Recent development of the virtual community research: A citation and co-citation analysis

Chih-Chien Wang, Ph.D
Grad. Inst. of Info. Management
National Taipei University
Taipei County, Taiwan
wangson@mail.ntpu.edu.tw

I-Ping Chiang, Ph.D
Grad. Inst. of Info. Management
National Taipei University
Taipei County, Taiwan
ipchiang@mail.ntpu.edu.tw

Chen-Fu Chuang, B.I.
Grad. Inst. of Info. Management
National Taipei University
Taipei County, Taiwan
gamekingkid@gmail.com

Abstract—**This study aims to identify the recent development of virtual community research. By citation and co-citation of virtual community research articles in Social Sciences Citation Index (SSCI) between 1980 and 2009, this study maps the intellectual structure and development trend of virtual community research. The results provide important insights on the future directions of the field.**

Keywords: Virtual community, Bibliometrics, Citation analysis, Co-citation analysis

I. INTRODUCTION

Internet is quickly changing and reforming the world we live and incorporating into our daily life. People use Internet for the diversify purposes. For some users, Internet is now a medium for information exchange and social interaction with others. Internet users formatted enormous virtual communities. Among various Internet applications, virtual community is an important application with increasing population.

"Virtual community", also known as online community, electronic community and internet community, was first argued by Rheingold's book [1]. This idea of virtual community appeared in 1980s and boomed from the 1990s, the world wide web (WWW) appears. At first, virtual community is to disseminate different themes of news on Internet. Now, virtual community is a virtual space to aggregate people with similar interesting.

Virtual community is a social aggregation, arises from the virtual space with sufficient people, emotional, and relationship with the long-term development in the internet [1].

In recent years, virtual community brings the value into full play because of the development of information and network technology, we can define it as "people who has the same needs and interests collect the information and communicated with each other through the internet."

This article analyzes the virtual community research over the 30-year period of 1980-2009. This study attempts to use cited references to identify core articles of research of virtual community. This study uses citation analysis with co-citation analysis to mapping the network of documents. The citation analysis points out the most frequently-cited authors and publications that viewed as useful by researchers. And, the co-citation analysis generates clusters of articles to classify the research area based on the co-citation frequencies of cited

articles. According to [2], the most frequently-cited authors and publications are thought as useful.

The remainder of this article is structured into four sections. Introduction is the first section, the section illustrates the situation of internet and contains a description of virtual community. The section entitled "Methodology" presents a detailed description of the methodology employed. And section entitled "Analysis" addresses the results. The final section is entitled "Discussions and conclusions" presents the key conclusions and limitations of this article, and propositions for future research.

II. METHODOLOGY

The current study searches the database to collect virtual community literature and found 1122 articles published in the database of Social Science Citation Index and Sciences Citation Index in the period of 1980 to 2009. The keywords and phrases used in searching included online community, online communities, on-line community, on-line communities, virtual community, virtual communities, electronic community, electronic communities, internet community and internet communities. Articles related with the keywords above by SCI and SSCI were nominated as eligible.

Then, this study selected "journal article" as the document type to confine the range of the articles. Articles of conference proceedings and editorial material were excluded. After the filtering, this study got 783 articles. The reference set of each article was downloaded and saved in files. Then, this study exported the file into Excel. In order to explore the author and journal networks between each article, this study used the software UCINET 6 [3] and Bibexcel [4] to analyze the bibliometrics data of these articles.

The bibliometric analyses might present valuable insights on how the field has evolved. Citation analysis and co-citation analysis are the most frequently utilized method in bibliometrics [5] [6]. The citation analysis provides data relating to the influence of literatures, and the co-citation analysis traces the co-occurrence between scholars and literatures. Both citation and co-citation studies could enhance one's ability to study the intellectual structure of an academic discipline when combined with social network analysis based on graph models [7]. Figure 1 revealed the process of the current research.

This study aims to provide data relating to the force of impact or strength of influence of research efforts, and races the links and interactions between different researchers and

different fields of research. Though this research was not exhaustive, it could be a comprehensive base for understanding virtual community.
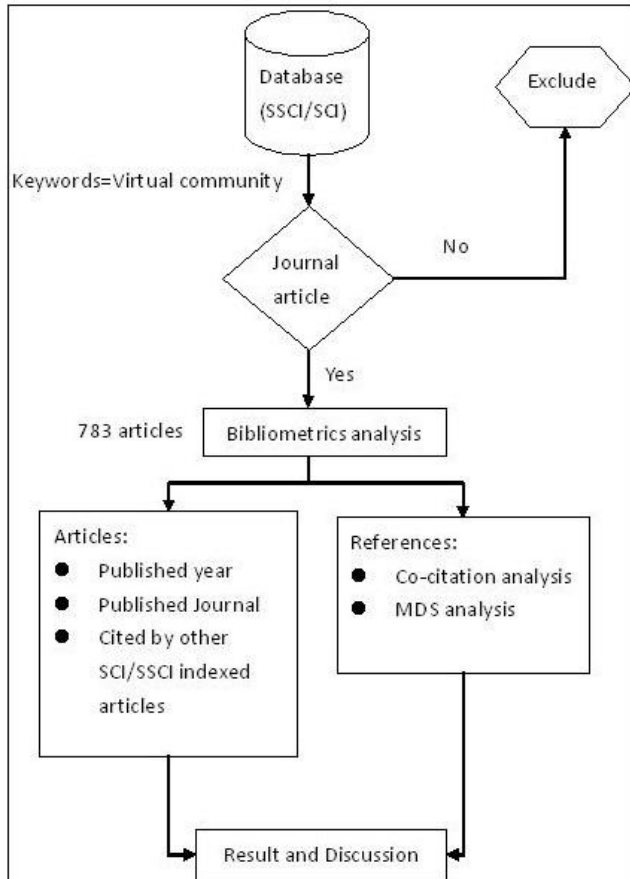

Figure 1.   The process of the research.

III.   ANALYSIS

Figure 2 shows the publication-year distribution of cited papers in the database going back to 1980. As seen, most of the cited papers were published from 2000 onwards. There was only one article in the period between 1980 to 1993. In 1994, the article amount increased to eight and continually increase after 1994. The booming of virtual community article from 1994 could attribute to [1] which proposed the idea of virtual community. Though the sharp falloff in 2002, but the growth is stable overall. With the advances of the internet technology, number of virtual community articles raised rapidly to 143 articles in 2009.
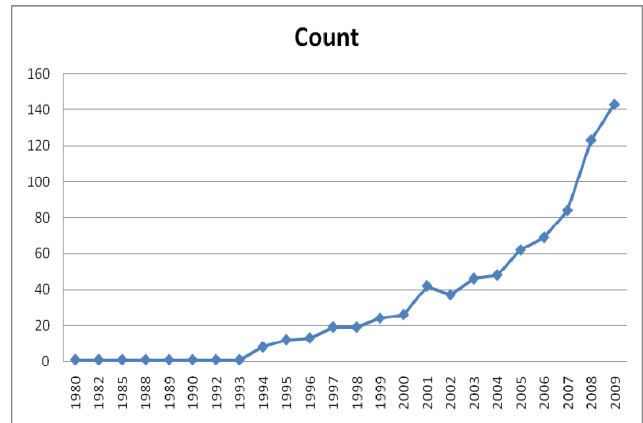

Figure 2.   Distribution of virtual community articles by years

We use the citation analysis to identify the major publications in the field of virtual community. Table I lists the top 10 most-frequently cited virtual community articles. Based on the citation frequencies, the article of Husar et al "Asian dust events of April 1998" is the most frequently cited article, which takes the virtual community as an application of the dust events. The second frequently cited article is Wasko and Faraj's article "Why should I share? Examining social capital and knowledge contribution in electronic networks of practice" which focused on knowledge sharing in virtual community. The third frequently cited article is "PeerTrust: Supporting reputation-based trust for peer-to-peer electronic communities" by Xiong and Liu (2004) and the fourth one is "How open source software works: "free" user-to-user assistance" by Lakhani and von Hippel (2003), both of them are talking about the technology using in virtual community. The following articles are Wasko and Faraj (2000), Wellman et al. (2001), Kozinets (2002), Eysenbach et al. (2004), Armstrong and Hagel (1996), Zacharia and Maes (2000), which focus on knowledge management, human behavior, online consumption, health care and definition of virtual community.

Similarly, table II reveals the distribution of virtual community articles by journals. The amount of articles published in journals may indicate the influence of journals to the research fields [8]. The journals represented on table II reveals that psychology, communication, information science, computer science, social science, education, Medical Informatics, and physics are the subject areas for virtual community research. Among the journals, we can discover that the main subject of virtual community is computer science, and the second subject is information science. CB published the largest number (23) of virtual community articles, following by JCMC, which published 20 articles. The other 7 journals published 10 or more articles, including IS, NMS, CHB, DSS, IJEC, CE, and SSCR.

TABLE I.   HIGHLY CITED VIRTUAL COMMUNITY ARTICLES

Virtual Community Research (Leading author, year, Journal)	Cited Times	Research focus
Husar RB, 2001, JGRA	280	Application of

Wasko MM, 2005, MISQ	177	virtual community Knowledge sharing
Xiong L, 2004, IEEE-TKDE	175	Technology in virtual community
Lakhani KR, 2003, RP	126	Technology in virtual community
Wasko MM, 2000, JSIS	124	Knowledge sharing
Wellman B, 2001, ABS	112	Human behavior
Kozinets RV, 2002, JMR	108	Online consumption
Eysenbach G, 2004, BMJ	97	Health care
Armstrong A,1996, HBR	87	Definition of virtual community
Zacharia, 2000, AAI	87	Human behavior

Note: The above highly influence virtual community article were published in 1980-2009 and ranked at top 10.

TABLE II.   DISTRIBUTION OF VIRTUAL COMMUNITY ARTICLES BY JOURNALS

Journals	Articles	Percentage	Disciplines
CB	23	2.94%	Psychology
JCMC	20	2.55%	Communication
IS	17	2.17%	Information Science
NMS	16	2.04%	Communication
CHB	13	1.66%	Psychology
DSS	12	1.53%	Computer Science
IJEC	11	1.40%	Computer Science
CE	10	1.28%	Computer Science
SSCR	10	1.28%	Social Science
BIT	9	1.15%	Computer Science
IC	8	1.02%	Computer Science
IR	8	1.02%	Computer Science
JOCEC	8	1.02%	Computer Science
ISF	7	0.89%	Computer Science
IJHCS	7	0.89%	Computer Science
JIS	7	0.89%	Computer Science
MCS	7	0.89%	Communication
CACM	6	0.77%	Computer Science
EL	6	0.77%	Information Science
IRIEJ	6	0.77%	Information Science
JCAL	6	0.77%	Education
ETS	5	0.64%	Education
IM	5	0.64%	Information Science
ISR	5	0.64%	Information Science
IJIM	5	0.64%	Information Science
OIR	5	0.64%	Information Science
JMIR	5	0.64%	Medical Informatics
JASIST	5	0.64%	Information Science
OIR	5	0.64%	Information Science
PASMA	5	0.64%	Physics
WIR	5	0.64%	Computer Science

Note: Only journals with ten or more Virtual Community articles are included.

Table III shows the reference cited by the virtual community articles we collected for this research. People who do the research of virtual community could rapidly find what they need from these frequently cited literatures. As table III reveals, Rheingold's (1993) book "The Virtual Community: Homesteading on the Electronic Frontier" was the most cited source for virtual community. This might due to the reason that he defined the meaning of virtual

community, and many articles quoted his definition for their researches. The following frequently cited articles from the second to the sixth are all books, including: "Online Communities: Designing Usability" (Preece, 2000), "Communities of Practice: Learning, Meanings, and Identity" (Wenger , 1998), "Net Gain: Expanding Markets Through Virtual Communities" (Hagel, 1997), "Situated learning, Legitimate peripheral participation" (Lave, 1991), and "Life on the Screen: Identity in the Age of the Internet" (Turkle, 1995). These books give the definition and discuss the functions of the virtual community, which give us a good direction to understand what the virtual community is.

TABLE III.   LITERATURES FREQUENTLY CITED BY VIRTUAL COMMUNITY RESEARCH

Referred literature (Leading author, year, Journal,/book)	Cited Times
Rheingold H, 1993, The Virtual Community: Homesteading on the Electronic Frontier.	78
Preece J, 2000, Online Communities: Designing Usability.	55
Wenger E, 1998, Communities of Practice: Learning, Meanings, and Identity	52
Hagel J, 1997, Net Gain: Expanding Markets Through Virtual Communities.	48
Lave J, 1991, Situated learning, Legitimate peripheral participation.	47
Turkle S, 1995, Life on the Screen: Identity in the Age of the Internet.	35
Wellman B, 1996, ARS, V22, P213	30
Wellman B, 1999, CC, P167	27
Fornell C, 1981, JMR, V18, P39	26
Kiesler S, 1984, AP, V39, P1123	25
Kraut R, 1998, AP, V53, P1017	25
Muniz AM, 2001, JCR, V27, P412	24
Kim AJ, 2000, Community Building on the Web: Secret Strategies for Successful Online Communities.	23
Wasko MM, 2000, JSIS, V9, P155	23
Kozinets RV, 1999, EM, V17, P252	22
Constant D, 1996, OSCI, V7, P119	21
Granovet.MS, 1973, AJS , V78, P1360	21
Preece J, 1999, IC, V12, P63	21
Brown JS, 1991, OSCI, V2, P40	20
Nahapiet J, 1998, AMR, V23, P242	20
Ridings CM, 2002, JSIS, V11, P271	20
Rothaermel FT, 2001, JM, V27, P297	20
Walther JB, 1996, CR, V23, P3	20
Wasko MM, 2005, MISQ, V29, P35	20

Note: The above literatures were cited by 30 or more Virtual Community articles published in 1980-2009.

Figure 3 illustrates the multidimensional scaling (MDS) map of literature co-citation profiles. MDS is trying to conversion the dissimilarities between the original data structure to a multi-dimensional space map. The aim of MDS is to find the hidden structure behind a set of data, constituted the hidden dimensions of the content map of the main elements. Demarcating the data along two dimensions could help us to understand the correspondence between documents by the co-citing preferences based on their relative distances of citing articles. The more closely on the map means the more frequently they were cited by the 783 articles.

Based on Figure 3, we tentatively note that the four documents on the upper left-hand side of the map, namely, Preece (2000), Hagel (1997), Rheingold (1993), and Preece

(1999) are comparatively more relevant to each other compared with the rest. This virtual community definition cluster includes three books and one article by Preece (1999) published in Interacting with Computers. The second cluster includes three documents, namely, Kozinets (1999), Rothaermel (2001), and Turkle (1995), which were related the application of virtual community. The third cluster, which is depicted on the upper right-hand side of the main dense cluster, includes four documents, namely, Lave (1991), Brown (1991), Wenger (1998), and Muniz (2001). The article of Muniz (2001) is relatively an incompatible scope, and the remaining documents are related with communities of practice. The last one cluster includes three articles, they are Wasko (2005), Nahaoiet (1998), and McAlexander (2002). The article of McAlexander (2002) is also relatively an incompatible scope that talking about building a brand community. The rest two article are related with knowledge sharing.
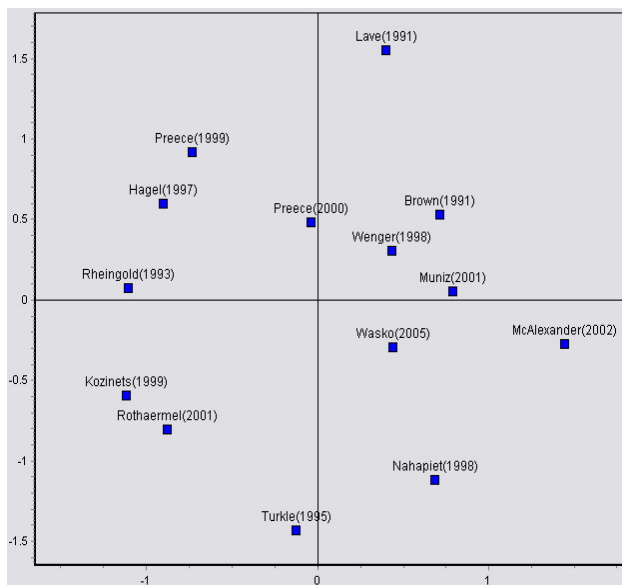

Figure 3. Multidimensional scaling map of document co-citation profiles

Figure 4 shows the co-citation-based network of documents with at least 10 citations. The co-citation-based network illustrates the documents as nodes and co-citation links as edges. The length and width of the lines represents the strength of relevance between documents of co-citation links.

As this network, we can discover that there are four subjects in the field of virtual community, as communities of practice, knowledge sharing, brand community, and application and definition of virtual community. And the articles of the four fields are Brown (1991), Lave (1991), and Wenger (1998) as in communities of practice; Wasko (2005) and Nahapiet (1998) in the field of knowledge; Muniz (2001) and McAlexander (2002) in the field of brand community; and the last field of application and definition of virtual community includes seven articles, namely, Rheingold

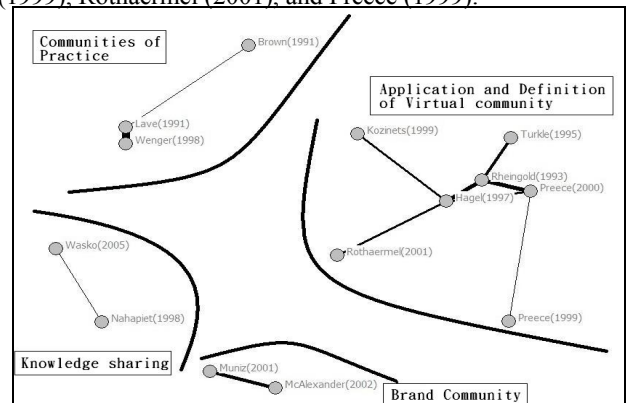(1993), Hagel (1997), Preece (2000), Turkle (1995), Koznets (1999), Rothaermel (2001), and Preece (1999).

Figure 4. Co-citation's network map of reference with at least 10 citations

IV.   DISCUSSION AND CONCLUSIONS

This study represents a specific effort to use bibliometric analysis to examine virtual community studies published in a wide range of journals during the three-decade period of 1980–2009. We hope that the results of the study could find out the impact of core documents in the field of virtual community, and provide a useful direction for new researchers. Another contribution of this study is that we revealed the profiles of virtual community based on document citation and co-citation analysis.

Relative to our goals for this study, we analyzed the most frequently cited publications in SCI and SSCI database over a period of 30 years and found that books dominated the references, and journal articles coming second. In fact, books played a major role in the field of virtual community, such as "The Virtual Community: Homesteading on the Electronic Frontier" and "Online Communities: Designing Usability." This co-citation's network map gives the classification of virtual community in four subjects, as communities of practice, knowledge sharing, brand community, and application and definition of virtual community. Analysis of the distribution journals give us a clear direction that most of the articles of virtual community are published in the disciplines of journals as computer science and information science.

It is worth noting that there are some authors that have served as bridges between the knowledge groups, such as Rheingold (1993) and Preece (2000), that their publications play a major role in the research of virtual community. This facilitates the growth and maturation of the research of virtual community. In conclusion, this study has found that the year 1993 is the turning point of virtual community since the initiation of Rheingold's book.

This article provides the researchers many types of data that allow them could have a deeper research and point out a clear direction of the subject of virtual community. We also hope that this type of research is continued in the future, as the research of virtual community continues to develop.

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APPENDIX: JOURNALS ABBREVIATION

Journals name	Abbreviation
Academy of Management Review	AMR
American Behavioral Scientist	ABS
American Journal of Sociology	AJS
American Psychologist	AP
Annual Review of Sociology	ARS
Applied Artificial Intelligence	AAI
Behaviour & Information Technology	BIT
British Medical Journal	BMJ
Communications of The ACM	CACM
Communication Research	CR
Communities in Cyberspace	CC
Computers & Education	CE
Computers in Human Behavior	CHB
Cyberpsychology & Behavior	CB
Decision Support Systems	DSS
Educational Technology & Society	ETS
Electronic Library	EL
European Management	EM
Harvard Business Review	HBR
IEEE Transactions on Knowledge and Data Engineering	IEEE-TKDE
Information & Management	IM
Information Research-an International Electronic Journal	IRIEJ
Information Society	IS
Information Systems Frontiers	ISF
Information Systems Research	ISR
Interacting with Computers	IC
International Journal of Electronic Commerce	IJEC
International Journal of Human-Computer Studies	IJHCS
International Journal of Information Management	IJIM
Internet Research	IR
Journal of Communication	JC
Journal of Computer Assisted Learning	JCAL
Journal of Computer-Mediated Communication	JCMC
Journal of Consumer Research	JCR
Journal of Geophysical Research-Atmospheres	JGRA
Journal of Information Science	JIS
Journal of Management Information Systems	JMIS
Journal of Marketing	JM
Journal of Marketing Research	JMR
Journal of Medical Internet Research	JMIR
Journal of Organizational Computing and Electronic Commerce	JOCEC
Journal of Personality and Social Psychology	JPSP
Journal of Strategic Information Systems	JSIS
Journal of the American Society for Information Science and Technology	JASIST
Management Science	MSCI
Media Culture & Society	MCS
MIS Quarterly	MISQ
New Media & Society	NMS
Online Information Review	OIR
Organization Science	OSCI
Physica A-Statistical Mechanics and its Applications	PASMA
Research Policy	RP
Social Science Computer Review	SSCR
Wirtschaftsinformatik	WIR