Understanding Participant Loyalty Intentions in Virtual Communities

[1]ECHO HUANG [2]MENG-HSIANG HSU
[1 2]Department of Information Management
National Kaohsiung First University of Science and Technology
2 Juoyue Rd., Nantz District, Kaohsiung 811
Taiwan, R.O.C.
echoh@ccms.nkfust.edu.tw mhhsu@ccms.nkfust.edu.tw

[3]YU-REN YEN
[3] College of Management
National Kaohsiung First University of Science and Technology
[3]Department of Management Information Systems
Far East University
49 Chung Hua Rd., Hsin-Shih, Tainan Country 744
Taiwan, R.O.C.
champ.mis@msa.hinet.net
http://cc.feu.edu.tw/~abelyen

Abstract: - This study proposes a conceptual model based on expectation confirmation theory with extended antecedent variables (human assets, technical assets, and complementary assets) to examine the impact of virtual communities' assets on member satisfaction and perception of usefulness. The members of JavaWorld@TW, a representative professional community in Taiwan, were chosen to participate in the survey, and 235 usable responses were collected in three months. Partial Least Square(PLS) regression were used to test the model, the findings show that satisfaction is the strongest predictor of revisiting, following perceived usefulness. Furthermore, higher confirmation of human assets, technical assets, and complementary assets are accompanied with higher positive satisfaction and perceived usefulness which influence the intention to revisit. We also advanced to explore the difference within groups, weak-tie members and strong-tie members were separated for further examination. The difference in the behavioral models of weak-tie and strong-tie, particularly in the revisit context, shed light on the importance of development related theories that can be applied to shape the post-use behavior of specific groups. Implications are proposed in the final section.

Key-Words: - Resource-Based Theory, Expectation Confirmation Theory, Revisit, Virtual Communities, human assets, technical assets, complementary assets

1 Introduction

Virtual communities (VCs) are a kind of online social networks in which people with common interests, goals, or practices interact to share information and knowledge, and engage in social interactions [15][57]. It offers several ways for members to interact, collaborate, and trade [9]. Rheingold [52] argued that a community site should be an interesting place to visit, a kind of virtual community center. It should be a place where discussions may range over many controversial topics [52]. It is centered upon the communications and interactions of participants to generate specific domain knowledge that enables the participants to perform common functions and to learn from, contribute to, and collectively build upon that knowledge [39].

Virtual communities (VCs) have increased in population, category, and size in the past decades. Accompanying the growth of information and communication technologies, increasingly knowledge workers are choosing to join VCs for seeking useful information to resolve problems at work [34]. This trend explains why several professional high-tech VCs with over 50,000 members are still rapidly growing in Taiwan, such as *Delphi K.Top community, Javaworld@TW community, Blue Shop community, Flash2u community.*

A large number of new virtual communities are not well-accepted by individuals. Thus, it is important to find out the expectations of individuals towards visiting and revisiting behaviors. In recent years both technological advances and online stimulation have together created higher user

expectations. Therefore, it is no surprise that managing user expectations have become difficult yet more essential than ever. User expectations are potentially an important factor affecting the perceived beliefs arising from the use of new products/services [25]. How are user needs reflected in today's community site environment? An understanding of user perceptions of virtual communities contributes to a healthy development of the knowledge sharing field. Developing effective strategies can potentially enhance the success of VCs.

Each environment determines the nature, scope, and tolerance for the knowledge at the core of its processes. Every organization needs to begin analyzing their knowledge. In VC case, each community needs to begin identifying their knowledge assets. As a strategic asset, it is the key to competitive viability and growth of the learning community. According to the longitudinal researches [27] done in the past years, we recognized the phenomenon that individuals choose to join VCs with different purposes, motivation, and stay with different tenure. Therefore, it is necessary to further explore the underlying motivations of participants toward retaining in a virtual community. Therefore, the proposition is that by combining the asset-based and expectation approaches, the strong theory linking beliefs to behavior can be exploited in past studies, with the expectation literature being used to help identify the antecedents that affect satisfaction.

The remainder of this article is organized as follows: First, we review competing literatures which are widely used to predict user continuance. Second, the research model is proposed and the corresponding hypotheses are listed. Third, the research methodology is discussed, and the fitness of the proposed model is then assessed using Partial Least Square (PLS) regression, following the finding and discussion. Finally, implications of the study to both researchers and practitioners are discussed.

2 Literature review

Today's user perception of information systems is a more critical issue than before, specifically in the context of Internet applications [14]. Some well-known technology acceptance theories, such as technology acceptance model (TAM), the theory of planned behavior (TPB), the reasoned action (TRA), diffusion of organizational innovation (DOI) have been used to examine variables that motivate users to accept and revisit the web.

Three major streams of research have addressed online user continuance. The first stream focuses mainly on the antecedents of satisfaction, and has yielded many extension models of user continuance. The studies of Choudhury and Sampler [16], Shin [56], Geng et al. [25], Gu and Konana [27] derived important economic factors from transaction costs, agency and game theories to explain why individuals are willing to share knowledge.

The second stream of research concentrates on system enhancement and its impacts on outcomes such as participants' performance [21][23][35][40][43], and relies mainly on a system approach [20].

The third stream of research highlights the culture issue and its impacts on user behaviors. Wasko and Faraj [58], Bock et al., [12], Kankanhalli et al. [36] and Chiu et al. [15] have highlighted various social drivers, such as organization climate, extrinsic and intrinsic motivations, affect individual's willingness to share privately owned knowledge, which have been mainly applied to a variance approach. Table 1 summarizes the different theories adopted in this study to explain participants' willingness to continue sharing knowledge in a particular virtual community. Different approaches attempt to reveal knowledge sharing mysteries, resulting ambiguity and inconsistency which need to be further discussed and examined.

The first stream of research provided significant insights into various aspects of user continuance of new technologies, information systems, and innovation. However, current research is fragmented, and has evolved over the years without a clear direction. The Continuance model is criticized for having a low explanatory power. Some empirical studies have recommended integrating the continuance model with other theories to improve its predictive power [21][31][33]. Attempts to extend continuance model have generally taken one of three approaches: introducing factors from related models; introducing additional or alternative belief factors, and examining antecedents and moderators of perceived usefulness and satisfaction [65]. A framework that integrates different continuance theories, and allows studying the antecedents, beliefs, intention and behaviors of user continuance together to explain virtual communities contexts, should be the purpose of current research. Therefore, this paper proposes a model that integrates the Continuance model and RBV to explore and explain participants' willingness to continue share knowledge in VCs.

3. The research model and related theories

3.1 Revisit Intention

As shown in Fig. 1, this study extends expectation confirmation theory (ECT) and IS Continuance Model, as shown in Fig. 1 and Fig. 2 with asset constructs derived from resource-based theory (RBT) to explain members' intention to revisit VCs. Fig. 3 depicts the research model. Note that the model deviated in two major ways from standard ECT formulation in recognizing that knowledge sharing continuance: satisfaction and perceived usefulness are posited to directly influence revisit. The related theories are detailed in the next sections.

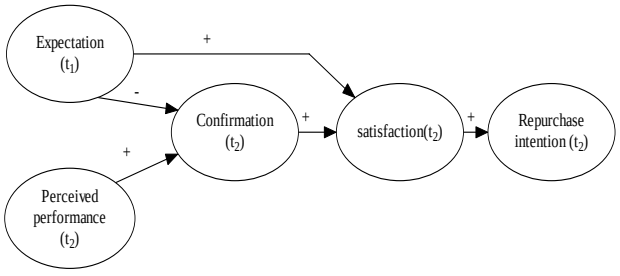

Fig. 1 Expectation Confirmation Model
(Source: Oliver, [45])

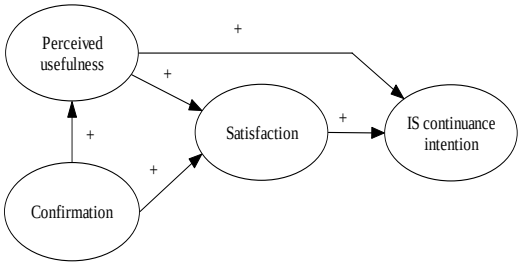

Fig. 2 IS Continuance Model
(Source: Bhattacherjee, [7])

Why individual continues to transfer their expertise to someone they don't know? One possible reason is that sharing behavior is the only way to maximize her or his utility [11] and minimize the costs to gain needed knowledge in VCs [35]. More and more individuals participate in VCs, for seeking helpful and useful knowledge to resolve problems at work. They can be motivated when their needs (e.g. knowledge acquisition) are satisfied, or when their satisfaction lies in the content of the activity (website use) itself.

IS continuance model was adapted from Expectation confirmation theory (ECT) by Bhattacherjee [8]. This model posits 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, and satisfaction is determined by consumers' pre-consumption expectation and post-consumption confirmation. Prior continuance studies indicate that satisfaction is an ex post evaluation of consumers' initial experience with the web service, trigger B2C continuance [8][19][32][64]. De Valck et. al.[21] confirmed satisfaction with virtual communities of interest effects members' visit frequency. Therefore, intention to revisit a VC is posited to directly influence satisfaction and perceived usefulness [35]. This leads to the following hypotheses:

H_1: Satisfaction positively affects revisit intention.

H2: Perceived usefulness positively affects revisit intention.

H_3: Perceived usefulness of a VC's assets positively affects satisfaction

3.2 Resource-Based Theory and Strategic assets in VCs

Resource based theory (RBT) proposed by Barney [5], as shown in Fig. 4, has received attention from many researchers; it originated in the management and industrial organization literatures and stated firms deploy their resources in an effort to gain a sustainable competitive advantage over their competitors [5][62]. This model begins with the assumption that firm resources are heterogeneous and immobile.

To have this potential, a firm resource must have four attributes: First, the resource must be valuable in the situation it is to be used. Firm resources can only be a source of competitive advantage or sustained competitive advantage when they are valuable [5][9]. Valuable resources can take a variety of forms, including some overlooked by the narrower conceptions of core competence and capabilities. They can be physical like factories facilities or intangible, such as brand names or technological know-how; the valuable resource may also be an organizational capability embedded in a company's routines, processes, and culture [18].

Table 1 Knowledge Sharing Literature

Authors	Theory	Constructs	Research Method	Findings
Bock et al.	Theory of	Anticipated extrinsic rewards	Survey	ATK→ISK,

[12]	Reasoned Action (TRA), Motivation, Social-Psychology, Sociology	(AER), Anticipated reciprocal relationships (ARR), Sense of self-worth (SSW), Affiliation(AFF),Innovativeness (INN), Fairness(FAI), Attitude toward knowledge sharing(ATK), Subjective norm(SN), Organizational climate(OC). Intention to Share Knowledge(ISK)	(Organization)	ARR→ATK, SSW→SN, SN→ISK, SN→ATK, OC→SN, OC→ISK
Bock and Kim [11]	Economic Exchange Theory, Social Exchange Theory, Social Cognitive Theory, Theory of Reasoned Action	Expected Rewards (ER), Expected Associations(EA), Expected Contribution(EC), Level of IT Usage (U), Attitude toward Knowledge Sharing (A), Behavioural intention to share knowledge (I), Knowledge Sharing Behavior (B)	Survey (Large public organization)	ER→A, EA→A, EC→A, I→B, I→A
Chiu et al. [15]	Social Capital Theory, Social Cognitive Theory	Personal Outcome Expectations (PE), Community-Related Outcome Expectation (CE), Social Interaction Ties (ST), Trust (T), Norm of Reciprocity (NR), Identification (I), Shared Language (SL), Shared Vision (SV), Quantity of Knowledge Sharing KSQ, Knowledge Quality (KQ)	Survey (Virtual Community)	ST→KSQ, T→KQ, NR→KQS, I→KSQ, SL→KQ, SV→KQS, SV→KQ, CE→KQS, CE→KQ
Osterloh and Frey [48]	Motivation, Crowded effects, Cognitive Evaluation Theory, Psychological Contracts, Resource-Based View	Tacit Knowledge, Explicit Knowledge, Intrinsic Motivation, Extrinsic Motivation	Meta-Analysis	Different kinds of motivation (intrinsic and extrinsic) are vital for generating and transferring two forms of knowledge (tacit and explicit).
Ruppel and Harrington [54]	Organization Culture	Developmental (D), Rational (R), Hierarchical (H), Group (G), Ethical (E), KM via Intranets (I)	Survey (Organization)	H →I, E →I
Ryu et al. [55]	Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB)	Attitude (AT), Subjective Norm (SN), Perceived Behavior Control (PBC), Intention to Knowledge Sharing (IN)	Survey (Organization)	AT→IN, SN→IN, PBC→IN, SN→AT

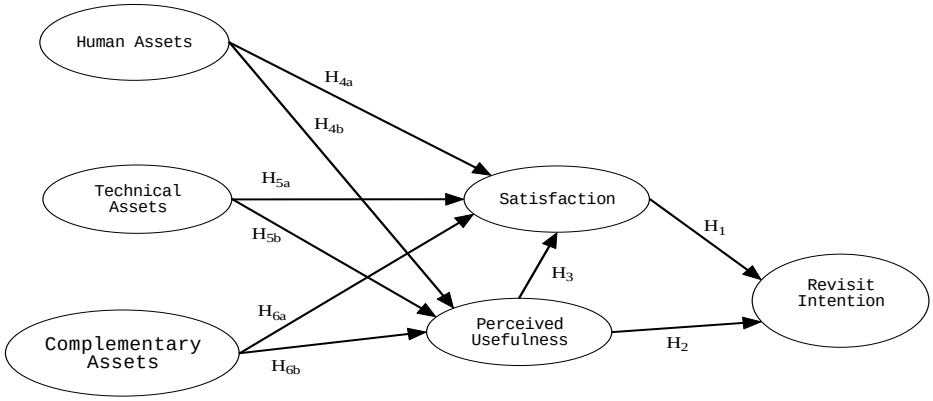

Fig. 3 The research model

Table 2 RBV and Knowledge Management

Author(s)	Context	Constructs	Finding
Bloodgood and Salisbury [10]	Knowledge Management	IT, strategic change and knowledge management strategies	Argued that codification using IT is appropriate for use with explicit knowledge more then tacit knowledge.
Coff [17]	Knowledge Management (Knowledge Intensity, Knowledge-Based Theory, Transaction Cost Economics, Agency	Lockup Agreements [LA], Bidding War [BW], Management Buyouts [MB], Target R&D Intensity [TRI], Control Variable [CV]	Agreements suggest that target managers actively thwart bidding wars. That is, R&D-intensive targets are more likely to grant favored bidders lockup agreements, putting potential rivals at a disadvantage.
Halawi, Aronson and McCarthy [29]	Knowledge management Systems, Resource based view	Knowledge Management Infrastructure[KMI], Knowledge Quality[KQ],Knowledge Properties[KP], Sustainable Competitive Advantage[SCA]	KMI->KP, KQ->KP, KP->SCA
Heiman and Nickerson [30]	Knowledge Management (Knowledge-based View、Transaction Cost Economics)	Knowledge Transfer Attributes [KTA], Knowledge Management Practices [KMP], Governance [P]	KTA->KMP, KMP->G, KTA->G
Shin [56]	Knowledge Sharing (Resource-Based View , Transaction Cost Theory , Agency Theory)	Instrumental Knowledge [IK], Motivating Individuals to Share Knowledge [MISK], Social Knowledge [SK], Facilitating Knowledge Flow between Individuals [FKI], Minimizing Risks form the Leakage of Knowledge [MRK], Codified Knowledge [CK]	IK->MISK-> SK, FKI->SK, SK->MRK->CK, CK->IK

Second, the resource must be rare. Resources that are held by one or only a few firms enable those firms to do things their competitors cannot. This enables the firm or firms to gain an advantage over their competitors at least temporarily [10]. Third, the resource must be inimitable. Inimitability is the extent to which a given competence cannot be copied and is analogous to the concept of structural differences, at least to the extent to which it may enhance competitive advantage [10]. The resource is difficult to acquire due to the ambiguous link between the capability and the achieved sustained competitive advantage, or because it is socially complex [13]. Fourth, the resource must be non-substitutable. Resources that are non-substitutable enable a firm to sustain an advantage by preventing competitors from accomplishing the same thing using a different set of resources [10].

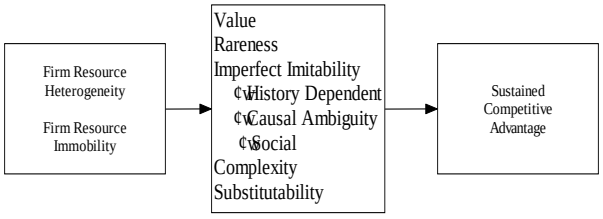

Fig. 4 The Framework of RBV
(Source: Barney [5])

Recently, many IS researches treat IT capability as a strategic asset and examine its effect on organizational performance [4][6][44][46][49][51][53]. Again, Lin [41] indicated that online features such as content management, specific sets of website functions and offline communication are determinants of sustainability of virtual communities. Refer to the Table 2, several KM scholars support RBV constructs empirical studies. Therefore, RBT is adequate to explain the IT-related issues.

In this study, we treat VCs as one type of non-profitable organization and further explore its assets which attract participants and retain them to generate more knowledge assets in comparison with other VCs. We assume that VCs possess strategic assets which will gain participants' preference. While the operational implications of strategic assets have not yet been fully developed and utilized in virtual communities empirical research, human asset [2][63], technical asset[26][37][42], and complementary asset[1][12][38][50] are the three components that are consistently presented in the literature.

VCs' strategic asset as a critical driver of satisfaction is generally understood. Per Bhattacherjee [8] assumption of the theoretical model, confirmation of post-purchase expectation affects individual satisfaction and perceived usefulness. This leads to the following hypotheses.

H_{4a}: The confirmation of human assets positively affects satisfaction.
$H_{4b:}$ The confirmation of human assets positively affects perception of usefulness.
H_{5a}: The confirmation of technical assets positively affects satisfaction.
H_{5b}: The confirmation of technical assets positively affects perception of usefulness.
H_{6a}: The confirmation of complementary assets positively affects satisfaction.
H_{6b}: The confirmation of complementary assets positively affects perception of usefulness.

4. Research methodology

4.1 Subjects and data collection

The research model used empirical data collected from members of JavaWorld@TW, an online community founded in May 2001, and has over 85,000 registered members as of May 2007. There are 1,000 new registered members and 1,200 new topics every month. This PVC contains several discussion forums mainly focused on communicating Java related knowledge, especially in JDBC/SQL, embedded design programs, web framework, application servers, and Java Scripting languages. All members have access to resources such as discussion room, newsletters, and recommended articles as part of their membership benefits and participation is voluntary. The PVC is supported by web-based systems where member interactions are visible to everyone and related messages are structured into discussion threads. Participants have to log into the systems to participate in the discussions with one another. The nickname of the participants, which is named by participants themselves when they registered earlier, are visible as part of the message header.

The questionnaire was posted on JavaWorld@TW from April to June 2007. Of the 295 surveys received, 235 were fully completed and usable for the purpose of this study. As shown in Table 3, Their JavaWorld@TW history ranged from three months to over 3 years, with 42.56% between 1 to 3 years, and with 48.5% less than six months. We gathered non-subjective archival data form logs produced by JavaWorld@TW 's servers since 2005. Never posted is 32.34%, with 25% posted over 10 items.

Table 3 Sample demographics of this study

	Num.	Percentage (%)
Age		
Under 18 years old	5	2.13
19~22 years old	41	17.45
23~29 years old	128	54.47
30~39 years old	53	22.55
Over 40 years old	8	3.40
Education		
High school or below	22	9.36
College	42	17.87
University	116	49.36
Graduate or above	55	23.40
Gender		
Female	30	12.77
Male	205	87.23
Member history		
1-3 months	83	35.32
3-6 months	31	13.19
6 months-1 year	21	8.94
1-2 year	54	22.98
2-3 year	23	9.79
Over 3 year	23	9.79
Post Quantity (Since 2005)		
Never	76	32.34
1~3	50	21.28
4~10	50	21.28
11~30	27	11.50
31-150	21	8.94
Over 150	11	4.68

4.2 Construct measurement

We developed the items in the questionnaire either by adapting measures that had been validated by other researchers or by converting the definitions of constructs into a questionnaire format. Each item was rated on a scale of 1 to 7, where 1 equals "strongly disagree" and 7 "strongly agree. Table 4 shows the definition of constructs. Table 7 shows the questionnaire items, and corresponding loading and CR.

Pre-tests were conducted to ensure the instrument is acceptably valid. The instrument was first evaluated for content validity by three IS/KM scholars, and then further tested for reliability, item consistency, ease of understanding, and question sequence appropriateness. Twenty MBA students who have taken Java were asked to complete the questionnaire. Comments on question sequence, wording choice, and measures were solicited, leading to minor modifications of the questionnaire. Based on feedback from pre-test subjects, several items were removed from our instrument.

Table 4 Definition of Constructs

Construct	Definition	Adapted from
Human asset	The sources about participants' knowledge, professional skills and experiences are assets created by members who attract new comers and retainers.	Amit and Schoemaker [2]; Winter [63]
Technical asset	The capability of a virtual community's platform to provide interactive activities, message management, and search for participants to use.	Lin and Lee [42]; Gefen et al, [25]; Kulkarni et al, [38]
Com-plementary asset	Refers to the reputation, management style, climate, and sharing of a virtual community.	Quinn, et al, [49]; Bock et al [12]; Alavi et al [1]; Lee and Cole [39]
Satisfaction	Refers to the positive feeling after joining a virtual community.	Bhattacherje e, [8]; Coughlan et al [19]; Hsu,et al, [33]; Wu and Wang [64]
Perceived usefulness	Refers to the performance of effectiveness after using the resources of a virtual community.	
Revisit intention	Willing to revisit a virtual community.	

5. Data analysis and results

5.1 Measurement model

The measurement model was evaluated in terms of convergent validity and discriminant validity [3]. Convergent validity was evaluated for the measurement scales using criteria suggested by Fornell and Larcker [24]. Factor loadings λ in the study exceeded 0.7, which represents the measure model is significant due to high convergent validity. AVE ranged from 0.63 to 0.82 as shown in Table 5, greater than variance due to measurement error.

Hence, both conditions for convergent validity were met.

Table 5：Correlations and AVE

Var.	AVE	HA	TA	CA	SAT	PU	RI
HA	0.75	**0.86**	–	–	–	–	–
TA	0.72	0.45	**0.85**	–	–	–	–
CA	0.63	0.39	0.70	**0.79**	–	–	–
SAT	0.82	0.53	0.71	0.66	**0.90**	–	–
PU	0.77	0.59	0.62	0.58	0.76	**0.88**	–
CRI	0.81	0.33	0.67	0.66	0.69	0.62	**0.90**

Legend : HA=Human assets; TA=Technical assets; CA=Complementary assets; SAT=Satisfaction; PU=Perceived Usefulness; RI= Revisit intent

Next, discriminant validity is assessed by examining if the squared correlation between a pair of latent variables was less than the AVE associated with each construct. Discriminant validity is conducted for both the indicator and construct level. For indicator level, Barclay et al. [6] suggested that no manifest variable should load higher on other constructs than on the construct it intends to measure. Table 6 shows that all manifest variables load higher on their respective intended latent variable, compared with other latent variables. Thus, discriminant validity at the indicator level is adequate. Furthermore, item cross-loadings were calculated based on the procedure recommended for PLS. As shown in Table 6, each item loaded higher on its principal construct than on other constructs.

Table 6 Loading and cross-loading matrix

		Latent Construct					
Construct		HA	TA	CA	SAT	PU	RI
Human Asset	HA1	.890	.460	.391	.550	.543	.455
	HA2	.920	.547	.488	.609	.624	.535
	HA3	.900	.656	.543	.663	.665	.606
Technical Assets	TA1	.572	.907	.730	.759	.692	.713
	TA2	.525	.891	.663	.730	.627	.727
	TA3	.560	.873	.683	.696	.721	.678
Complementary Assets	CA1	.459	.733	.869	.689	.568	.738
	CA2	.453	.599	.819	.614	.603	.587
	CA3	.458	.677	.893	.715	.618	.628
Satisfaction	SA1	.647	.760	.737	.926	.743	.746
	SA2	.614	.746	.711	.936	.735	.734
	SA3	.622	.771	.731	.922	.785	.758
Perceived usefulness	PU1	.633	.746	.660	.817	.906	.756
	PU2	.634	.659	.649	.726	.924	.716
	PU3	.583	.672	.573	.661	.895	.648
Revisit Intention	CI1	.543	.709	.709	.754	.756	.918
	CI2	.586	.766	.685	.746	.730	.935
	CI3	.525	.732	.711	.736	.686	.930

Table 7 Summary of measurement scales

Construct	Item	Mean	S.D.	Loading	CR
Human asset	I confirm that members of JavaWorld@TW are Java experts.	5.16	1.18	0.89	0.93
	I confirm that members of JavaWorld@TW have high level of Java skills.	5.28	1.12	0.91	
	I confirm that members of JavaWorld@TW have innovative capabilities.	5.33	1.02	0.90	
Technical asset	I confirm the content of JavaWorld@TW is reliable.	5.49	1.04	0.91	0.92
	I confirm the web pages management and subject classification of JavaWorld@TW is easy to use and understandable.	5.67	1.04	0.89	
	I confirm the service of JavaWorld@TW is reliable.	5.51	0.99	0.87	
Complementary asset	I confirm JavaWorld@TW is a famous virtual community.	5.80	1.09	0.87	0.90
	I confirm JavaWorld@TW's functions of 'private talk' which make me easily discussing with other people.	5.23	1.12	0.82	
	I confirm JavaWorld@TW's search tool which help me to find what I need.	5.51	1.06	0.89	
Satisfaction	I satisfied the knowledge and resources of JavaWorld@TW.	5.45	1.06	0.93	0.95
	I satisfied the response effectiveness of JavaWorld@TW.	5.37	1.00	0.94	
	I satisfied the response efficiency of JavaWorld@TW.	5.35	1.03	0.92	
Perceived usefulness	After using JavaWorld@TW I gain new Java knowledge and new ideas.	5.49	1.06	0.91	0.93
	Using JavaWorld@TW make me more efficient.	5.41	1.04	0.92	
	Using JavaWorld@TW enhance my performance.	5.34	1.08	0.89	

Revisit intention	I plan to reuse JavaWorld@TW to gain new Java knowledge and skills.	5.66	1.04	0.92	
	After my trial, I plan to reuse JavaWorld@TW.	5.76	1.06	0.94	0.95
	I'll reuse JavaWorld@TW even new Java communities emerge.	5.80	1.07	0.93	

5.2 Structural model and hypotheses testing

The theoretical model is multistage, suggesting the need for a structural equation modeling technique that simultaneously tests multiple relationships. To assess validation and test linkages in the theoretical model, partial least squares (PLS) was widely accepted as a method for testing theory in early stages, especially in IS research. Within the IS discipline, a large percentage of research had been devoted to examining the conditions and contexts under which relationships may vary, often under the general umbrella of contingency theory [45][61].

With an adequate measurement model in place, the structural model was collectively tested for the full sample, then was independently tested for weak-tie and strong-tie groups.

5.2.1The full sample

Figure 4 presents the standardized path coefficients and the explained construct variances. As mentioned earlier in the theoretical background section, the central idea from the ECT literature is that satisfaction and perceived usefulness play important roles in shaping the behavioral intention for individuals who have had direct experience in using the community. The survey data enabled us to evaluate the relative influence of satisfaction and perceived usefulness. As can be found in Figure 4, the path (path coefficient = 0.53; t=5.6, p<0.001) from satisfaction to RI is significant, and the path (path coefficient = 0.21; t=1.99 p<0.05) from PU to RI is also significant. In addition, the association between satisfaction and RI is indeed significantly higher than the association between PU and RI. The variance in intention explained (R^2) in this study was 50%. This finding is consistent with past studies on the relative importance of satisfaction and PU for RI for experienced users, suggesting that the participants indeed had involved community usage.

According to our literature section, perceived usefulness, community assets also have important indirect influence mediated by satisfaction/perceived usefulness in forming the revisit intention. As shown in Figure 4, the path (*path coefficient = 0.45; t=6.45, p<0.001*) from PU to SAT, TA to SAT, and CA to SAT are significant, whereas HA to satisfaction is not. In addition, the association between PU and satisfaction is significantly higher than the association between TA to SAT and CA to SAT. The path from HA to PU, TA to PU, and CA to PU are significant. In addition, the association between HA and PU is significantly higher than the association between TA to PU and CA to PU.

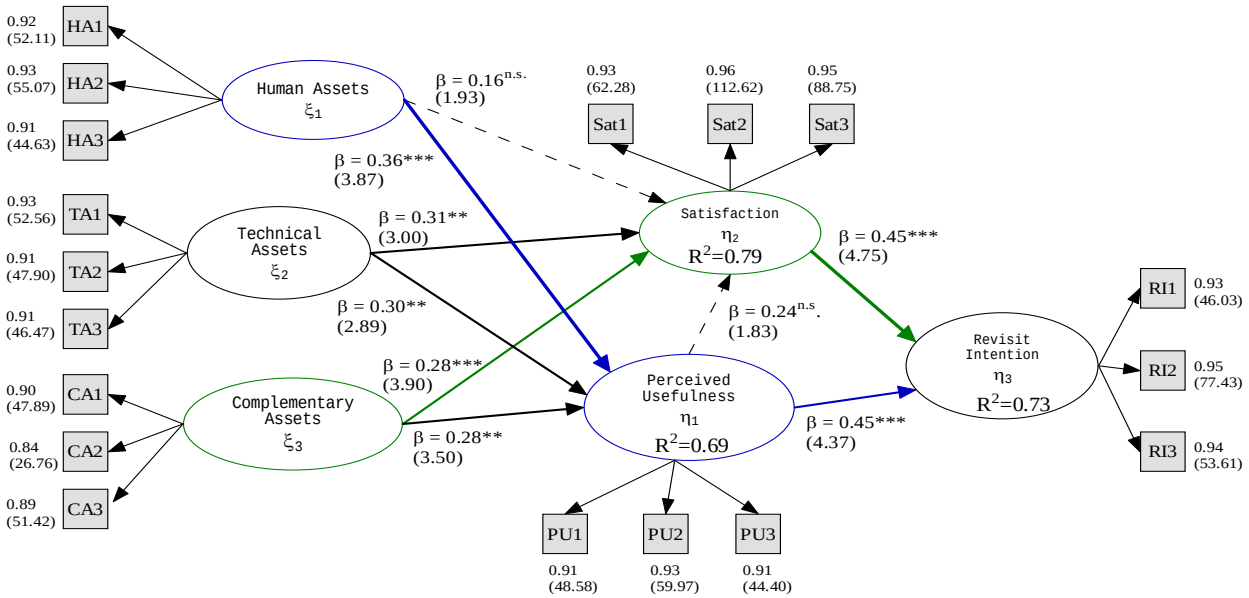

Figure 5 PLS Model Results for the weak-tie group

Note：Loadings and path coefficients, β i are shown above with their corresponding t-critical ratio below.
Path significance: * is p<0.05, ** is p<0.01, and *** is p<0.001.

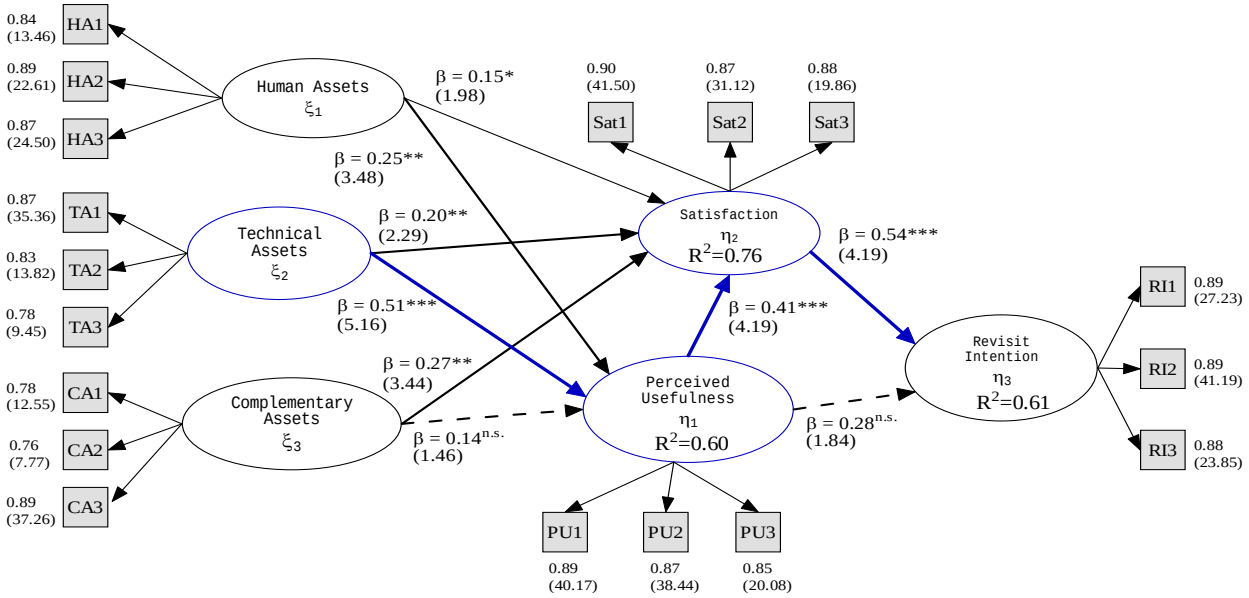

Figure 6 PLS Model Results for the full strong-tie group

Note：Loadings and path coefficients, β i are shown above with their corresponding t-critical ratio below. Path significance: * is p<0.05, ** is p<0.01, and *** is p<0.001.

5.2.2 The split sample

Referring to the Kozinets [37] approach, the frequency of interaction within communities may associate with different perceptions toward communities. To clarify this point, we then split samples into two groups based on their intensity of interaction with members. Weekly participation frequency fewer than 4 times is categorized as weak-tie; over 6 times per week are categorized as strong-tie.

For weak-tie group, as shown in Figure 5, the variance in intention explained (R^2) in this study was 73%, much higher than the full sample (R^2=50%). The paths from PU to RI (*path coefficient = 0.45, t=4.37, p<0.001)*, SAT to RI (*path coefficient = 0.45, t=4.75, p<.001)* are both significant. As can be seen in Figure 5, the paths from TA to SAT, CA to SAT are significant, whereas HA to SAT and PU to SAT are not. The paths from HA to PU, TA to PU, and CA to PU are significant.

For strong-tie group, as shown in Figure 6, the variance in intention explained (R^2) in this study was 61%, lower than the weak-tie sample. The path from SAT to RI (path coefficient = 0.54, t=4.19, p<0.001) is significant, but PU to RI is not. Again, in Figure 5, the paths from PU to SAT, HA to SAT, TA to SAT, and CA to SAT are all significant. The paths from HA to PU, TA to PU are significant, whereas CA to PU is not.

The results of hypotheses were summarized in Table 8. H1, H4b, H5a, H5b and H6a were fully supported by three models. The remaining hypotheses were partially supported by different group models; therefore, we suggested re-examination in future studies.

Table 8 Path Coefficients and Their T-value

	Path		Path Coefficient			Hypotheses Results
	From	To	Full sample	Weak-tie	Strong-tie	
H1	STA	RI	**0.53*** **	**0.45*** **	**0.54*** **	**Supported**
H2	PU	RI	**0.21***	**0.45*** **	**0.28**	**Partial supported**
H3	PU	SAT	**0.45*** **	**0.24**	**0.41*** **	**Partial supported**
H4a	HA	SAT	**0.07**	**0.16**	**0.15***	**Partial supported**
H4b	HA	PU	**0.37*** **	**0.36*** **	**0.25** **	**Supported**
H5a	TA	SAT	**0.27*** **	**0.31** **	**0.20** **	**Supported**
H5b	TA	PU	**0.29*** **	**0.30** **	**0.51*** **	**Supported**
H6a	CA	SAT	**0.18** **	**0.28*** **	**0.27*** **	**Supported**
H6b	CA	PU	**0.24** **	**0.28** **	**0.14**	**Partial supported**

6. Discussion and conclusion

This study integrated resourced-based theory into expectation confirmation theory by decomposing confirmation variable into three asset factors which help to better understand participant revisit intention for a VC. By integrating theoretical paradigms from ECT with RBV extension, we confirmed the dual nature of the VC members as a knowledge consumer and a resource seeker. The results show that contextual variable and perceptional constructs of VCs are important predictors to explain loyal

intention. We will further discuss interesting findings in the next two sections.

6.1 The Full Sample

Our findings are consistent with previous studies [20]. Results reassured ECT's assumption that satisfaction with the community use is the strongest predictor of members' revisit intention, followed by perceived usefulness as a significant but weaker predictor. Higher perception of satisfaction and perceived usefulness toward the community are associated with higher intention to revisit. Favorable perception of technical assets, complementary assets and perceived usefulness are associated with greater perception of satisfaction. Perceived usefulness is the strongest predictor of member's satisfaction, followed by technical assets and complementary.

Favorable perception of communities' human assets is associated with greater perception of usefulness. Therefore, we suggest communities' management should emphasize on recruiting members with high skills, expertise, and innovation, which will increase their levels of perceived usefulness. Our findings also show that favorable perception of communities' technical assets is associated with greater perception of satisfaction and perceived usefulness. Therefore, we suggest communities' management should well-organize their contents, services, and message management which will increase level of satisfaction and perceived usefulness. Again, favorable perception of communities' complementary assets is associated with greater perception of satisfaction and perceived usefulness. Our suggestions are to create a good reputation, to value member privacy, to provide useful tools, and to make members happy. These findings are consistent with previous knowledge search studies [32][35][64].

6.2 The split sample

Our proposed model shows the highest variance in intention explained (R^2) for the weak-tie group. The results of weak-tie indicate the significance of perceived usefulness and satisfaction. As shown in Figure 5, satisfaction and perceived usefulness both have direct impact on revisit intention. The findings suggest weak-tie members tend to revisit a community because of the post-use satisfaction and favorable perception of usefulness. The quality of technical assets and complementary assets determine their perception of satisfaction toward a community. The perception of human assets, technical assets, and complementary assets determine their perception of usefulness. Therefore, the level of satisfaction and perceived usefulness should be raised when human, technical, and complementary assets are significantly enhanced. The results of strong-tie members indicate satisfaction is the only determinant of revisit intention. Perceived usefulness, human, technical, and complementary assets have indirect impact on revisit intention, mediated by satisfaction. Our results reveal that the assets of a virtual professional community with the characteristics of rare, inimitable, non-substitutable and valuable are important.

The difference in the behavioral models of weak-tie and strong-tie, particularly in the revisit context, shed light on the importance of development related theories that can be applied to shape the post-use behavior of specific groups. Thus, we suggest further studies to evaluate how differences among individuals with different behaviors impact retention.

6.3 Implication and limitation

Based on our findings, several implications are proposed for practitioners. Understand what variables affect post-use behavior across VC groups is critical to effective improvement and management. Referring to our analysis, the level of satisfaction could be raised when a VC retains the population of active participants. Second, providing a user-friendly platform, stable website, and personalized function to encourage participation will enhance the degree of satisfaction. Third, a good content management system, FAQ, and encouragement to share will improve the degree of satisfaction.

This study represents an important step toward understanding the problem of member retention using a theoretically grounded approach based on expectation confirmation theory and resource-based view. This model addresses the often cited need to understand the mystery of member continuance of communities in the context of virtual professional communities. It demonstrates that an ECT-based model can explain a significant number of variance in revisit intention for both weak-tie and strong-tie groups. Most importantly, interaction differences between groups were theoretically deduced and empirically tested. Thus, from the standpoint of retention, this study contributes to explaining the phenomenon.

Our findings also respond to Bhattacherjee [7] suggestions, incorporating additional critical factors is necessary to improve ECT explanatory power. This study illustrates that ECT can be meaningfully extended through the assessment of communities' assets, which captures the perception of satisfaction and usefulness influence. The addition of communities' assets construct contributed more to the variance in the dependent variable.

The present research has several limitations that should be noted. First, the present study posits an extension to expectation confirmation theory for virtual professional communities' members. The VPC study raises several issues, including generalizability of the results to other settings, and operationalization of the study's constructs. Second, the integrated model should be interpreted carefully when using it to predict members' behavior of senior and juvenile users. Only 3.4% of the respondents were over 40 years old, and only 2.13% of the respondents were under 18 years, which may lead to conflicting cognitive impacts on assessing individual perception between different age groups. We recommend further research to explore this issue. Finally, the ideal sampling frame for stratified random sampling cannot be found due to privacy considerations, so identifying every member in the sample is almost impossible unless full support is obtained from the virtual community.

Acknowledgements

The authors are grateful for the constructive feedback received from the three reviewers and editor handling this manuscript for the journal. This study is funded by Taiwan National Science Council (NSC) under project number NSC 96-2416-H-327-002.

References:

[1] Alavi, M., Kayworth, T.R., & Leidner, D.E., An empirical examination of the influence of organizational culture on knowledge management practices, *Journal of Management Information Systems*, Vol. 22, No. 3, 2006, pp. 191-224.

[2] Amit, R. and Schoemaker, P.J., Strategic assets and organizational rent, *Strategic Management Journal*, Vol. 14, No. 1, 1993, pp.33-46.

[3] Anderson, J.C., and Gerbing, D.W., Structural equation modeling in practice: A review and recommended two-step approach, Psychology Bulletin, Vol.103, No.3, 1988, pp.411-423.

[4] Armstrong, C., and Sambamurthy, V., Information technology assimilation in firms: The influence of senior leadership and IT infrastructures, Information Systems Research, Vol. 10, No. 4, 1999, pp. 304-327.

[5] Barney, J., Firm resources and sustained competitive advantage, Journal of Management, Vol. 17, No. 1, 1991, pp. 99-120.

[6] Barclay, D., Higgins, C., and Thompson, R., The Partial Least Squares (PLS) Approach to Causal Modeling: Personal Computer Adoption and Use as an Illustration, Technology Studies, Vol.2, No. 2, 1995, pp. 285-309.

[7] Bharadwaj, A. S., A resource-based perspective on information technology capability and firm performance: An empirical investigation, MIS Quarterly, Vol. 24, No. 1, 2000, pp. 169-196.

[8] Bhattacherjee, A., Understanding information systems continuance：An expectation-confirmation model, MIS Quarterly, Vol. 25, No. 3, 2001, pp. 351-370.

[9] Blanchard, A., and Markus, L. M., The Experienced "Sense" of a Virtual Community: Characteristics and Processes. *The DATA BASE for Advances in Information Systems,* Vol. 35, No. 1, 2004, pp. 65-79

[10] Bloodgood, J.M. and Salisbury, W.D., Understanding the influence of organizational change strategies on information technology and knowledge management strategies, Decision Support Systems, Vol. 31, 2001, pp. 55-69.

[11] Bock, G. W., and Kim, Y., Breaking the myths of rewards: An exploratory study of attitudes about knowledge sharing, Information Resources Management Journal, Vol. 15, No. 2, 2002, pp. 14-21.

[12] Bock, G.W., Zmud, R.W., Kim, Y., and Lee, J., Behavioral intention formation in knowledge sharing：Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate, MIS Quarterly, Vol. 29, No.1,2005, pp. 87-111.

[13] Caldeira, M. M., and Ward, J. M.,Using resource-based theory to interpret the successful adoption and use of information systems and technology in manufacturing small and medium-sized enterprises,. European Journal of Information Systems, Vol. 12, No. 2, 2003, pp. 125-139.

[14] Chen, C. W., and Huang, Echo, A study of predicting taxpayers' acceptance of e-taxation, WSEAS Trans. On Information Science & Application, Vol. 3, No. 4, 2007, pp. 592-698.

[15] Chiu, C.M., Hsu, M.H., and Wang, Eric T.G., Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories, Decision Support Systems, Vol. 42, 2006, pp.1872-1888.

[16] Choudhury, V. and Sampler, J.L., Information specificity and environmental scanning: An economic perspective, Management Information Systems Quarterly, Vol. 21, No. 1, 1997, pp. 25-53.

[17] Coff, R. W., The emergent knowledge-based theory Of competitive advantage: An evolutionary approach to integrating economics and management, Managerial and Decision Economics, Vol. 24, 2003, pp. 245-251.
[18] Collis, D. J. and Montgomery C.A., Competing on resources: Strategy in the 1990s, Harvard Business Review, July-August, 1995, pp. 118-128.
[19] Coughlan, A.T., Anderson, E., Stern, L.W., El-Ansary, A.I., Marketing Channels, Englewood Cliffs, NJ, Prentice-Hall, 2001.
[20] de Moor, A., Weigand, H., Formalizing the evolution of virtual communities, Information Systems, Vol. 32, No. 2, 2007, pp.223-247.
[21] de Valck, K., Langerak, F., Verhoef, P. C., and Verlegh, P. W. J., Satisfaction with virtual communities of interest: Effect on members' visit frequency, British Journal of Management, Vol. 18, No. 3, 2007, pp. 241-256.
[22] Dehning, B. and Stratopoulos, T., Determinants of a sustainable competitive advantage due to an IT-enabled strategy, Strategic Information Systems, Vol. 12, No. 1, 2003, pp. 7-28.
[23] Dholakia, U.M., R. Bagozzi, and L.K. Pearo, A social influence model of consumer participation in network and small group based virtual communities, International Journal of Research in Marketing, Vol. 21, No. 3, 2004.
[24] Fornell, C. & Larcker, D.F., Structural equation models with unobservable variables and measurement error: Algebra and statistics, Journal of Marketing Research, No.18, 1981, pp.382-388.
[25] Gefen, D., Karahanna, E., and Straub, D.W., Trust and TAM in online shopping： an integrated model, MIS Quarterly, Vol. 27, No.1, 2003, pp. 51-90.
[26] Geng, X., Whinston, A.B., and Zhang, H., Health of electronic communities: An evolutionary game approach, Journal of Management Information Systems, Vol. 21, No. 3, 2005, pp. 83-111.
[27] Giannakakis, Nikolaos, Efstratios Poravas, Athina Lazakidou, Usefulness of the Virtual Private Networks in Health Sector, WSEAS Trans. on Information Science and Applications, Iss. 12, Vol. 2, 2005, pp. 2131-2137.
[28] Gu, B., Konana, P., Rajagopalan, B., and Chen, M. H. W., Competition among virtual communities and user valuation, Information Systems Research, Vol. 8, No. 1, 2005, pp.68~85.
[29] Halawi, L. A., Aronson, J.E., and McCarthy, R.V., Resource-based view of knowledge management for competitive advantage, *The Electronic Journal of Knowledge Management*, Vol.3, No.2, pp.75-86.
[30] Heiman, B. A., and J. A. Nickerson, Towards reconciling transaction cost economics and the knowledge-based view of the Firm: The context of interfirm collaborations, International Journal of the Economics of Business, Vol. 9, No. 1, pp. 97-116.
[31] Hersberger, J. A., Murray,A. L., and Rioux, K.S., Examining information exchange and virtual communities: an emergent framework, Online Information Review, Vol. 31, No. 2, 2007, pp.135-147.
[32] Hsu, M.H., Chiu, C.M., & Ju, T.L., Determinants of continued use of the WWW： an integration of two theoretical models, Industrial Management & Data Systems, Vol. 104, No. 9, 2004, pp. 766-775.
[33] Hsu, M.H., Ju, T.L., Yen, C.H., and Chang, C.M., Knowledge sharing behavior in virtual communities: The relationship between trust, self-efficacy, and outcome expectations, International Journal of Human-Computer Studies, Vol. 65, 2007, pp. 153-169.
[34] Hsu, M-H., Yen, C-H., Chiu, C-M., and Chang, C-M., A longitudinal investigation of continued online shopping behavior：An extension of the theory of planned behavior, Int. J. Human-Computer Studies, Vol. 64, 2006, pp. 889-904.
[35] Irene Y.L. Chen, The factors influencing members' continuance intentions in professional virtual communities—a longitudinal study, *Journal of Information Science*, Vol. 33, No. 4, 2007, pp. 451-467.
[36] Kankanhalli A., Tan, B.C.Y., & Wei, K-K., Contributing knowledge to electronic knowledge repositories：An empirical investigation, MIS Quarterly, Vol. 29, No. 1, 2005, pp.113-143.
[37] Kozinets, R.V., E-Tribalized Marketing?:The strategic implications of virtual communities of consumption, European Management Journal, Vol. 17, No.3, 1999, pp. 252-264.
[38] Kulkarni, U.R., Ravindran, S., and Freeze, R., A knowledge management success model: Theoretical development and empirical validation, Journal of Management Information Systems, Vol. 23, No. 3, 2007, pp. 309-347.
[39] Lee, G.K., & Cole, R.E., *From a firm-based to a community-based model of knowledge creation:*

the case of Linux kernel development, Organization Science, Vol. 14 , No. 6, 2003, pp. 633-649.

[40] Leimeister, J.M., and H., Krcmar Success factors of virtual communities from the perspective of members and operators: An empirical study, Proceedings of the 37th Annual HICCS Conference, Kauai, Hawaii, January 4-7, 2004.

[41] Lin, H.F., The role of online and offline features in sustaining virtual communities: an empirical study, Internet Research, Vol. 17, No. 2, 2007, pp. 119-138.

[42] Lin, H-F., and Lee, G-G., Determinants of success for online communities：an empirical study, Behavior & Information Technology, Vol. 25, No. 6, 2006, pp. 479-488.

[43] Ma, M., and Agarwal, R., Through a glass darkly: Information technology design, identity verification, and knowledge contribution in online communities, Information systems Research, Vol. 18, No. 1, 2007, pp. 42-67.

[44] Mata, F. J., Fuerst, W. L., and Barney, J. B., Information technology and sustained competitive advantage: A resource-based analysis, MIS Quarterly, Vol. 19, No. 4, 1995, pp. 487-505.

[45] McKeen, J.D., Guimaraes T. and Wetherbe, J.C., The relationship between user participation and user satisfaction: An investigation of four contingency factors, MIS Quarterly, Vol.18, No.4, 1994, pp.427-451.

[46] Melville, N., Kraemer, K., and Gurbaxani, V., Review: Information technology and organizational performance: An integrative model of IT business value, MIS Quarterly, Vol. 28, No. 2, 2004, pp. 283-322.

[47] Oliver, R.L., A cognitive model for the antecedents and consequences of satisfaction, Vol. 17, 1980, pp. 460-469.

[48] Osterloh, M. & Frey, B. S., Motivation, knowledge transfer, and organizational forms, Organizational Science, Vol. 11, 2000, pp. 538-550.

[49] Powell, T. C., and Dent-Micallef, A., Information technology as competitive Advantage: The role of human, business, and technology resources, Strategic Management Journal, Vol. 18, No. 5, 1997, pp. 375-405.

[50] Quinn, J. B., Anderson, P. and Finkelstein, S., Managing professional intellect：making the most of the best, Harvard Business Review, March–April, 1996, pp.71–80.

[51] Ravichandran, T. and Lertwongsatien, C., Impact of information systems resources and capabilities on firm performance: A resource-based perspective, Proceedings of 23rd International Conference on Information Systems, December 15-18, 2002, Barcelona, Spain, pp. 577-582.

[52] Rheingold, H., *The Virtual Community: Homesteading on the Electronic Frontier*. Reading, Massachusetts: Addison-Wesley. 1993.

[53] Ross, J. W., Beath, C. M., and Goodhue, D. L., Develop long-term competitiveness through IT assets, Sloan Management Review, Vol. 38, No. 1, 1996, pp. 31-42.

[54] Ruppel, C.P. & Harrington, S.J., Sharing knowledge through intranets: A study of organizational culture and intranet implementation, IEEE Transactions on Professional Communication, Vol. 44, No. 1, 2001, pp. 37-50.

[55] Ryu, S., Ho, S.H., Han, I., Knowledge sharing behavior of physicians in hospitals, Expert Systems with Applications, Vol. 25, No. 1, 2003, pp. 113-122.

[56] Shin, M., A framework for evaluating economics of knowledge management systems, Information & Management, Vol. 42, 2004, pp.179-196.

[57] Turban, E., King, D., McKay, J., Marshall, P., Lee, J., and Viehland, D., *Electronic commerce 2008 A management perspective*, Pearson Prentice Hall, 2008.

[58] Wang, H.C., and Chang, Y.L., PKR: A personalized knowledge recommendation system for virtual research communities, Journal of Computer Information Systems, Vol. 31, 2007, pp. 31-41.

[59] Wangpipatwong, Sivapom, Wichian Chutimaskul, Borworn Papasratorn, The Role of Technology Acceptance Model's Beliefs and Computer Self-Efficacy in Predicting E-Government Website Continuance Intention, WSEAS Trans. on Information Science & Applications, Iss. 6, Vol. 4, 2007, pp. 1212-1218.

[60] Wasko, M.M. & Faraj, S., It is what one does: Why people participate and help others in electronic communities of practice, The Journal of Strategic Information Systems, Vol. 9, No.2-3,2000, pp.155-173.

[61] Weill, P., Olson, M.H., Managing investment in information technology: Mini Case examples and Implications, MIS Quarterly Vol. 13, No. 1, 1989, pp. 3-17.

[62] Wernerfelt, P.M., A resource-based view of the firms, Strategic Management Journal, Vol. 5, 1984, pp. 171-180.
[63] Winter, S., Knowledge and competence as strategic assets, In Teece, D.(ed), The Competence Challenge-Strategies for Industrial Innovation and Renewal, 1987, pp.84-159.
[64] Wu, J-H., & Wang, Y-M., Measuring KMS success：A respecification of the DeLone and McLean's model, Information & Management, Vol. 43, 2006, pp. 728-739.
[65] Yang, Z., Cai, S., Zhou, Z., and Zhou, N., Development and validation of an instrument to measure user perceived service quality of information presenting Web portals, Information & Management, Vol. 42, 2005, pp. 575-589.