The factors influencing members' continuance intentions in professional virtual communities a longitudinal study

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The factors influencing members' continuance intentions in professional virtual communities – a longitudinal study

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Abstract.

The advance of internet technology has stimulated the rise of professional virtual communities (PVCs). The objective of PVCs is to encourage people to exploit or explore knowledge through websites. However, many virtual communities have failed due to the reluctance of members to continue their participation in these PVCs. Motivated by such concerns, this study formulates and tests a theoretical model to explain the factors influencing individuals' intention to continue participating in PVCs' knowledge activities. Drawing from the information system and knowledge management literatures, two academic perspectives related to PVC continuance are incorporated in the integrated model. This model posits that an individual's intention to stay in a professional virtual community is influenced by a contextual factor and technological factors. Specifically, the antecedents of PVC members' intention to continue sharing knowledge include social interaction ties capital and satisfaction at post-usage stage. These variables, in turn, are adjusted based on the confirmation of pre-usage expectations. A longitudinal study is conducted with 360 members of a professional virtual community. Results indicate that the contextual factor and technological factors both exert significant impacts on PVC participants' continuance intentions.

Keywords: continuance intention; virtual community; social capital; IS success; expectation-confirmation theory

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1. Introduction

In the past two decades, the proliferation of exciting internet technology has given rise to professional virtual communities (PVCs) which enable knowledge exchange without the participating members ever meeting. Professional virtual communities are cyberspaces supported by computer-based information technology, centered upon communication and interaction of participants to generate member-driven knowledge of a specific domain, and resulting in a relationship being built [1]. More and more individuals have participated in professional virtual communities, seeking knowledge to resolve problems at work. Many organizations have also recognized professional virtual communities as valuable systems for knowledge management and have begun to support the development and growth of professional virtual communities to meet their business needs and objectives [2].

The competitive advantage of a professional virtual community is fundamentally based on how efficiently knowledge is shared across members and created to enrich the digital content of the PVC. The activities of knowledge sharing will encourage members to use the PVC repeatedly as the channel for knowledge seeking. However, the knowledge sharing in some professional VCs has not lived up to expectation. Two barriers to online knowledge sharing have been found to be factors driving members away from using professional VCs.

The first barrier is the technological factor associated with the quality of the websites. A central element of a professional VC is its website where people with common interests exchange knowledge on the world-wide-web (WWW). Most managers of PVCs implement such an information technology (IT) application with the assumption that such information systems (ISs) would facilitate member participation in the knowledge exchange. However, some members discontinue their use of a PVC because they find it difficult to perform these activities due to the poor quality of the website. According to DeLone and McLean [3], system quality, information quality and satisfaction impact IS users' intentions. In a professional VC, the major content delivered by the website is knowledge. Website quality of a professional VC refers to knowledge quality and system quality.

Lee et al. [1, p. 48] suggest that the tools (e.g. discussion forum, message boards) that VC websites use to assist in relationship building and knowledge sharing are of dubious value. Sangwan [4] indicates that VC websites with empty message boards, ancient posts, unanswered questions and unused discussion spaces provide little information about the functioning of these VCs, and diminish member satisfaction. Systems that make it difficult to do what the users intend to do will fall out of use [5]. Members of professional VCs will continuously participate in knowledge exchange if they are comfortable with the knowledge quality and system quality of the website, and satisfied with the website use experience. These variables constitute the technological factors impacting VC members' continuance intentions.

The second barrier to knowledge sharing is the contextual factors associated with both the sending and the receiving individuals (e.g. [6]). Wasko and Faraj [7] indicate that knowledge sharing has been found to be a motivation for using emergent VCs. In professional virtual communities, members are not only receivers of knowledge, but also providers of knowledge. However, the extent to which people would contribute their knowledge may vary with the contextual factors in VCs. In recent research concerning online knowledge sharing (e.g. [8, 9]), social capital has been considered a very important contextual factor that facilitates knowledge exchange. Social capital refers to the resources embedded within networks of human relationships [10]. Gillam and Oppenheim [11] point out that networks, relationships and globalization typify the era of the Information Age. The number of social interaction ties linking an individual to others in a network is an important attribute of social capital [8, 10]. It influences the extent to which interpersonal knowledge sharing occurs [10, 12]. Therefore, it is used as the contextual factor in this study.

In volitional behaviors such as website use in professional VCs, initial use (acceptance) is merely the first step toward realizing VC success; an eventual VC success will further depend on members' continued use (continuance). Some VCs attract a large number of members in the early stages, but suffer from turnover at a later stage. Bhattacherjee and Premkumar [13] suggest that the use of IS encompasses two stages: pre-usage stage and usage stage. They indicate that user beliefs may change with time as users gain first-hand experience with IT usage behavior. This signifies that, at both pre-usage

stage and usage-stage, the contextual factor and technological factors will play important roles in VC members' continuance decisions. Specifically, VC members form an initial expectation concerning the number of social interaction ties they can create to connect to other members, and the knowledge quality and system quality of the VC. These expectations will be confirmed or disconfirmed, and will be modified after a period of usage for next stage participation. The confirmed or disconfirmed perceptions facilitate satisfaction or dissatisfaction, and lead to a member's continuance or discontinuance.

The purpose of this study is hence to propose a professional VCs' continuance model to advance the understanding of online behavior. The two research questions of interest to this study are:

(1) What are the emergent factors leading to PVC members' continuance intentions?

(2) To what extent do these factors influence PVC members' continuance intentions?

To address these questions, this study integrates two perspectives in this model, context and technology, to provide an explanation of the factors that influence PVC members' continuance intentions.

2. Theoretical background

2.1. Professional virtual communities

The rise of the virtual communities (VCs) has been considered to be an important stimulus for the interest in knowledge management (KM) during the last decade [14]. Several types of VCs have been established based on their underlying principles or focuses. Hagel and Armstrong [15] point out that one type of VC is built up by a dispersed group of people who share an interest and expertise in a specific topic; namely the professional virtual community (PVC). They are cyberspaces supported by computer-based IT, centered upon communication and interaction of participants to generate member-driven knowledge of a specific domain, resulting in a relationship being built up [1]. They are also places with socially constituted values and expectations [16]. The objective of KM in professional VCs can be to enhance exploitation or exploration of knowledge.

Consistent with the exponential growth of VCs during the last decade, a considerable number of VC studies have been conducted. Some of these studies are related to VC success and knowledge management. For example, Sangwan [4] used member need satisfaction as a proxy measure for virtual community success to study the factors motivating a member to participate in a professional virtual community. She concluded that content building is critical to the success of a virtual community. Preece [17] attempted to identify determinants of sociability and usability that help determine online community success. She indicated that social interaction support and community participants' satisfaction are central to online community success. Wellman et al. [18] asserted that computer-supported social networks can maintain strong, supportive ties as well as increase the number and diversity of weak ties in virtual communities. These ties make online communications less inhibited and more creative. Wasko and Faraj [8] investigated why people share their knowledge with others in electronic networks of practice. They found that both reputation and centrality have significant influences on the helpfulness and volume of knowledge contribution. Koh and Kim [19] investigated the relationship between community knowledge sharing activity and loyalty toward the virtual community service provider. The results indicated that the level of community knowledge sharing activity may be a proper proxy for the state of health of a virtual community. Ardichvili et al. [20] reported the results of a study of motivation and barriers to employee participation in virtual knowledge-sharing communities of practice at a Fortune 100 multinational corporation. They suggested that knowledge can flow easily when employees view knowledge as a public good belonging to the whole organization. Finally, Burnett [21] proposed a typology of the varieties of information behavior to be found in virtual communities.

Other studies in this research stream have focused on exploring issues of e-learning performance, e-commerce success, etc. For example, Daniel et al. [22] addressed the importance of social capital in enhancing learning performance in virtual learning communities. Haythornthwaite [23] found that centrality in a network may correlate with performance or satisfaction measures. Cummings

et al. [24] found that the net benefit of online relationships depends on whether they supplement or substitute for offline social relationships. Markland [25] pointed out that the 'new alliances' approach is most effective at individual as well as at group level for information resource seeking in virtual learning communities. Finally, Lin and Hsueh [26] proposed a knowledge map management system to facilitate knowledge management in virtual communities of practice.

Despite the wide acceptance of VCs in modern life, many VCs have been found to be obsolete due to member discontinuance. One plausible explanation is that the factors facilitating member participation have not yet been identified. Based on a review of the literatures on VCs, KM and ISs, this study suggests that the factors related to member continuance can be classified into two categories: contextual and technological.

2.2. Contextual factor for a professional virtual community

Professional virtual communities provide a suitable environment for those seeking knowledge-based communication. Most members in a professional VC do not know each other, yet they sometimes communicate actively through the VC. With no immediate benefit to the knowledge contributors, and free-riders able to acquire the same knowledge as everyone else [8, p. 35], why these members exchange ideas and experience with strangers is not well understood. Some academics [8–10, 27] have attributed such behavior to a composite contextual variable: social capital, derived from Social Capital Theory.

Social capital has been considered an important enabler of creation, exchange and combination of knowledge [8–10, 12, 28–31]. Scholars have addressed the importance of various components of social capital based on their study contexts. For example, Tsai and Ghoshal [12] found that social interaction tie and trust both have direct positive impacts on the extent of inter-unit resource exchange. Kankanhalli et al. [9] found that trust and identification influence knowledge contribution to an electronic knowledge repository (EKR). Although trust and identification are important factors influencing online knowledge sharing, this study focuses on social interaction ties to explain the importance of the centrality in the network.

Social interaction is the process by which VC members act toward or respond to one another. Social interaction ties can be considered a bond between two people based on one or more relations they maintain in a social network [23]. A professional virtual community's knowledge has both explicit and tacit components. The explicit knowledge can easily be browsed over the internet. The implicit knowledge, however, resides in the heads of the community members themselves but can be shared with others through social interaction. Prior studies have found that social interactions help to create social interaction ties among members in a network, which are important predictors of collective action [8, 32, 33]. Such ties tend to develop between individuals with the same interest and similar resources rather than between individuals who are dissimilar [34]. Therefore, such ties facilitate knowledge sharing and help retain existing members. VCs that do not value such social capital are more likely to incur instances of voluntary turnover.

2.3. Technological factors in a professional virtual community

Technology has played an important role in knowledge sharing particularly with the advent of technologies such as the internet [35, p. 142]. Given the fact that the internet is embracing more and more social functions, such as electronic commerce, public government and various kinds of community interactions [36, p. 1], professional VCs may be formed on the internet and are expected to evolve to enable VC members to learn from, contribute to, and collectively build upon professionals' knowledge and improve many member tasks without the expense and trouble of relocating members [15]. With recent advances in computer-mediated communications, professional VCs are able to extend their reach using technologies such as websites and electronic bulletin boards [8].

Knowledge activities in a PVC are undertaken through its website. Many academics have addressed the importance of internet website quality in knowledge seeking behavior [37–39]. The website enables communication and interaction among members, breaks down geographical barriers and

makes knowledge available across the PVC. Therefore, a high-quality website may encourage existing members to return for more benefits. The success of a PVC lies in the accumulation and enrichment of knowledge in the repository. The information areas such as discussion forum, news letters, and recommended articles in a PVC's website constitute its knowledge/experience repository. DeLone and McLean [3, 40, 41] have indicated that the success of an information system can be determined by the use and satisfaction of prior use experience, which are both influenced by the system quality, information quality and service quality of the system. Given that a PVC's website is the channel where members interact with others, its performance will influence how effectively the website is used by members. That is, a PVC with a high-quality website is more likely to enhance members' revisit intention.

While service quality is an important attribute of IS quality generally, it is critical to the websites for electronic commerce. However, in a non-fee PVC which can be used by any interested individuals without paying a membership fee, no service is provided in addition to a well structured and maintained website. Thus, service quality in this case can be considered part of system quality. Moreover, the motivation for using a VC is knowledge sharing [8] and the use of a PVC focuses on knowledge-based communications. Therefore, the knowledge quality dimension substitutes for the information quality dimension in this study.

2.4. Continued participation in professional virtual communities

Seddon [42] indicated that ongoing use behavior is the dependent variable of IS success. Predicting consumers' repurchase intentions and ongoing use of information systems is at the core of the expectation-confirmation theory (ECT). The ECT holds that consumers' intention to repurchase a product or continue service use is determined primarily by their satisfaction with prior use of that product or service [43, 44], and satisfaction is determined by consumers' pre-consumption expectation and post-consumption confirmation. McKinney et al. [45] defined customers' expectation as their 'pretrial beliefs' about a product (a website in the study), and as a precursor in predicting a variety of phenomena involved in buying behaviors and subsequent perceptions. Confirmation is consumers' subjective judgments resulting from comparing their expectations and their perceptions of performance received.

Having roots in social psychology and organizational behavior, expectancy disconfirmation is actually two processes consisting of the formation of the expectations and the disconfirmation of those expectations through performance comparisons [46]. Drawing upon cognitive dissonance theory and Oliver's [47] original conceptualization of expectancy disconfirmation theory (EDT), Bhattacherjee and Premkumar [13] further suggested that user beliefs and attitudes may change with time as users gain first-hand experience with IT usage; the impact of disconfirmation and satisfaction on later intention of subsequent IT usage is mediated by later belief and attitude. Therefore, the ECT can be viewed as a two-stage model where later-stage belief and attitude is caused by initial-stage expectation and attitude, and disconfirmation and satisfaction realized at a later stage. ECT is used as the underlying guideline of this longitudinal study.

Some VCs attract a large number of members at an early stage, but suffer from turnover at a later stage. In a professional virtual community, getting people to sign in through the website is merely the first step toward realizing PVC success; its eventual success will further depend on members' continuing participation via its website. When people join the PVC, they expect the PVC to provide a high quality system, and that social interaction ties will accrue from their participation. If these expectations are not met after a period of participation and they no longer bear any expectations of future benefits from staying in the VC, they will eventually cease to participate. Therefore, the contextual factor and technological factors are important in the two stages of member participation.

3. Research model and hypotheses

Figure 1 illustrates the research model of PVC members' continuance intentions. This model posits that PVC members' continuance intentions are determined by two variables at the post-usage stage:

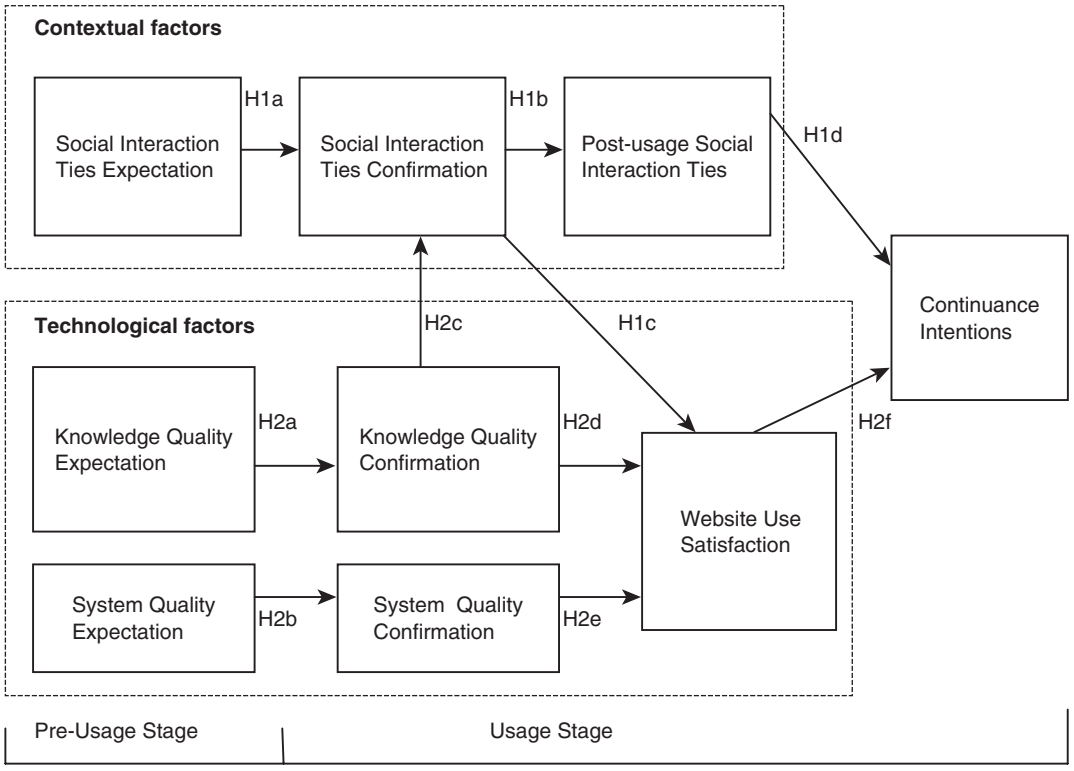

Fig. 1. Professional virtual community continuance model.

satisfaction with website use and modified expectation of social interaction ties. Members' satisfaction with website use is determined by confirmation of social interaction ties, system quality expectation and knowledge quality expectation, which in turn, are determined by the corresponding expectations. Social interaction ties confirmation can also be influenced by the knowledge quality confirmation. The modified expectation of social interaction ties at the post-usage stage is derived from the confirmation of pre-usage expectation, which in turn is influenced by members' initial expectations. The following sections elaborate on the posited relationships.

3.1. Contextual factors and continuance intentions

In prior studies of resource exchange, value creation and knowledge management [8–10, 12, 28, 29, 48], social interaction ties have been considered an important attribute of social capital under various research contexts. In examining the effects of social capital in key customer relationships on knowledge acquisition, Yli-Renko et al. [30] found that a member that is central in a network of social interactions likely has greater potential to exchange resources with others because of his locational advantages in the network. Tsai and Ghoshal's [12] empirical study demonstrated that the interpersonal social interaction tie has a positive effect on the resource exchange. Haythornthwaite [23] found that centrally located learners may be the ones most likely to feel part of the network; centrality in a network may correlate with performance or satisfaction measures.

Social interactions among PVC members allow a cost-effective way of accessing a wider range of knowledge sources. The ties created through such interactions permit PVC members to develop a common understanding as to how their respective knowledge might be blended and leveraged in order to fulfill their goals. After a period of participation, a member may confirm/disconfirm prior expectation of his centrality in the network, and form post-usage expectations on how centrally he can be embedded in the network of a PVC if he continues to participate. Also, such confirmation/disconfirmation

will enhance/diminish his satisfaction with prior use of the PVC's website. The positive post-usage expectation enhances his intention to continue and the negative post-usage expectation will discourage his continuance intentions. Therefore, the following hypotheses are proposed:

H1a: Members' pre-usage expectation of social interaction ties positively affects later social interaction ties confirmation.

H1b: Members' social interaction ties confirmation positively affects their post-usage social interaction ties.

H1c: Members' social interaction ties confirmation positively affects their satisfaction with website use.

H1d: Members' post-usage social interaction ties positively affect their continuance intentions.

3.2. Technological factors and continuance intentions

According to ECT, users' IS continuance intentions are determined primarily by their satisfaction with prior IS use [49]. Satisfaction, in turn, is influenced by confirmation of expectation, which is determined by initial expectation. In their original and reformulated models of IS success, DeLone and McLean [3, 40, 41] suggested that there are positive relationships between satisfaction, system quality (SQ), and information quality (IQ). Therefore, by combining the two theoretical views, satisfaction can be predicted by users' confirmation of initial expectation in terms of SQ and IQ, which will be influenced by the initial expectation.

The relationships between continuance intentions, satisfaction, SQ and IQ have been repeatedly validated in the literatures of IS success and ECT. DeLone and McLean [41] adapted the D&M-2003 model to measure the success of e-commerce systems. They found that this model can be applied to the e-commerce environment. Specifically, the information quality and system quality of e-commerce systems have impacts on user satisfaction, which influences use (number of interactions or site visits).

The expectation–confirmation relationship was validated by Bhattacherjee [49] in the context of continued usage of an online banking system, by Bhattacherjee and Premkumar [13] in the two-stage model of computer-based training software usage and rapid application development tool usage, and by Choi and Park [50] in their study on determinants of repurchase intentions in mobile internet services. Based on the expectation-confirmation paradigm, McKinney et al. [45] declared that website customer satisfaction is determined by the confirmation of prior expectations of SQ and IQ.

Interaction in a virtual community is based on collaborative tools such as web-enabled tools [51]. Prior studies found that people choose other people as their preferred source of knowledge, and that personal contact is important in knowledge seeking behavior [34]. The quality of knowledge a member can acquire will influence the extent to which he/she consequently contacts others. In other words, higher evaluation of knowledge quality will be associated with higher evaluation of social interaction ties. Therefore, the following hypotheses are proposed:

H2a: Members' pre-usage expectation of knowledge quality positively affects later knowledge quality confirmation.

H2b: Members' pre-usage expectation of system quality positively affects later system quality confirmation.

H2c: Members' knowledge quality confirmation positively affects social interaction ties confirmation.

H2d: Members' knowledge quality confirmation positively affects their satisfaction with website use.

H2e: Members' system quality confirmation positively affects their satisfaction with website use.

Coughlan et al. [52] asserted that satisfaction is an attitude construct that affects a customer's behavioral intentions. It can be viewed as the key to building and retaining a loyal base of long-term website

users. Website users can be motivated when their needs are satisfied (e.g. knowledge acquisition), or when their satisfaction lies in the content of the activity (website use) itself. After the initial use of the website, if its quality does not meet users' expectations, that system will not satisfy users and will eventually be deserted by them. On the other hand, an easy-to-use, responsive, and reliable website will enhance the process and outcomes of users' website usage, thus enhance user satisfaction, and encourage users to stay with the VC. Therefore, the following hypothesis is proposed:

H2f: Members' satisfaction with website use positively affects their continuance intentions.

4. Research methodology

4.1. Sample and procedures

The two-phase data was collected from members of a professional VC in Taiwan. Founded in March 2002, this VC had over 57,000 members by the end of October 2005. The objective of Delphi K.Top is to provide an environment in which people who are proficient or interested in Delphi/Borland C++ programming skills can exchange their knowledge or call for help. All members have access to the resources such as discussion forum, newsletters, and recommended articles as their membership benefits and participation in the network is voluntary. This VC is supported by a web-based system where member interactions are visible to everyone and related messages are structured into discussion threads. Participants include IT experts globally dispersed in over 20 countries. This VC provides demographic information about its members and each member's posting history.

The first phase survey questionnaire was posted onto the discussion forum at the beginning of March 2005. Given that the access log was not provided, this study uses message postings as access evidence to distinguish between experienced and inexperienced members in this VC. The target subjects were those enrolled after 1 January who had posted fewer than three messages by the end of February. In other words, the members that were invited to participate in this survey were those considered relatively inexperienced. A total of 582 valid responses were collected and serve as pre-usage input. The second phase survey started from the beginning of May 2005. The target subjects were the members who had participated in the first survey. By the end of August, 492 valid responses were obtained. Responses from the two surveys were then matched to create a single record for each respondent. In all, 360 responses were used for the data analysis in this study. Thirty of these subjects were then randomly selected to receive a sixty-dollar reward for supporting the surveys. Table 1 presents the demographics of the final sample.

Although most of the measurement items were adapted from prior research, some of them were developed in this study based on the definitions provided in the literature. The instrument was therefore examined to ensure content validity and reliability within the target context. A pre-test of the questionnaire was performed using five experts in the IS area to assess logical consistencies, ease of understanding, question item sequence adequacy, and context fit. The comments collected from these experts led to several minor modifications of the wording and the question item sequence. Furthermore, an online pilot study was conducted involving another two PhD students, three MIS students and three members who had been webmasters of this VC. Comments and suggestions on question item content and structure were solicited. Modifications were made until there was no problem pointed out by these experts.

4.2. Construct measurement

Most of the scales were drawn from pre-validated measures in IS or KM literature. Specifically, PVC continuance intentions were measured by the items adapted from Bhattacherjee [13, 49]. Items for measuring social interaction ties (expectation, confirmation, post-usage) were adapted from prior related research [10, 12, 28–30]. Website use satisfaction was measured by the items adapted from Bhattacherjee [49], Bhattacherjee and Premkumar [13], and McKinney et al. [45]. System quality (expectation, confirmation) and knowledge quality (expectation, confirmation) were measured by

Table 1
Demographic profile (total subjects = 360)

Measure	Items	Number	Population
Work experience	Less than one year	32.4%	NA
	1–2 years	15.8%	NA
	3–5 years	23.3%	NA
	6–10 years	14.4%	NA
	Over 10 years	14.1%	NA
Age	20 years old or below	5.8%	6.7%
	21–29 years old	54.0%	54.5%
	30–39 years old	29.9%	31.9%
	40–49 years old	8.6%	5.8%
	50 years old or above	1.7%	1.1%
Education	High school or below	8.9%	NA
	College or University	62.3%	NA
	Graduate school or above	28.8%	NA
Gender	Female	20.8%	13.6%
	Male	79.2%	86.4%
Location	China	11.1%	26.2%
	Hong Kong	3.0%	3.6%
	Macao	0.6%	0.5%
	Malaysia	0.3%	NA
	Taiwan	84.2%	65.6%
	Others	0.8%	4.1%

the items adapted from Clay et al. [53], DeLone and McLean [3, 40, 41], and McKinney et al. [45]. For the aforementioned measures, a five-point Likert type was used, with anchors ranging from strongly disagree (1) to strongly agree (5). Appendix A and B present the questionnaire items measuring constructs in the research model.

5. Data analysis

5.1. Measurement model testing

Construct validity for the 9 measurement scales with a LISREL confirmatory factor analysis (CFA) was assessed. The measurement model in the CFA was revised by dropping items, one at a time, which shared a high degree of residual variance with other items, according to the standard LISREL methodology [54]. Items were dropped depending on reported standardized residuals, that is, those showing a significant degree of shared non-specified variance among the measurement items. Composite reliability was then examined using Cronbach's alpha values. All of these values were greater than 0.77, well above the recommended threshold value of 0.6.

Additionally, convergent validity of the resulting scales was verified by using three criteria suggested by Fornell and Larcker [55]:

(1) all indicator loadings (λ) should be significant and exceed 0.7,

(2) construct reliabilities should exceed 0.8, and

(3) average variance extracted (AVE) by each construct should exceed the variance due to measurement error for that construct (i.e. AVE should exceed 0.50).

For the current CFA model, four λ were between 0.55 and 0.59, 10 λ were between 0.60 and 0.69. The other 19 λ were above the 0.70 benchmark. Composite reliabilities of constructs ranged between 0.77 and 0.86. The square root of AVEs ranged from 0.73 to 0.96.

Finally, discriminant validity of the resulting scales was assessed using the guideline suggested by Fornell and Larcker [55]: the AVE for each construct should exceed the squared correlation between

that and any other construct. The factor correlation matrix indicates that the test of discriminant validity was also met. Table 2 shows the paired correlations and the square roots of the AVEs.

5.2. Structural model testing

For models with good fit, it is suggested that chi-square normalized by degrees of freedom (χ^2/df) should not exceed 5 [56], GFI, NFI, NNFI and CFI should exceed 0.9, and SRMSR should be less than 0.1. For the current CFA model, χ^2/df was 3.83 ($\chi^2 = 80.54$; df = 21), NFI was 0.93, NNFI was 0.91, CFI was 0.95, GFI was 0.95, AGFI was 0.90 and SRMSR was 0.07 (see Table 3). These figures signify an adequate model fit.

The path significance of each hypothesized association in the research model and variance explained (R^2 value) by each path were examined. All the paths were significant except the path points from system quality confirmation to satisfaction. Intention to continue participation (INT) was predicted by post-usage social interaction ties and satisfaction, which jointly explained 46% of the intention variance. Post-usage social interaction ties (PSI) were predicted by social interaction ties confirmation, which explained 37% of the PSI variance. Social interaction ties confirmation (SIC) was predicted by social interaction ties expectation and knowledge quality confirmation, which jointly explained 36% of the SIC variance. Satisfaction was predicted by knowledge quality confirmation, system quality confirmation, and social interaction ties confirmation, which jointly explained 40% of the satisfaction variance. Knowledge quality confirmation (KQC) was predicted by knowledge quality expectation, which explained 1.5% of the KQC variance. System quality confirmation (SQC) was predicted by system quality expectation, which explained 2.3% of the SQC

Table 2
The paired correlations and the square roots of average variance extracted

Construct	SIE	KQE	SQE	SIC	PSI	KQC	SQC	SAT	INT
SIE	0.75								
KQE	0.567**	0.86							
SQE	0.456**	0.403**	0.90						
SIC	0.158**	0.087	0.205**	0.77					
PSI	0.213**	0.141**	0.204**	0.655**	0.73				
KQC	0.102	0.099	0.150**	0.594**	0.515**	0.89			
SQC	0.078	0.003	0.193**	0.459**	0.431**	0.441**	0.96		
SAT	0.164**	0.108*	0.144**	0.588**	0.529**	0.550**	0.382**	0.89	
INT	0.254**	0.142**	0.146**	0.498**	0.504**	0.494**	0.300**	0.668**	0.87

SIE: social interaction expectation; KQE: knowledge quality expectation; SQE: system quality expectation; SIC: social interaction confirmation; PSI: post-usage social interaction expectation; KQC: knowledge quality confirmation; SQC: system quality confirmation; SAT: satisfaction; INT: continuance intention.
**Correlation is significant at the 0.01 level (two-tailed).
*Correlation is significant at the 0.05 level (two-tailed).

Table 3
Goodness of fit statistics

Construct	Guideline	Fit indices
χ^2/df	≤5.0	3.83
NFI	≥0.90	0.93
NNFI	≥0.90	0.91
CFI	≥0.90	0.95
GFI	≥0.90	0.95
AGFI	≥0.90	0.90
SRMSR	≤0.10	0.07

variance. Figure 2 illustrates the SEM result of the research model. In sum, hypothesis H2e was not supported whereas the other hypotheses were all supported.

6. Discussion and conclusion

6.1. Key findings

The goal of the present study was to develop a multi-perspective theoretical model to offer an explanation of factors influencing members' continuance intention in professional VCs. The findings from this study corroborate the importance of the contextual factor and technological factors in this regard. The results of this study support the ECT's contention that the pre-usage expectation positively influences post-usage confirmation. Specifically, the expectations of social interaction ties, knowledge quality and system quality have positive impacts on their corresponding confirmation.

Consistent with the ECT concept, social interaction ties confirmation has a very strong influence on the post-usage social interaction ties and satisfaction which, in turn, positively affect members' continuance intentions. Social interaction ties confirmation is shown to have a strong positive association with knowledge quality confirmation. Moreover, the relationship between knowledge quality confirmation, satisfaction and continuance intentions basically support previous findings by Bhattacherjee [49, 57], Bhattacherjee and Premkumar [13], Choi and Park [50], Coughlan et al. [52], DeLone and McLean [3, 40, 41], and McKinney et al. [45]. Yet the non-significant relationship between system quality confirmation and website use satisfaction does not prove previous conjecture. This finding leads to a review of the three parts of the sample data: system quality confirmation, satisfaction and participants' comments about this VC. No subjects complained about knowledge quality. Yet, some subjects complained about system performance such as a poor response rate in the daytime. The author reviewed the scores given by these complainants and found that they were satisfied with their overall website use experience, but gave very low scores for the items measuring system quality confirmation. This may explain why system quality confirmation barely has the power to impact satisfaction in this case. Finally, comparing with post-usage social interaction ties, consistent with the findings by prior ECT studies [13, 49, 57], satisfaction is the stronger predictor of continuance intentions.

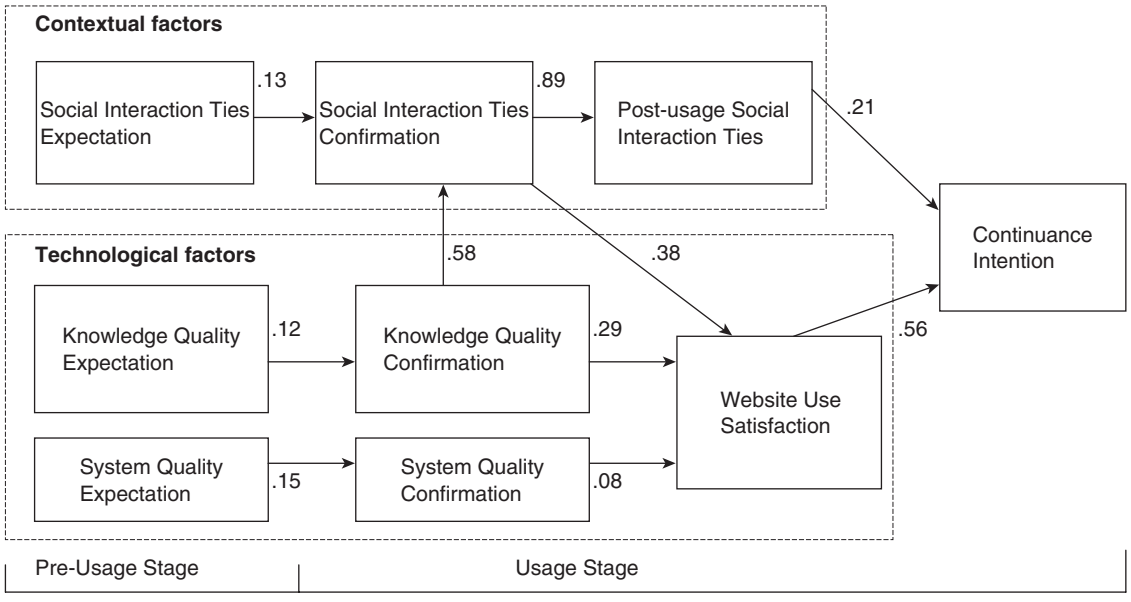

Fig. 2. Results of SEM analysis.

6.2. *Implications*

The findings of the study have various implications for research as well as for practice. For research, the results of this study show that post-usage social interaction ties are an important variable for continuing PVC participation. This is consistent with Wasko and Faraj's [8] and Kankanhalli et al.'s [9] findings that social capital plays an important role underlying online knowledge exchange. The theory of planned behavior contends that intention is the emergent factor of actual behavior. Thus, further research is suggested to examine the role of trust and identification in PVC members' continuance intentions. Also, an extension of the current model is encouraged to investigate whether PVC members' continuance intentions can lead to actual future action of continued participation.

The non-significant relationship between system quality confirmation and satisfaction is inconsistent with prior ECT-based studies. Given the technical-oriented characteristic and member usage pattern of the targeted VC, whether this finding can be generalized to other types of professional virtual communities is unclear. Future research is encouraged to validate this result in PVCs that have different usage patterns.

For practice, the findings of this study imply that social interaction ties significantly impact members' intention to continue their participation. However, this contextual factor by itself is not sufficient to encourage continuing member participation. It can only contribute to some extent to continuance intentions. The technological factors, however, dominate a member's decision to stay with the PVC. Therefore, managers of virtual communities of practice need to expend effort on the maintenance of website quality (i.e. system quality and knowledge quality) to satisfy VC participants.

Moreover, relationship building in a VC is a long-term commitment that requires mutual willingness. The development of social interaction ties leading to continuance intentions is an ongoing phenomenon. Managers of virtual communities of practice need to create an environment for positive and active knowledge-based communications. This can be done by having a mechanism in place for blocking or punishing deceptive communications.

6.3. *Limitations of the study*

Although this research presents strong evidence regarding the impacts of the contextual factor and technological factors on PVC members' continuance intentions, this study suffers from several limitations. First, the sample in this study comprised the members of one specific type of professional virtual community. Hence, whether or not the key findings can be generalized to all types of professional virtual community is unclear. What motivates individuals to participate in virtual communities of practice may be different for intra-organizational and inter-organizational virtual communities of practice. Further verification is suggested to check the generalizability of the findings.

Secondly, the sample in this study is composed of active participants in the PVC. There is no opportunity to collect opinions from individuals who have ceased to participate in virtual communities. These people may have different opinions about the associations between the expectations, confirmations and post-usage perceptions. Moreover, the factors that drove them away from PVC participation may be valuable information for the managers of virtual communities of practice.

6.4. *Conclusion*

Sustaining virtual communities of practice continues to be a challenge for managers. A virtual community of practice that wishes to achieve sustained success will aim to retain its existing members by continually expending effort on the maintenance of the website functions and knowledge resource to facilitate knowledge sharing. This study brings an important contribution to the VC literature by providing a comprehensive, empirically grounded picture of the antecedents of PVC members' continuance intentions.

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Appendix A: stage one questionnaire

Construct	Measure	Mean	Std Dev.	Loading
Social interaction ties expectation Cronbach's alpha = 0.79				
SIE1	I expect that I will maintain close social relationships with some members in the Delphi K.Top virtual community.	4.29	0.74	0.55
SIE2	I expect that I will intensively exchange ideas with some members in the Delphi K.Top virtual community.	4.35	0.66	0.68
SIE3	I expect that I will know some members in the Delphi K.Top virtual community on a personal level.	4.22	0.68	0.59
SIE4	I expect that I will have frequent communication with some members in the Delphi K.Top virtual community.	4.45	0.63	0.74
SIE5	I expect that I will spend a lot of time interacting with some members in the Delphi K.Top virtual community.	4.51	0.63	0.70
Knowledge quality expectation Cronbach's alpha = 0.79				
KQE1	I expect that the knowledge shared by members in the Delphi K.Top virtual community is relevant to the topics.	4.46	0.65	0.72
KQE2	I expect that the knowledge shared by members in the Delphi K.Top virtual community is helpful for problem solving at work.	4.43	0.66	0.85
KQE3	I expect that the knowledge shared by members in the Delphi K.Top virtual community is reliable.	4.41	0.64	0.68
System quality expectation Cronbach's alpha = 0.77				
SQE1	I expect that the website of the Delphi K.Top virtual community provides good access.	4.16	0.79	0.71
SQE2	I expect that the website of the Delphi K.Top virtual community is responsive to members' requests.	4.28	0.75	0.87

Appendix B: stage two questionnaire

Construct	Measure	Mean	Std Dev.	Loading
Social interaction ties confirmation Cronbach's alpha = 0.81 Compared to my prior expectation, …				
SIC1	My maintaining close social relationships with some members in the Delphi K.Top virtual community was	4.06	0.83	0.57
SIC2	My idea exchange with some members in the Delphi K.Top virtual community was	4.09	0.82	0.68
SIC3	The number of members in the Delphi K.Top virtual community I knew on a personal level was	3.99	0.76	0.69
SIC4	The frequency of my communication with some members in the Delphi K.Top virtual community was	4.20	0.70	0.70
SIC5	The time I spent in interacting with some members in the Delphi K.Top virtual community was	4.23	0.70	0.69
Knowledge quality confirmation Cronbach's alpha = 0.82 Compared to my prior expectation that …				
KQC1	The knowledge shared by members in the Delphi K.Top virtual community relevant to the topics was	4.05	0.76	0.83
KQC2	The knowledge shared by members in the Delphi K.Top virtual community helpful for problem solving at work was	3.98	0.84	0.82
KQC3	The knowledge shared by members in the Delphi K.Top virtual community was reliable	4.08	0.74	0.69
System quality confirmation Cronbach's alpha = 0.86 Compared to my prior expectation, …				
SQC1	The website's performance in providing good access was	3.81	0.87	0.91
SQC2	The website's performance in being responsive to my requests was	3.91	0.87	0.84
Post-usage social interaction ties Cronbach's alpha = 0.78				
PSI1	I will maintain close social relationships with some members in the Delphi K.Top virtual community.	4.15	0.69	0.60
PSI2	I will intensively exchange ideas with some members in the Delphi K. Top virtual community.	4.23	0.64	0.70
PSI3	I will know some members in the Delphi K.Top virtual community on a personal level.	4.16	0.68	0.65
PSI4	I will have frequent communication with some members in the Delphi K.Top virtual community.	4.363	0.60	0.66
PSI5	I will spend a lot of time interacting with some members in the Delphi K.Top virtual community.	4.41	0.60	0.55

(continued)

Satisfaction Cronbach's alpha = 0.86 I feel … with my use of Delphi K.Top's website.				
SAT1	Very displeased vs Very pleased.	4.24	0.68	0.75
SAT2	Very frustrated vs Very contented.	4.35	0.64	0.77
SAT3	Very terrible vs Very delighted.	4.25	0.63	0.79
SAT4	Very dissatisfied vs Very satisfied.	4.16	0.73	0.81
Continuance intentions Cronbach's alpha = 0.84				
CI1	I intend to continue participating in the Delphi K.Top virtual community.	4.51	0.59	0.80
CI2	I plan to continue using the Delphi K.Top virtual community to learn about new knowledge.	4.35	0.61	0.67
CI3	I will continue using the Delphi K.Top virtual community to exchange knowledge with other members.	4.44	0.62	0.74
CI4	I will continue using the Delphi K.Top virtual community to seek problem solutions at work even if there are other alternatives.	4.43	0.62	0.81