

Virtual Community Dynamics: A Conceptual Framework and Empirical Validation

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Abstract

The Internet revolution has evoked an unprecedented proliferation of virtual communities. In this article, we examine the factors that affect the level of virtual community activation and whether the level of virtual community activation affects virtual community performance and loyalty to the virtual community provider (VCP). To test several hypotheses, we conducted multiple regression analyses using both the perception data of the community members and actual data related to virtual community activation. We found that virtual communities are stimulated predominantly by the off-line activities and the level of virtual community activation not only improves community outcome but also leads to increased loyalty to the community-host (i.e. VCP).

Keywords: virtual community; virtual community activation; off-line activities

1. Introduction

With the Internet broadening the coverage of our lives, the virtual community has become an emerging and interesting topic for IT professionals and management researchers (e.g., Koh and Kim 2001; Jones 2000). How can the *virtual community* be conceptualized? Moreover, how can we understand the overall dynamics of the virtual community? What implications does this unprecedented growth of virtual communities have on information systems (IS) community? A variety of questions are emerging and challenging us.

At the individual and the group level, understanding of virtual community dynamics can facilitate virtual collaboration among organizational members beyond the traditional groupware usage. In addition, this understanding provides the potential to transform the off-line, intra-organizational communities-of-practice (CoPs) into on-line, extra-organizational context. Virtual communities can also cultivate a new breed of younger generation workers who feel much more comfortable at working on-line. At the enterprise level, virtual communities will lead us to a radically different set of organizational design options by changing the view from the hierarchy of command and

control into a competency-based network.

Despite virtual communities' explosive growth and importance (Hagel III and Armstrong 1997; Balasubramanian and Mahajan 2001), limited empirical research at the community level for understanding the virtual communities has been conducted. In this study, we intend to analyze how virtual community can be activated and how virtual community dynamics affect virtual community performance from the perspectives of the virtual community itself and virtual community providers (VCPs). More specifically, research questions are as follows:

- What factors stimulate virtual communities?
- How does the level of virtual community activation affect virtual community performance?
- Does community-loyalty extend to loyalty to the virtual community provider?

2. Virtual Community: Conceptual Background

A community is mainly characterized by the relational interaction or the social ties that draw people together (Heller 1989). Then how can the *virtual community* be defined? We find that there have been two different viewpoints on understanding and defining the virtual community in previous research. One is to understand the *virtual community* as "a community extended by new information technologies" (e.g., Fernback and Thompson 1995; Balasubramanian and Mahajan 2001; Jones 2000), while the other is to treat it as "a new type of community fully distinguished from the traditional community" (e.g., Wood and Smith 2001; Hagel III and Armstrong 1997; Wellman and Gulia 1999).

Despite the subtle differences in focus, the two lines of thought on the virtual community agree on the use of "cyberspace" as a default or mandatory place for the virtual community members' interaction. However, this agreement does not fully reflect the reality of the millions of diverse virtual communities in the real world. It is true that some virtual communities do exist strictly in cyberspace. But in a number of other virtual communities, we find that community members engage in *off-line* as well as *on-line interactions*. This phenomenon is particularly visible in virtual communities which originate from off-line

organizations (e.g., fan clubs, alumni associations, etc.). Thus, to accommodate a broader range of real world virtual communities, we define the *virtual community* as “a group of people with common interests or goals, interacting predominantly in cyberspace.”

3. Research Model and Hypotheses

In the initial phase of this study, we focused on developing a conceptual foundation to understand virtual community dynamics. The research model for this study is shown in Figure 1.

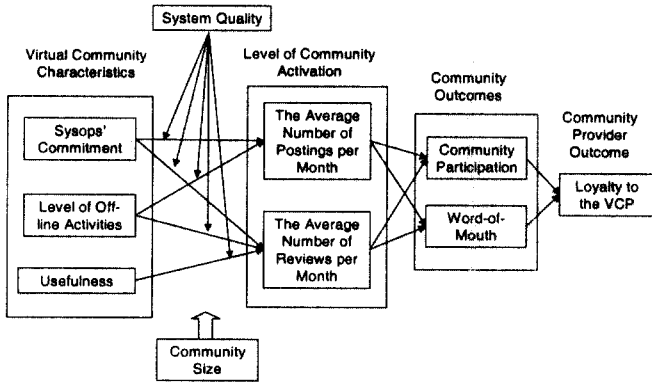


Figure 1. Research Model

Based on the literature and in-depth understanding of virtual community behaviors at the individual through preliminary studies, we predict that certain positive characteristics of a virtual community contribute to its activation and such activation will lead to positive community outcomes. We also predict that positive community outcomes will lead to positive community provider outcome. Rationale for each research variable and related hypotheses follows next.

Sysops' commitment is believed to help community members feel that their virtual community is very active (Kim 2000). The practitioners in our preliminary interviews noted that the survival of virtual communities often depends on the leaders' efforts in terms of visioning, caring for members and devoting themselves at the initial community building stage. They also argued that one passionate leader could transform its members to be highly committed to the community activities. Therefore, *sysops' commitment* is expected to foster active member participation in the form of posting and/or reviewing community contents (Steckler and Fondas 1995).

Hypothesis 1a: There is a positive relationship between *sysops' commitment* and *the average number of postings per month*.

Hypothesis 1b: There is a positive relationship between *sysops' commitment* and *the average number of reviews per month*.

Balancing on-line and off-line activities is critical for sustaining a virtual community, implying that the use of diverse communication channels may be effective in the

computer-mediated environment (Kiesler et al. 1984). On-line activities can be reinforced and broadened by face-to-face meetings because *off-line activities* heighten their members' social presence and frequently become a source of new ideas and information to share with the rest of the community. Thus, we expect off-line meetings will fuel virtual community activation.

Hypothesis 2a: There is a positive relationship between *the level of off-line activities* and *the average number of postings per month*.

Hypothesis 2b: There is a positive relationship between *the level of off-line activities* and *the average number of reviews per month*.

Usefulness is based on the motivation theory which argues that if an individual perceives an activity to be instrumental for achieving valued outcomes, he/she will be more likely to accept the new technology (Igbaria 1994). It has been pointed out that usefulness appears to exhibit a stronger and more consistent relationship with usage behavior than other variables, including various satisfaction and perception measures (Davis 1989). Therefore, we propose that the perceived community *usefulness* will trigger more frequent reviews of the members from the utilitarian perspective.

Hypothesis 3: There is a positive relationship between *usefulness* and *the average number of reviews per month*.

If the quality of IT services provided by the virtual community provider does not meet the users' needs, IT will turn into a major impediment to facilitating virtual community activation. We view the *quality of IT services* as the *system quality* perceived by the community members. There are several key quality sub-dimensions of IT services (Bailey and Pearson 1983; Ballou and Pazer 1995; DeLone and Mclean 1992), which can be applicable to the virtual community context. For example, system response time should be satisfactory in order for organizations or virtual communities to be activated (Stein 1995). The virtual communities whose system quality is satisfactory can possibly be more activated than those of which system quality is not satisfactory, because it will affect the community members' computer accessibility or intensity of computer usage. Thus, *system quality* is expected to moderate the relationship between the virtual community characteristics and the level of virtual community activation.

Hypothesis 4a: *System quality* moderates the relationship between the *virtual community characteristics* and *the average number of postings per month*.

Hypothesis 4b: *System quality* moderates the relationship between the *virtual community characteristics* and *the average number of reviews per month*.

If a virtual community is activated, it may lead its members to participate in *organizational citizenship behaviors* (OCBs) as well as frequent visits or long stays. Here, OCB refers to voluntary help-giving behavior

(Barnard 1938; Organ 1988). For example, members can provide contributing messages and post the help-giving contents for the requester personally. This behavior frequently appears in a virtual community in terms of intensive postings and reviews of the members. Thus, we believe there exists a positive relationship between *the average number of postings (or reviews) per month* and *community participation* in the form of OCB. At the same time, members whose virtual community is active tend to be more loyal to their community and frequently “preach” to their acquaintances about their community or even invite their friends to join it. Thus, we hypothesize that *the average number of postings (and reviews) per month* is positively associated with *word-of-mouth* behavior.

Hypothesis 5a: There is a positive relationship between *the average number of postings per month* and *community participation*.

Hypothesis 5b: There is a positive relationship between *the average number of reviews per month* and *community participation*.

Hypothesis 6a: There is a positive relationship between *the average number of postings per month* and *word-of-mouth*.

Hypothesis 6b: There is a positive relationship between *the average number of reviews per month* and *word-of-mouth*.

Through *virtual community participation*, members are likely to be exposed to a variety of user interfaces and interventions offered by the virtual community provider. Since various promotional services and events by the community provider are more frequently exposed to the community members who are committed to the virtual community, it is likely that members with higher level of community participation tend to form a more positive attitude toward their virtual community provider. Similarly, when community members promote their community through positive *word-of-mouth*, they are unconsciously promoting the community provider which hosts their community. Thus, *community participation* and *word-of-mouth* are expected to be related to the community members’ loyalty to the community provider.

Hypothesis 7a: There is a positive relationship between *community participation* and *loyalty to the VCP*.

Hypothesis 7b: There is a positive relationship between *word-of-mouth* and *loyalty to the VCP*.

4. Methods

4.1. Sample and data collection

The instruments of the study were developed based on the relevant literature and the results of the preliminary interviews with the sysops of the five virtual communities in Korea. A pilot test was conducted with 90 members in 10 virtual communities hosted by a community provider, “Netian” (www.netian.net), in Korea. The pilot test was to evaluate the relevance of the items related to research

variables, using a seven-point Likert scale. With the questionnaire modified through pilot testing, we were able to secure “Freechal (www.freechal.com)” as our research site. “Freechal” is one of the representative community providers in Korea that was reported to have about 800,000 virtual communities as of November 2001 (Freechal was ranked 19th in the world by Alexa in November, 2001). We installed a web-based questionnaire system within the Freechal.com site in December, 2001. A banner advertisement about the survey was exposed to every Freechal member as a survey promotion for one week, and 3450 members from 691 virtual communities participated in the survey. Out of 691 communities, the number of virtual communities with at least three respondents was 82. Then, five samples out of 82 were dropped because of the unacceptable inter-rater agreement level among members ($r_{wg(j)} < .70$). Thus, the final sample size was 77, and 641 usable web-questionnaires from 77 communities were used for the analysis. Also, we collected fact data such as *community size* and *the average number of postings/reviews per month* of each community. Detailed descriptive statistics of the respondents’ characteristics and their communities are shown in Table 1 and 2, respectively.

Table 1: Descriptive Statistics of the Respondents’ Characteristics

Measure	Items	Frequency	Percent
Gender	Female	270	42%
	Male	361	56%
	Missing	10	2%
	Total	641	100%
Age	< 16	24	4%
	16-20	149	23%
	21-25	172	27%
	26-30	163	26%
	31-35	100	16%
	> 35	24	3%
	Missing	8	1%
Total	641	100%	

Table 2: Descriptive Statistics of Participated Virtual Communities

Measure	Items	Frequency	Percent
Community Size (Unit: Members)	< 100	18	23%
	100-500	27	35%
	501-1000	6	8%
	> 1000	26	34%
Total	77	100%	
Community Age (Unit: Months)	< 6	17	22%
	6-12	23	30%
	13-18	19	25%
	> 18	16	21%
	Missing	2	3%
Total	77	100%	

4.2. Measures

4.2.1. Measurement

Independent variables and the moderating variable were measured by a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. The questionnaire

items for the variables are provided in Appendix A. Also, Appendix B shows the results of the principal component factor analysis to investigate distinctions among the independent variables and the moderating variable - *sysops' commitment, level of off-line activities, usefulness and system quality*. All four factors were loaded on each distinct factor and they explained 71.3% of the total variance.

We developed dependent variables which were measured by a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), too. The questionnaire items for the dependent variables are given in Appendix C, and Appendix D provides the results of the principal component factor analysis that confirmed the expected factor structure of the dependent variables.

Finally, we measured *the average number of postings per month and the average number of reviews per month* as the variables for the level of virtual community activation. *The average number of postings per month* is calculated as the cumulative number of postings divided by the virtual community age (months). *The average number of reviews per month* is measured as the cumulative number of reviews of the contents divided by the virtual community age (months).

The means, standard deviations and reliabilities of all the research variables are shown in Table 3 (there is no reliability in case of fact-data). The reliabilities of variables were well over .600, which is considered satisfactory for new measures (Sabherwal and Chan 2001; Nunnally 1978).

Table 3: The Research Variables (n=77)

Variables	Reliability	No. of Items	Mean	S.D.
Sysops' commitment	0.883	5	4.211	0.461
Level of off-line activities	0.895	4	3.978	0.683
Usefulness	0.811	4	4.020	0.486
System quality	0.843	4	3.750	0.440
Average number of postings per month*	N/A	N/A	1807	1600
Average number of reviews per month*	N/A	N/A	7679	15265
Community participation	0.856	6	3.866	0.416
Word-of-mouth	0.784	3	3.774	0.476
Loyalty to the VCP	0.841	5	3.393	0.441

(Note) *: Fact-data

N/A: Not available

4.2.2. Inter-rater agreement

We estimated the agreement score for the seven variables with the index of *within-group agreement*, $r_{wg(j)}$, derived by James et al. (1984). Within-group agreement among individuals could qualify theoretically to aggregate the perceptions to the higher unit level, and to use the mean to represent this collective interpretation. The average within-group agreements for the seven variables such as *sysops' commitment, level of off-line activities, usefulness, system quality, community participation, word-of-mouth and loyalty to the VCP* were 0.855, 0.911, 0.931, 0.849, 0.877, 0.797 and 0.909, respectively. The agreements are generally

acceptable because they are well above 0.700. Five samples out of the first 82 sample candidates were dropped because of the agreement problem as mentioned before.

5. Results

We examined the effects of the virtual community characteristics (such as *sysops' commitment, off-line activities, and usefulness*) on the level of virtual community activation. Before conducting the multiple regression analysis, we checked for potential multicollinearity among the independent variables. Though several variables showed significant correlations, their *tolerance* values ranged from 0.275 to 0.949, indicating that multicollinearity is not a likely threat to the parameter estimates (Hair et al. 1995). Table 4 shows the results of the multiple regression analyses, testing the hypotheses. The results indicate that all five regression models are significant at $p < 0.01$ level or at $p < 0.05$ (F -value = 12.468, 5.311, 4.439, 7.697 and 5.193), and the predictors of each model explain 35%, 30%, 12%, 19% and 18% of the total variance, respectively.

Hypotheses 1a and 2a examine the relationship between *virtual community characteristics* and *the average number of postings per month* with a control variable, *community size*. The *off-line activities* were positively related to *the average number of postings per month* in virtual communities, while the *sysops' commitment* variable was not significantly associated with it. Therefore, hypothesis 1a is not supported, while hypothesis 2a is supported. In hypotheses 1b, 2b and 3, we investigated the effect of *virtual community characteristics* on *the average number of reviews per month* but no hypothesis was supported. In terms of hypotheses 5a and 6a, *the average number of postings per month* significantly affected both *community participation* and *word-of-mouth* behavior. However, *the average number of reviews per month* was found to affect neither the *community participation* nor the *word-of-mouth* behavior significantly. Thus, hypotheses 5a and 6a are supported, while hypotheses 5b and 6b are not supported. In hypotheses 7a and 7b with a control variable of *community age*, *loyalty to the VCP* was affected not by *community participation* but by *word-of-mouth*. Consequently, hypothesis 7a was not supported, but hypothesis 7b was supported.

Table 4: Results of Hypotheses Tests (From H1a to H7b)

Model	R ²	F	β	Results
(1) Postings (POS)				
POS = S + O + N	0.348	12.468***		
+ errors				
S			0.021	H1a not supported.
O			0.351***	H2a supported.
N (control var.)			0.450***	N/A
(2) Reviews (REV)				
REV = S + O + U	0.300	5.311***		
+ N + errors				
S			-0.084	H1b not supported.

O	0.143	H2b not supported.
U	0.154	H3 not supported.
N (control var.)	0.437***	N/A

(3) Participation (PAR)		
PAR = POS +	0.119	4.439**
REV + errors		
POS	0.394***	H5a supported.
REV	-0.135	H5b not supported.

(4) Word-of-Mouth (WOM)		
WOM = POS +	0.189	7.697***
REV + errors		
POS	0.431***	H6a supported.
REV	0.007	H6b not supported.

(5) Loyalty (LOY)		
LOY = PART + WOM + T + errors	0.180	5.193***
PART	0.172	H7a not supported.
WOM	0.228*	H7b supported.
T (control var.)	-0.277**	N/A

(Note) S: Sysops' commitment; O: Off-line activities; U: Usefulness; N: Community size; T: Community age; POS: the average number of postings per month; REV: the average number of reviews per month.

***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.1$

To examine whether the effects of virtual community characteristics on the level of community stimulation are moderated by the *system quality*, we conducted a moderated regression analysis (Atuahene-Gima and Li 2000). We added interaction terms to the overall model including all the independent variables. Two equations for the moderated regression analyses are presented in Table 5. In hypotheses 4a and 4b, no significant change in R^2 was found in the two moderated regression analyses (significances of F change by incremental $R^2 = 0.563$ and 0.880) and all the interaction terms of *system quality* with each independent variable were not significant. Thus, hypotheses 4a and 4b are not supported.

Table 5: Models for the moderated regression analyses

Models for Moderated Regression Analyses	Related Hypothesis
Model 1 POS = S + O + N + SQ + SQ*S + SQ*O + errors	Hypothesis 4a
Model 2 REV = S + O + U + N + SQ + SQ*S + SQ*O + SQ*U + errors	Hypothesis 4b

(Note) S: Sysops' commitment; O: Off-line activities; U: Usefulness; N: Community size; SQ: System quality; POS: the average number of postings per month; REV: the average number of reviews per month.

Based on statistically accepted hypotheses, the overall paths of virtual community dynamics are graphically shown in Figure 2.

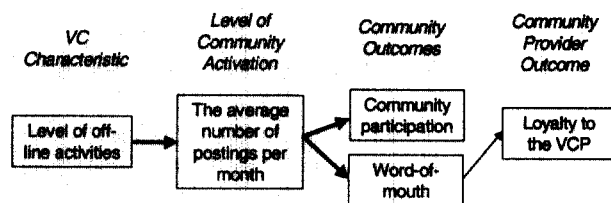


Figure 2. Virtual Community Dynamics

6. Discussions and Implications

Of the three virtual community characteristics we examined, only the *off-line activities* variable showed the significant effect on one virtual community activation variable (*the average number of postings*). We interpret that the posting intensity of the virtual community was affected by the *off-line activities* because off-line meetings often encourage community members to be more active in posting new on-line contents. We suggest that sysops boost regular or irregular off-line meetings and events, and promote their community members for participation. In cases where off-line activities are not feasible due to their geographical dispersion from each other, adoption of multimedia support such as video conferencing or avatar chatting will help stimulate the effects of off-line, face-to-face meetings. On *sysops' commitment*, we presume that its effect was either affected by the relatively young community age (52%, less than 12 months) or overshadowed by the effect of off-line meetings.

Result on *usefulness* was a surprise to us. We expected it to be definitely related to the average number of reviews by members since the link was so obvious conceptually as well as intuitively. Here, we realize the difficulty of validating a link between perception measure and factual data since such link was confirmed numerously in the Technology Acceptance Model (Davis 1989) based studies, using both perceptual measures.

System quality seems to be a *hygiene* factor rather than a facilitator for virtual community activation. That is, if it is dissatisfactory, it may affect the users' virtual community activities negatively. However, we conclude that high system quality may *not necessarily* fuel the relationship between virtual community characteristics and the level of virtual community activation.

On the link between community activation and community outcomes, *posting activities* were closely associated with *community participation and word-of-mouth*, while reviewing activities were *not* so closely related to it. We interpret that posting behavior is a more powerful indicator to predict community commitment because contents posting requires much more effort and resources of the members than contents reviewing. Finally, we also found a weak link between the community outcome and the virtual community provider outcome (i.e. the link between *word-of-mouth* and *loyalty to the VCP*). This implies loyalty to the virtual community can extend to loyalty to the community provider.

7. Conclusions and Limitations of the Study

In this study, we examined which factors are related to the level of virtual community activation and how virtual community activation affects virtual community performance and loyalty to the community provider. A major finding of the study was the critical role played by *off-line activities* in virtual community activation. Since a majority of virtual community activities take place on-line in cyberspace by definition, we did not expect the *off-line activities* variable to have such a strong impact on activation. However, the finding is consistent with the prior studies which confirmed that strong ties among members cannot be sustained without physical cues (Beniger 1987; Stoll 1995; Koh and Kim 2001).

We also found that *posting dynamics* were different from *reviewing dynamics* within the community. Only the number of postings was affected by *off-line activities* and was significantly related to community outcomes such as *community participation* or *word-of-mouth*, suggesting new community activation directions to the community sysops and providers.

Furthermore, we validated that the level of virtual community provider loyalty can be increased by the level of community loyalty. We suggest that the virtual community providers should trace the elaborate links between their communities and the virtual community providers themselves, which would help create profitable Internet business models. Finding such link deems critical to every virtual community providers to be more competitive.

There are several limitations in this study. Since the data was collected only in Korea and the sample size was relatively small, the general applicability of the findings is limited. More sophisticated data collection is needed for future research, including virtual community providers in more than one country. Also, a cross-cultural study on virtual community dynamics would be valuable. Next, the research model of our study may not be applicable to communities with geographic limitations or commercial communities such as brand communities (e.g., Amazon.com), because they include relatively few off-line activities or interactions between members. Our proposed research model has much room for further elaboration based on more solid background theories. We expect other researchers to build a theoretical model and to discuss the model with us in order to lay a conceptual foundation related to virtual community dynamics.

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Appendix A: Measures of Independent Variables and Moderating Variable

Variables	Items
Sysops' commitment	<p>The sysops in my virtual community have clear vision of my virtual community.</p> <p>The sysops are concerned with my virtual community members' affairs.</p> <p>The sysops do their best to support my virtual community.</p> <p>The sysops encourage interactions among my virtual community members.</p> <p>The sysops understand the needs of my virtual community members.</p>
Level of offline activities	<p>Regular meetings of my virtual community are given frequently.</p> <p>My virtual community members meet each other even in informal meetings.</p> <p>My virtual community members take an active part in off-line meetings.</p> <p>A variety of off-line activities are held in my virtual community.</p>
Usefulness	<p>Topics treated in my virtual community are useful to me.</p> <p>It is useful to interact with other members in my virtual community.</p> <p>There are many experts to help the members in my virtual community.</p> <p>There are many useful postings on the BBS of my virtual community.</p>
System quality (SQ)	<p>It is easy to navigate my virtual community.</p> <p>It is easy to participate in my virtual community using the website.</p> <p>The response speed of my virtual community website is fast.</p> <p>Services provided by my virtual community are stable in terms of website capability.</p>

Appendix B: Factor Structure of Measures of Independent Variables and Moderating Variable

Appendix C: Measures of Dependent Variables

Variables	Items
Participation	<p>I take an active part in my virtual community.</p> <p>I do my best to stimulate my virtual community.</p> <p>I often provide useful information/contents for my virtual community members.</p> <p>I eagerly reply to postings written by the help-seeker.</p> <p>I am concerned about my virtual community members.</p> <p>I often help virtual community members who seek the support of other members.</p>
Word-of-mouth	<p>I suggest to my acquaintances that they enroll in my virtual community.</p> <p>I often talk about benefits of my virtual community.</p> <p>I often talk to my peers in my company or school about my virtual community.</p>
Loyalty to the VCP	<p>I recommend to my acquaintances that they enroll in freechal.com.</p> <p>I often talk about benefits of freechal.com.</p> <p>I often talk to my peers in my company or school about freechal.com.</p> <p>I even give freechal.com ideas/suggestions on planning and operations.</p> <p>I will visit freechal.com continuously, even if my virtual community vanishes.</p>

Appendix D: Factor Structure of Measures of Dependent Variables