539**	.577**	1	
4. Security	.461**	.400**	.678**	1
Mean Value	3.953	3.910	3.497	3.395
Standard Deviation	.551	.583	.692	.774

Note. * $p < 0.05$, ** $p < 0.01$.

6. Hypothesis testing

Usefulness has a positive impact on interaction participation ($\beta=0.376$, $p<0.01$). Trust has a positive impact on interaction participation ($\beta=0.201$, $p<0.01$). Security has a positive impact on interaction participation ($\beta=0.184$, $p<0.01$). Thus, H1, H2, and H3 are supported. Table 2 presents the hypothesis testing, and the results are shown in Figure 1.

Table 2: Hypothesis Testing

Variables	Dependent Variable: Interaction Participation		
	Model 1	Model 2	Model 3
Age	-.048	.005	.003
Education -Bachelor Bellow	-.037	-.023	-.020
Education -Master or Above	-.012	-.025	-.024
Occupation -Education and Research Development	-.058	-.063	-.063
Occupation -Institutional and Other Organizations	.054	-.014	-.014
Usefulness		.398	.376**
Trust		.192	.201**
Security		.179	.184**
R ²	.011	.422	.424
F	.861	35.741**	26.053**
ΔR^2	.011	.411	.002
F of ΔR^2	.861	92.874**	.548
Maximum VIF Value	1.058	2.347	2.460

Note. * $p<0.05$, ** $p<0.01$.

7. Conclusion

Based on the information ecology theory, this paper built a research model in virtual communities. Using data collected through 401 surveys in virtual communities, we empirically tested the hypotheses. The main conclusion is that usefulness, trust, and security have positive impact directly on interaction participation. Therefore, users' interaction participation in the virtual community is affected by many aspects, including information, information man, and information environment. The better the information

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ecology that exists in a virtual community, the higher degree of users' interaction and participation will be.

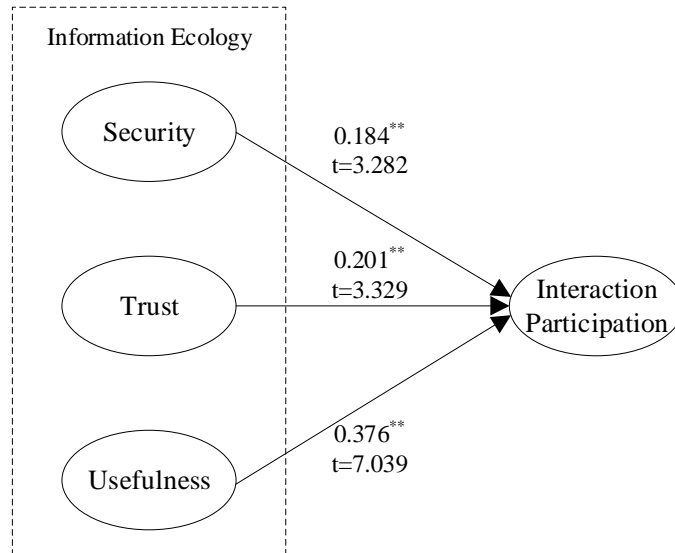


Figure 1: Research results

The theoretical significance provided in this research includes two aspects: On one hand, this paper focuses on virtual communities, and builds a research model of users' interaction participation. On the other hand, from the perspective of interaction participation, this paper analyzes interaction participation from three important elements which are information, information man and information environment. The empirical results indicate that the virtual community's managers should pay attention to users' interaction participation, which are influenced by many factors. In the process of their conducting architecture designs, function settings, and system improvements in the virtual community, there is a need to adjust relationships between the different factors, and to enforce the construction of the virtual community in order to support users' behaviors and promote the development of the virtual community.

Limitations of the study and future directions in this paper include: in the setting of the variable, there is a lack of consideration to information, information man, and information environment. To open and diverse virtual communities, these three main elements are influenced by many factors. This paper only selects the most important one as a variable from the factors influencing the three main elements, respectively.

Meanwhile, its measurement of the variable only reflects users' subjective willingness to participate and interact in virtual communities. Therefore, in future investigations, we could collect the data of users' real behaviors in virtual communities (for example, access numbers, reply numbers, collection numbers, etc.) to proceed with objective verification. Besides, because different types of virtual communities will have different influences on interaction and participation, future research may focus on one

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type of virtual community (such as a learning community, an interesting community, a transaction community, etc.) to carry out a targeted study on interaction participation.

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