Knowledge sharing in communities of practice : examining usefulness of knowledge from discussion forums versus repositories

Boh, Wai Fong

2014

Boh, W. F. (2014). Knowledge sharing in communities of practice : examining usefulness of knowledge from discussion forums versus repositories. ACM SIGMIS Database, 45(2), 8-31.

<https://hdl.handle.net/10356/79551>

<https://doi.org/10.1145/2621906.2621908>

© 2014 ACM. This is the author created version of a work that has been peer reviewed and accepted for publication by ACM SIGMIS Database, ACM. It incorporates referee's comments but changes resulting from the publishing process, such as copyediting, structural formatting, may not be reflected in this document. The published version is available at: [<http://dx.doi.org/10.1145/2621906.2621908>].

Downloaded on 26 Apr 2023 15:13:46 SGT

**KNOWLEDGE SHARING IN COMMUNITIES OF PRACTICE: EXAMINING USEFULNESS
OF KNOWLEDGE FROM DISCUSSION FORUMS VERSUS REPOSITORIES**

Wai Fong Boh*
Nanyang Technological University
Nanyang Business School
S3-B2A-14
Nanyang Avenue
Singapore 639798
Singapore
Email: awfboh@ntu.edu.sg
Tel : (65) 6790-6196
Fax : (65) 6792-4217

Forthcoming in The DATA BASE for Advances in Information Systems.

Note: I gratefully acknowledge Nanyang Technological University for their financial support of this project.

KNOWLEDGE SHARING IN COMMUNITIES OF PRACTICE: EXAMINING USEFULNESS OF KNOWLEDGE FROM DISCUSSION FORUMS VERSUS REPOSITORIES

Abstract

With the prevalent use of virtual Communities of Practice (CoPs) in organizations to link networks of individuals located in disparate geographical areas, information communication technologies (ICTs) take on a crucial role in supporting CoPs. In this paper, I examine the role that ICTs play in supporting knowledge sharing in virtual CoPs. In particular, I examine the use of two key types of ICTs – knowledge repositories and online discussion forums. Based on the perceived cost of using these two types of ICTs, I theorize about how various factors would differ in their influence on knowledge sourcing from knowledge repositories and from online discussion forums. Two event-driven surveys were conducted with members of a CoP in a consulting firm to test the hypotheses. The surveys were conducted when CoP members downloaded documents from the knowledge repository and when CoP members posted inquiries and received responses in an online discussion forum. The results of the event-driven surveys partially support the hypotheses and show the importance of understanding the perceived costs of using the ICT to support knowledge reuse when we study knowledge sharing in virtual CoPs and in other settings that depend significantly on technological tools for knowledge sharing.

Keywords: Knowledge management, Repositories, Online Discussion Forums

INTRODUCTION

There is much practical and theoretical interest in how organizations can make use of communities of practice to more effectively manage, organize and integrate knowledge across groups of people who have common interests and work in the same topic area. A community of practice (CoP) is a group whose members regularly engage in sharing and learning from one another, based on their common interests (Lave & Wenger, 1991, p. 115). The idea of CoP brings together the notion of learning through practice, by having members of a CoP share their experiences and knowledge that they have gained through practice with others who are in a similar practice and who can benefit from this set of experiences and knowledge (Brown & Duguid, 1991; Lave & Wenger, 1991). Much research on CoPs focuses on learning in intimate groups that meet face-to-face. For example, Orr (1990) focuses on technicians who meet over meals to share and generate new insights into how they handle the repairs of Xerox machines (Brown & Duguid, 1991) and Wenger (1998) examined co-located insurance administrators. However, much modern work interaction occurs virtually between individuals located in disparate geographical areas who may never meet face-to-face. In these situations, information communication technology (ICT) takes on a crucial role in supporting knowledge sharing in CoPs (Brown & Duguid, 1991).

Prior studies have extensively discussed the types of ICT that can be used to support knowledge sharing in virtual CoPs (e.g., Alavi & Leidner, 2001), including knowledge repositories, expertise directories, and online discussion forums. There has, however, been little empirical research comparing how different types of ICTs are effectively utilized for knowledge sharing (See Gray & Meister, 2006 for an exception). To effectively examine the role of ICT in facilitating knowledge sharing, I study two types of ICTs frequently used to support knowledge

sharing in virtual CoPs: knowledge repositories and online discussion forums. Knowledge repositories refer to information technology (IT) systems that store codified knowledge so that other employees can search and retrieve this knowledge for reuse (Markus, 2001). Well-known examples of knowledge repositories include Xerox's Eureka system, which provides technical tips to its service engineers for servicing photocopier machines (Kankanhalli, Tanudidjaja, Sutanto, & Tan, 2003) and Accenture's knowledge management system for storing documents and outputs from prior consulting engagements. Online discussion forums refer to interactive forums online used to enable users to store inquiries and questions so that others can respond to the inquiries. All comments would be stored in threaded conversational sequences. A well-known example of the use of online discussion forums is the Buckman Laboratories, which has enabled Buckman to evolve from merely selling products to solving customers' chemical treatment problems (Alavi, Kayworth, & Leidner, 2005).

By explicating the costs associated with knowledge seeking via knowledge repositories and online forums, and highlighting their key differences, I theorize about how the differences in perceived costs of seeking knowledge via these two types of ICTs affect the effectiveness with which CoP members use these ICTs to share knowledge. Much of the KM literature has focused on supply-side arguments (Gray & Meister, 2004; Ma & Agarwal, 2007), for both knowledge repositories (Kankanhalli, Tan, & Wei, 2005b) and discussion forums (Wasko & Faraj, 2005). There has, however, been increasing recognition that it is also important to examine the demand-side – examining what facilitates knowledge seeking (e.g., Bock, Kankanhalli, & Sharma, 2006; Cross & Borgatti, 2004; Cross & Sproull, 2004; Gray & Meister, 2004; Teigland & Wasko, 2009). This study thus adds to this latter body of work, by focusing on the demand for

knowledge in CoPs by examining how CoP members source for and reuse knowledge from others through knowledge repositories and online discussion forums.

In particular, this study examines the purposeful use of both knowledge repositories and online discussion forums in CoPs as alternative knowledge sources when individuals conducting knowledge work are looking for specific types of knowledge to solve a problem on-hand. When individuals are faced with a problem and they would like to access knowledge provided by other members of a CoP, they can access various sources of knowledge: access experts directly, download documents from a knowledge repository, or post inquiries in an online discussion forum. Both the use of knowledge repositories and online discussion forums represent uses of ICTs supporting knowledge sharing. Hence, I examine the use of these two sources of knowledge. Prior research has shown that the key benefit that individuals derive from knowledge seeking is the utility derived from solving a problem on hand (Phang, Kankanhalli, & Sabherwal, 2009). I thus focus on comparing the use of knowledge repositories and online discussion forums at the point when a person has a problem and has tried to use either the knowledge repository or online discussion forum to solve their problem. I examine the relative importance of various factors that would influence the perceived usefulness of knowledge retrieved from both knowledge sources. Such a narrow definition of the problem statement allows for more effective comparison between the two types of ICTs as sources of knowledge, as the use of ICTs for other purposes (e.g. for scanning a knowledge domain to obtain a wide scope of knowledge) or in different phases of a work project (e.g. initial exploratory phase) may be substantially different (Hansen, Mors, & Lovas, 2005).

The research question of which ICT would be chosen as a source for knowledge when individuals are faced with a problem is similar to the media choice problem that has been well

studied in the literature (Daft & Lengel, 1986). Media choice studies tend to examine the problem of which media (face to face or email, for example) will be chosen when managers want to communicate with a specific other party for collaboration purpose. The richness of the media, or the media's capacity to transmit a large amount of information to change the receiver's understanding within a short time interval (Robert & Dennis, 2005), influences media choice depending on the ambiguity of messages to be transmitted (Daft, Lengel, & Trevino, 1987). The ability of the media to convey the psychological perception that other people are physically present has also been argued to be more important for social tasks such as relationship building (Short, Williams, & Christie, 1976). This paper, however, focuses on a knowledge sourcing perspective, and examines how the ICT choice as a source of knowledge influences the usefulness of the knowledge sourced. From this perspective, collaboration with a specific individual is not the objective, but location of the relevant knowledge source with potential solutions to a problem is the key issue. Hence, the media richness and social presence theories highlighted in media sourcing studies are not applicable in the comparison of these two ICTs.

Instead, this paper identifies the perceived costs associated with the use of the two types of ICTs to seek knowledge. The ability to seek and access knowledge embedded in other parts of the organization has significant benefits in helping individuals perform better in their work (Hansen, 2002). Knowledge seeking, however, is not costless (Bock et al., 2006). This paper highlights two key dimensions of perceived costs that individuals face when seeking knowledge via repositories and online forums – namely, the cognitive difficulties involved in reusing knowledge and the evaluation apprehension from openly admitting ignorance on a specific topic. Cognitive difficulties involved in using repositories may arise from the search costs in locating relevant knowledge (Gray & Durcikova, 2005; Huang, Wang, & Seidmann, 2007), costs of

filtering the appropriate knowledge and interpreting and applying the knowledge to the problem (Schultze & Vandenbosch, 1998). Evaluation apprehension, on the other hand, refers to the anxiety and concern over the undesired impression that may be projected through the act of seeking knowledge from others (Bordia, Irmer, & Abusah, 2006; Menon & Pfeffer, 2003). As noted by Lee (1997, p. 336), “individuals do not seek help, even when help is needed and available, because help seeking implies incompetence and dependence”. Based on these two types of perceived costs and how they differ for the two ICTs, I make hypotheses about how various factors influence the usefulness of knowledge obtained using the two ICTs. This paper thus contributes to the literature by examining how the perceived costs of using different ICTs for knowledge seeking may influence ICT choice from a knowledge sourcing perspective.

The rest of the paper is organized as follows. The paper begins with a review of two key dimensions of perceived costs for knowledge seeking that differentiate a knowledge repository from an online discussion forum. Szulanski (1996) and Argote’s (1999) framework on factors affecting knowledge transfer is then used to identify the key independent variables of the research model and to hypothesize about how each factor affects the usefulness of the knowledge obtained for users of knowledge repositories and online discussion forums. To test the research model, two event-driven surveys were conducted with members of a CoP – when CoP members downloaded documents from a knowledge repository and when CoP members posted inquiries and received responses on an online discussion forum. The research methodology is discussed and finally, the results of the survey study are presented and the main research findings and implications are discussed.

Perceived Costs of Using Knowledge Repositories and Online Discussion Forums for Knowledge Seeking

Prior literature identified three key knowledge sources: (1) informal network, where the knowledge seeker approaches his informal network and communicates directly with a single knowledge provider; (2) knowledge repository, where the knowledge provider codifies and stores knowledge and publishes them in a repository so that the knowledge can be accessed by many knowledge seekers; and (3) online discussion forums, where knowledge is exchanged amongst multiple seekers and multiple knowledge providers in an open venue (Gray & Meister, 2006). Since the objective of this paper is to examine the key ICTs used to support knowledge sharing in virtual CoPs, I compare the search, retrieval and use of knowledge embedded in documents stored in knowledge repositories, with the use of responses from inquiries posted in online discussion forums. Both knowledge repositories and online discussion forums support knowledge sharing in distinct ways. Online discussion forums, for example, provide a place to meet (although asynchronously). Knowledge repositories, on the other hand, provide a database to store content and documents, thus providing an organizational memory for employees (Kankanhalli et al., 2005b).

One key difference in the perceived costs of using knowledge repositories and online discussion forums for knowledge seeking is the amount of cognitive processing required on the part of the knowledge seeker. The amount of cognitive processing refers to the effort required by individuals to engage in the process of searching, selecting, sorting and organizing information and decision making (Schultze & Vandenbosch, 1998). The amount of cognitive processing is especially high to reuse knowledge from unstructured repositories, or repositories that store knowledge that has only been articulated, captured and stored, but not systematically structured

to facilitate reuse (Huber, 2001; Markus, 2001). This refers to knowledge repositories that store passive by-products of work processes, such as presentations and reports that were generated for project clients as part of the process of completing project work. In contrast, knowledge that has been structured for reuse would be cleaned, polished, formatted by adding context, deleting context, filtering and condensing content and developing classification schemes to aid in the search process (Markus, 2001). Given that the requirement to “codify” and systematically structure knowledge to enable its reuse can be extremely onerous on the part of the knowledge contributor, many organizations are increasingly storing and reusing knowledge that may not have been created for reuse. This creates more difficulties on the part of the re-user, as these documents are not explicitly created to facilitate reuse, and may not systematically explain all aspects of the knowledge to be transferred. Thus, the amount of cognitive processing required by a user of a knowledge repository can be high.

Several studies have highlighted the cognitive difficulties in using knowledge repositories. Firstly, it is a non-trivial problem to match users to documents, because users cannot easily identify appropriate documents for their needs, and are likely to experience problems in finding relevant documents, especially in the absence of “near-perfect” search engines (Hansen & Haas, 2001, p. 2). Lee and Thomas (2008) found that consultants in a global IT services firm perceived high time cost to searching and retrieving the relevant information from the knowledge repository. Furthermore, individuals need to sort through and interpret the information available. The lack of contextual knowledge makes it difficult to interpret the documents (Markus, 2001) from the database. In a repository, where people tend to dump their ideas without prioritizing them, and when there is incomplete information, individuals tend to have to use more processing capacity to

“build a coherent world out of incomplete and unconnected details” (Schultze & Vandenbosch, 1998, p. 134).

On the other hand, posting inquiries in a discussion forum allows individuals to pose specific questions that are directly relevant to the knowledge seeker’s concern. This allows the information generated to be immediately applicable to the individual’s task, thus providing more control over the information generated (Schultze & Vandenbosch, 1998). If users phrase their inquiries clearly, including contextual information and ask very specific questions, knowledge providers would be able to provide specific responses to the queries, taking into consideration the context of the problem. This thus “creates a funnel through which information that is immediately applicable to an individual’s task can be channeled” (Schultze & Vandenbosch, 1998, p. 135).

Another key characteristic distinguishing the perceived costs of using knowledge repositories and online discussion forums for knowledge seeking is the extent to which knowledge seeking will cause evaluation apprehension on the part of the knowledge seekers. Evaluation apprehension refers to a person’s anxiety or concern about how s/he may be evaluated negatively by others (Bordia et al., 2006). Knowledge seeking from others often entails an acknowledgement of one’s deficiency in knowledge in one or more aspects, thus causing anxiety and concern over the undesired impression that may be projected through the act of seeking knowledge from others (Bordia et al., 2006; Menon & Pfeffer, 2003). Prior research has shown that help seeking can be perceived to imply incompetence and dependence (Lee, 1997).

Knowledge seeking via discussion forums is especially susceptible to evaluation apprehension, as individuals have to openly admit ignorance on a given topic area to all individuals in the discussion forum (Borgatti & Cross, 2003). Ardichvili, Page, and Wentling (2003, p. 70) found that “many users fear possible criticism or ridicule of what they might post”

when they share knowledge in virtual CoPs. This applies not only to responses that users provide to others' questions, but also to the questions that users post on the online forums as well.

Knowledge seeking via repositories, on the other hand, does not entail observable dependence upon others, or admission of one's ignorance on a topic area, since searches in repositories can be done anonymously and in private.

THEORY AND HYPOTHESES

Based on the perceived costs of using knowledge repositories and online discussion forums for knowledge seeking, I generate hypotheses comparing the usefulness of knowledge sought from these two sources in virtual CoPs. Markus (2001) distinguished between knowledge creation (e.g. research or new product development) and knowledge reuse (e.g. sharing best practices or helping other solve common technical problems). She noted that knowledge reuse is a key concern of organizations, and is clearly related to organizational effectiveness, but there is a lack of understanding of knowledge reuse. This paper thus focuses on factors that affect the usefulness of knowledge retrieved for reuse from knowledge repositories versus discussion forums. Prior research suggests that four sets of factors are likely to affect the ease with which knowledge is transferred (Argote, 1999; Szulanski, 1996). These include: (1) characteristics of the person seeking knowledge, (2) characteristics of the person providing the knowledge, (3) characteristics of the knowledge transferred, and (4) characteristics of the relationship between the source and knowledge seeker. The four sets of factors identified in this framework have been used for studying knowledge transfer between organizational units. However, these four sets of factors are highly applicable in guiding this study, as this study focuses on the knowledge sourcing aspect of a knowledge sharing problem. Boh (2008) has also shown the usefulness of this framework in predicting knowledge reuse from knowledge repositories, but found that characteristics of the

knowledge provider had limited impact on knowledge reuse in large communities based in organizations. This is because the size of the community made it difficult for the CoP members to know one another and establish the credibility of the source, especially if the tool did not provide statistics illustrating the frequency of posting by the knowledge source. Moreover, prior research has shown that characteristics of the knowledge source such as trust in the source's competence might not be as critical for explicit knowledge compared to tacit knowledge, as the knowledge has been codified and can be understood apart from the source competence (Levin & Cross, 2004). As our study examines the use of knowledge codified in repositories and online discussion forums of a large community of practice (with more than 5000 members), this study does not consider the characteristics of the knowledge provider but instead, focuses on the three other factors.

Characteristics of Knowledge Seeker

The familiarity of the user with the knowledge domain is expected to play a key role in affecting knowledge reuse. However, the knowledge seeker's familiarity with the domain is expected to play a different role in the use of knowledge from knowledge repositories compared to online forums.

Due to the relatively higher extent of cognitive information processing required for using knowledge from knowledge repositories, the familiarity of the user with the domain area will not only assist in the search process of the knowledge seeker, but will also help users to understand and effectively apply the information and knowledge conveyed in the document downloaded from the repository. Knowledge from repositories often does not exactly fit the knowledge seeker's question, but must be adapted to his/her situation. Adapting such knowledge is a skill contingent on the seeker's familiarity with the problem domain. Prior research has found that individuals' prior knowledge significantly improves individual's search performance (Barrick &

Spilker, 2003). There are two ways familiarity with the domain facilitates the search process (Gray & Meister, 2006). First, a search query retrieves information that can be relevant or irrelevant to the search. Knowledge about the domain helps the knowledge seeker filter and discard irrelevant knowledge. Second, a knowledge seeker often queries a repository with search terms. Knowledge seekers more familiar with the knowledge domain will be able to use more appropriate search terms to obtain the relevant documents.

Potentially relevant information obtained from a database must be adapted to the problem faced by the seeker. Seekers familiar with the domain can accurately relate the facts of the problem they are facing with potentially relevant information they found. Familiarity with the domain influences the user's ability to effectively assimilate information and knowledge conveyed in a document downloaded from a repository (Cohen & Levinthal, 1990; Szulanski, 1996). From studies on individual learning, we know that new skills are more quickly learned the more they share elements with already acquired knowledge (Brucks, 1985). In reusing knowledge from documents downloaded from a repository, users may not be able to obtain all relevant aspects of the knowledge from the documents that they are trying to reuse. With familiarity in a domain, users will better understand the missing pieces of information in a document. Knowledge about the domain will enable users to decode and interpret the information embedded in documents and make the appropriate assumptions to assimilate and apply the knowledge to their problem context (Carlson & Zmud, 1999). Higher levels of users' prior knowledge and comprehension increase the quantity and depth of issue-relevant thoughts that occur to them, and their ability to understand them, thus improving the users' ability to effectively assimilate and reuse the relevant knowledge embedded in the document.

Similarly, individuals who are more experienced with a topic about which they are communicating will be better able to decipher the meanings behind the messages provided by communication partner (Carlson & Zmud, 1999). Hence, familiarity in the domain is also expected to be useful for reusing knowledge obtained via inquiries posted on discussion forums, but this paper proposes that it will be less important than for reusing knowledge from repositories. This is because as noted earlier, posting inquiries in a discussion forum provides more control to the knowledge seekers, as they are able to pose specific questions that generate information and knowledge that directly applicable to their question (Schultze & Vandenbosch, 1998). This ability to personalize the information obtained (Wickramasinghe, 2002) imply a lower level of cognitive information processing cost, which implies that the importance of prior knowledge for the search and understanding of information is expected to play a significantly less important role in the use of responses to one's knowledge inquiries. Hence:

H1: In a Virtual Community of Practice, the familiarity of knowledge seekers with the knowledge domain area will be more significantly associated with the usefulness of knowledge obtained from the knowledge repository than from the online forums.

Characteristics of Relationship between Knowledge Seeker and Provider

CoPs bring together communities of users who have a common interest. Hence, members of a CoP may not necessarily be in the same occupation, but they may be of diverse occupations. Bechky (2003) highlighted that members of the same occupation tend to have the same set of perspectives, as they specialize in a specific set of tasks. They also tend to share the same set of technical vocabulary, which serves as a shared code for facilitating a common understanding and an overlapping base of knowledge (Chiu, Hsu, & Wang, 2006). Sharing knowledge across people of different occupations can thus be a challenge, due to the diverse experiences, training and

vocabulary (Bechky, 2003). Due to the higher level of cognitive processing required for reuse from the repository, both the knowledge seeker and knowledge provider need a requisite level of shared knowledge for the knowledge seeker to effectively adapt the knowledge retrieved from repositories. The level of shared understanding between the knowledge provider and knowledge seeker is likely to play a significant role in enabling the knowledge seeker to understand and effectively make use of the document s/he retrieved from the knowledge repository (Hislop, 2002). Sharing experiences and training renders messages more meaningful and less discussion is required to support the knowledge exchange (Orlikowski, 1993). There would be less need to communicate details about a particular solution, as a common perspective would be available between the source and knowledge seeker (Mennecke & Valacich, 1998). When users reuse documents authored by someone with similar training and experience, the user will be better able to understand and appreciate the knowledge documented in the document. As a result, users are more likely to effectively reuse the documents downloaded from the repository.

On the other hand, due to apprehension of how they may be evaluated and perceived by the community, users of online forums are likely to put significant thought to questions that they post on discussion forums. Posting questions with simple and straightforward answers that can easily be determined with some research and diligence may put the knowledge seeker in a bad light. Hence, users of online forums are more likely to post questions that do not have straightforward answers. They thus are more likely to seek access to more innovative advice that they have not been previously exposed to. Hence, a key purpose of using online forums is to access a broad range of perspectives and increase the diversity of viewpoints, thus stimulating individuals to develop more novel solutions (Nemeth, 1986). Teigland and Wasko (2003) also showed that boundary spanning communication and decreased reliance on coworkers that had similar perspectives as the knowledge

seeker, as knowledge sources improved the creativity of the knowledge seekers. Individuals who post inquiries on online forums would thus potentially benefit more from responses of individuals who are of different training and experience. Prior research has shown that cognitive distance between individuals can be helpful in ensuring that solution to a problem can be found (Sharratt & Usoro, 2003). As highlighted by Leonard-Barton (1995), such “creative abrasion” enables new perspectives to be realized and novel solutions to be obtained. People with similar training and experience will tend to have similar perspectives while people exposed to a different set of training and experiences can bring with them comparative experiences and new perspectives that can be particularly valuable for bringing for the knowledge seeker. Hence, I hypothesize:

H2a: In a Virtual Community of Practice, knowledge obtained from the knowledge repository contributed by a knowledge provider with similar training and experiences is likely to be more useful than by that contributed by a knowledge provider with dissimilar training and experiences.

H2b: In a Virtual Community of Practice, knowledge obtained from an online discussion forum contributed by a knowledge provider with dissimilar training and experiences is likely to be more useful than by that contributed by a knowledge provider with similar training and experiences.

Characteristics of the Knowledge Sourced

Two dimensions of knowledge have been highlighted in the literature to influence knowledge sharing: knowledge tacitness and knowledge complexity (Garud & Nayyar, 1994; Hansen, 1999; Ranft & Lord, 2002; Zander & Kogut, 1995). Knowledge tacitness refers to the extent to which knowledge can be articulated and made explicit. It is particularly relevant when examining knowledge sharing via personalization (Hansen, Nohria, & Tierney, 1999), and not

through the use of any type of ICT (e.g., Hansen et al., 2005; Reagans & McEvily, 2003). Prior studies have also noted knowledge tacitness, in particular, influences whether people go to explicit sources of knowledge (e.g. databases, online discussion forums) or use interpersonal sources of knowledge when seeking for knowledge (Levin & Cross, 2004; Su & Contractor, 2011). This study, however, focuses on the use of ICTs to support knowledge sharing; hence, the type of knowledge that is sought is inevitably explicit rather than tacit in nature, as the knowledge seeker makes use of ICT which requires both knowledge seeker and knowledge provider to explicate the knowledge to be shared. As all knowledge sought is explicit in nature, this dimension of knowledge is not relevant in this study.

Next to knowledge tacitness, the other most important dimension of knowledge studied is knowledge complexity (Garud, Jain, & Kumaraswamy, 2002; Hansen, 1999; Simonin, 1999; Zander & Kogut, 1995). Knowledge complexity refers to the extent to which the knowledge transferred is difficult to understand, and requires more information to describe the idea or information transmitted (Blandin & Brown, 1977; Goodman & Darr, 1998). Generally, knowledge complexity is also related to the extent to which the knowledge draws on ideas and information in different domains (Garud & Nayyar, 1994). This study thus examines this dimension of knowledge – complexity, as it has been highlighted as an important dimension of the knowledge affecting knowledge sharing (Argote, 1999; Su & Contractor, 2011).

Complexity of knowledge embedded in documents can play a significant deterrent role in influencing the ability of users to understand and reuse knowledge from repositories. A document embedding complex knowledge means that deep and broad competencies are required to understand and process the information obtained from the document (Su & Contractor, 2011). The more complex the knowledge, the more difficult it is to reuse, because users would need an

understanding of many different areas in order to assimilate and reuse the knowledge (Wood, 2009; Zander & Kogut, 1995). Users would also need to understand how the different areas relate when the information crosses domain boundaries. On the part of the author, it also becomes more difficult to compose a complex piece of document such that all the information is complete so that another person can understand it. Gaps between information needed and information available tend to arise in this situation (Garud & Nayyar, 1994).

Given the steeper learning curve associated with reusing complex documents, users would be more likely to find it difficult to use the knowledge embedded in the document. Similarly, for users of online forums, the greater the complexity of knowledge required to respond to the inquiry, the less likely others will be able to respond to the inquiry. Users will find it more difficult to obtain and use responses to such inquiries. Hence, I hypothesize:

H3: In a Virtual Community of Practice, the greater the complexity of knowledge, the less useful the knowledge obtained from both the knowledge repository and the online forum.

CoPs facilitate knowledge transfer by setting up connections between individuals to enable easy communication between them (Ba, 2001; Hsu, Ju, Yen, & Chang, 2007). The online forum provides the venue for people with different types of expertise to meet, and helps to match knowledge seekers with potential knowledge providers. The response of the knowledge provider to the inquiry of a knowledge seeker creates a connection between the two individuals, and they can subsequently follow-up with one another. When individuals subsequently follow-up with each other and engage in further discussions, they are more likely to share a greater amount of knowledge and the knowledge seeker is more likely to benefit from these discussions, especially for complex inquiries.

Similarly, knowledge repositories help to create linkages as it not only allows individuals access to the knowledge codified by a knowledge provider, but it also provides the opportunity for individuals to further follow-up with and contact the knowledge provider for further clarification, and discussion. Knowledge seekers who capitalize on this opportunity to create a direct linkage with the knowledge providers offered by the CoP will be better able to benefit from the use of the knowledge repository (Boh, 2008). Sharing knowledge by interacting directly with the knowledge provider provides different advantages compared to knowledge sharing via documents (Hansen & Haas, 2001). While documents provide an effective way to efficiently transfer large amounts of detailed information (Stein & Zwass, 1995), the ability to interact directly with the knowledge provider is effective for creating a better understanding of a problem and suggesting alternatives for consideration (Hansen & Haas, 2001). This is especially useful in the case where knowledge seekers are trying to reuse knowledge that is highly complex. In such a case, knowledge seekers who create a direct linkage with the knowledge provider by seeking assistance from the authors of the documents they are seeking to reuse obtain in-depth information and explanations about the context surrounding its use, and they can seek clarifications and advice that are tailored to their specific situations. As a result, they are better able to appreciate the knowledge embedded in the document and make effective use of it. Hence:

H4: In a Virtual Community of Practice, complex knowledge obtained from both the knowledge repository and the online forum is likely to be more useful when the knowledge seeker establishes linkages and follow up with the knowledge provider, than when the knowledge seeker does not establish a linkage with the knowledge provider.

Based on the above hypotheses, an overall research model is generated for the sourcing of knowledge from knowledge repositories and from posting inquiries in online discussion forums and illustrated in Figures 1A and 1B respectively.

Insert Figures 1A and 1B about Here

RESEARCH METHODOLOGY

To test the research models and the above hypotheses, I examined how a large, geographically dispersed CoP in a big consulting firm, Consulting Inc. (a pseudonym), made use of ICT to effectively share knowledge with one another. Consulting Inc. does management and technical consulting work for other organizations. Examples of organizations in this industry include Accenture, Computer Sciences Corporation, IBM Global Services, and Electronic Data Systems. The organization has more than 50,000 employees distributed in several countries and in different locations within the U.S. Many consultants work remotely at the clients' site, travel from one office to another or work from home.

Consulting Inc. is an appropriate setting to study knowledge sharing. Like other professional service and technical organizations, consulting firms often regard knowledge as an essential resource because they are in the business of selling their expertise and knowledge (Maister, 1993; Prahalad & Ramaswamy, 2004). It is important for consulting firms not only to have knowledge resources, but also to ensure that they effectively share and utilize the knowledge resources possessed by their employees (Brown & Duguid, 1998; Lowendahl, Revang, & Fosstenlokken, 2001). Projects are often the major business endeavor and the normal mechanism for executing new business opportunities for consulting firms (Hobday, 2000). The potential for knowledge sharing across projects is high as common problems may be encountered across different projects, and effective sharing of knowledge across projects can reduce the organizational costs of

duplicating efforts to invent the same solutions (Goodman & Darr, 1998). Employees also tend to be geographically distributed because of the need for the consultants to work closely with clients, sometimes at client premises. Hence, consulting firms have to ensure adequate sharing of knowledge not only across projects, but also across geography.

Consulting Inc. has adopted CoPs as a key way to overcome the problems related to knowledge sharing across projects, time, and geographical boundaries. They established more than fifty CoPs, or what they termed as “knowledge networks.” Each CoP focuses on a different area of practice. Examples include CoPs for testing methods and practices, for enterprise systems management, and for networking and connectivity. Each CoP is run by a core team, who has the responsibility of organizing activities and obtaining resources to provide support for the CoP. Common ways of sharing knowledge in CoPs in Consulting Inc. include having online discussion forums, knowledge repositories, regular conference calls, and newsletters. The core team also has content management responsibility for managing the documents and contributions in their knowledge repository, which include reviewing potential contributions, encouraging contributions, and publicizing contributions, but does not include polishing and editing contributions to make them easier to reuse.

I studied in-depth one of the CoPs in Consulting Inc., which focuses on issues surrounding the development and implementation of a product produced by Consulting Inc. (System Web). This CoP (Pseudonym - Community Web) is sponsored by the management executives of Consulting Inc. The community has two full-time staff members who provide support for various activities (e.g., supporting the infrastructure for the repositories, moderating forums, publishing newsletters, organizing conference calls and presentations, etc.). The purpose of the community is to facilitate knowledge sharing across the community of System Web practitioners and to promote

a reuse program designed to provide information to those seeking support for development, administration, design, and architecture issues related to System Web.

Community Web was chosen for several reasons. First, the CoP was a large and geographically dispersed CoP that had a growing membership base and many active members. Membership in this community had steadily increased since it was established two years prior to the start of this study. At the time of this study it had 5,610 members, 58% of whom were located in the United States. Second, Community Web had members of different job types. There were: (1) consultants and project managers who helped clients to manage, install, and maintain System Web; (2) developers and IT architects who continually developed and designed new versions of System Web; (3) IT specialists and support staff who helped to trouble shoot issues related to the implementation and maintenance of System Web; and (4) sales staff who promoted the sale of System Web. This is unlike other CoPs which involved members of only one job type (e.g. project managers), and thus provides an interesting setting to examine how a CoP can assist in knowledge sharing across members who are interested in the same product, but have different responsibilities relating to this product. Finally, this CoP provides two main venues for knowledge seekers to source for knowledge or information when they are faced with a problem: a knowledge repository, and an online discussion forum. The repository stores two main types of documents: lessons learned (documents that describe experiences and solutions to non-trivial issues) and reusable assets (e.g., components, utility classes, object models, functional solutions for common problems, architectures, and designs). At the time of this study, the community had about 220 reusable assets and 310 lessons learned published in its repository. The online discussion forum, on the other hand, has been active over the years. The average number of inquiries per month was

139 for the year prior to the start of this study, and the average number of responses received per month was 183 for the same period.

Response Rates and Sample Characteristics

To effectively test the hypotheses, I conducted two event-driven surveys. For the knowledge repository, a survey was sent to each participant every time s/he downloaded a document from the repository. For the online discussion forum, a survey was sent to each participant every time s/he posted a knowledge inquiry on the online discussion forum, and received at least one response to the query. Due to privacy concerns in the organization, however, only those individuals who had indicated that they were open to being contacted by the community leaders (when they joined the community) were allowed to be contacted for surveys. Hence, only those who met this requirement were invited to participate in the survey.

Repository Survey. Consulting Inc. invested in a centralized repository, where individuals would deposit the knowledge artifacts created while completing consulting engagements and projects. The repository provided examples of customer projects, and stored prior proposals, work products (e.g., project deliverables) and solutions discovered for problems that were encountered in projects for reuse. Hence, the repository stored documents that have not been systematically structured for reuse. Data were collected over a four-week period. During this period, 651 people downloaded documents from the repository; 295 of them were sent invitations to participate in this study. No significant differences were found in the job types, number of downloads, and characteristics of the documents downloaded for the people invited versus those who were not invited to participate. Within two weeks after individuals downloaded the documents from the repository, I sent them a web-based survey that asked them about the document they downloaded and how they made use of it. The web survey was provided to each respondent, listing the

documents that they downloaded in the past two weeks. A response rate of 42% was obtained for this survey, and there were no significant differences between the characteristics of respondents and non-respondents.

Of the 121 respondents, 90 downloaded only one article during the research period and 31 downloaded more than one article. In the latter case, respondents were asked to identify the document that was the most useful and respond to the survey based on that document. I asked respondents to choose the most useful document because it would be the one for which they spent the most time on and would be able to provide the most accurate responses. There was no significant difference in the usefulness ratings by the individuals who made one download compared to those who made more than one document download ($t = 0.137$, $p = 0.891$). Because I was interested in how individuals reused knowledge for problems they were facing in current projects, I focused on the 103 responses that indicated that the document was downloaded for use in a project. The other survey respondents had downloaded the documents mainly to learn more about a topic area described in the document.

Online Discussion Forum Survey. Data were collected over a four-month period.¹ During this period, 271 people posted 566 knowledge inquiries in the online discussion forum. Invitations were only sent to the individual the first time s/he posted an inquiry during this four-month period, as I did not want to over-tax the respondent. For the same reason, I avoided sending the online forum survey to the respondents who had responded to the repository survey. The invitation was only sent to individuals who received at least one response to their inquiry. The survey sample, on average, received 2.36 responses to their inquiries. For those who

¹ A longer research period was required for the online forum survey, as there were not as many people posting inquiries compared to the number of people downloading documents from the repository. The research period was extended sufficiently long to obtain a sample size comparable to the repository survey.

responded to the survey, they received, on average, 2.42 responses to their inquiries, and there are no significant differences between this number for the respondents and non-respondents of the survey. In total, 253 invitations were sent, and 92 responses were received, providing a 36% response rate. Within two weeks after individuals posted the knowledge inquiry, I sent them a web-based survey that asked them about the responses they received from the knowledge inquiry and how the responses had helped them. The web survey for each respondent listed the subject line of the knowledge inquiry they had posted. There were no significant differences in the job types and number of responses received for the knowledge inquiry between the respondents and non-respondents. There were also no significant differences in the usefulness ratings for early versus late respondents.

Operationalization of Constructs

This section describes the measures used to operationalize the constructs involved in testing the research models for both the repository survey and the online forum survey. To generate the measures for the survey, the author conducted a series of semi-structured telephone interviews with consultants in different cities in the United States. Five knowledge management staff supporting the centralized repository were first interviewed to gain an overview of the context and use of the electronic repository. Based on their recommendations, thirty-four consultants were contacted and invited for phone interviews, and 25 responded (providing a response rate of 73.5%). Most measures were based on existing measures from the literature; but for some constructs where directly applicable measures cannot be found, measures were generated based on the insights from the phone interviews. Appendix A provides details of the measures used.

Document/ Inquiry Response Usefulness. To determine if practitioners found the downloaded document or response to their inquiry useful and were able to use the information in it, I asked respondents to indicate if the downloaded document or their inquiry prevented the respondent from making the same mistakes others made, saved time on the project, and increased customer satisfaction. These three items were self generated from the interview findings by probing interviewees for different ways that reusing knowledge helped community members. In addition, drawing upon Constant et al. (1996), I measured the perceived usefulness of the document or response by asking respondents to rate its usefulness.

Individual Domain Familiarity. I measured respondents' familiarity with the task domain by asking respondents to rate on a scale of one to five how familiar they were with the domain area described by the downloaded document or for the task that they sent the knowledge inquiry for. I also asked respondents how many years they had worked in that domain area (Heslin & Streufer, 1968).²

Similarity of Experience and Training. I operationalized the similarity of experience and training with the similarity in job type between the knowledge seeker and knowledge provider, as those individuals with a similar job type tend to have similar experiences and training (Bechky, 2003). The jobs of the employees participating in this community can be classified into seven types: consultant, developer, IT architect, IT specialist, project manager, sales personnel, and support staff. Two independent raters categorized the job type of each survey respondent and each knowledge provider based on their job titles and descriptions that were obtained from Consulting Inc.'s online organizational database. Inter-rater reliability was high (kappa=0.91 for repository,

² The scales for these two items were standardized to make them more comparable.

kappa = 0.89 for online forum). For each respondent, I compared his/her job type to the job type of the knowledge provider and coded for whether their job types were similar.

Knowledge Complexity. I measured the complexity of the downloaded document or the responses to the inquiry by asking respondents to rate the following items on a five-point Likert scale – the extent to which they believe that: (1) they would need to spend a lot of time to understand the document or to respond to the inquiry; (2) they would need to understand many different areas to make use of the document or to respond to the inquiry; and (3) they would easily be able to make use of the document or to respond to the inquiry. This measure of complexity was adapted from Gosain (2003).³

Follow-Up with Knowledge Provider. I asked respondents to indicate how many hours, if any, they spent following up with the knowledge provider. I also asked respondents to indicate if using the repository or posting the inquiry helped them to identify a critical expert who could provide advice and explanations. These two items were generated from insights gained during the interviews.

Other Control Variables. I controlled for three other factors in each analysis. To control for the prior relationship between the knowledge seeker and knowledge provider, I asked respondents how well they knew the knowledge provider. The scale for this question was adapted to this particular context and included the following options: (1) know him/her well, (2) have communicated with him/her before, (3) heard his/her name before, and (4) do not know

³ Of the 38 assets downloaded, 18 were rated by more than one respondent. To examine if there was a significant difference in using a document level rating of complexity (obtained by averaging all individual's rating of complexity for the same document) and individual level rating of complexity. This document-level measure of complexity correlates highly ($r = 0.92$, $p < .001$) with the complexity measure calculated from the complexity ratings for each respondent. This provides support for using the individual complexity ratings (by each respondent) rather than the average complexity rating for each document (averaged across all respondents who downloaded the same document).

him/her. I also controlled for the frequency with which respondents reused documents from the repository, and the frequency with which respondents participated in the online forum.

Content validity of the measures was qualitatively assessed through reviews by experts. Three experts who provide knowledge management support for Community Web reviewed the survey instrument before it was distributed to the subjects.

ANALYSIS AND RESULTS

Measurement Models

I used PLS, a latent structural equations modeling technique that utilizes a component-based approach to estimation (Agarwal & Karahanna, 2000; Bollen, 1989; Gefen, Straub, & Boudreau, 2000). The adequacy of the reflective measures was assessed by evaluating the convergent and discriminant validity of the constructs. Item reliability was assessed by examining the loading of the measures on their corresponding construct in PLS. A common rule of thumb in PLS analysis is that the loadings should be greater than 0.7, implying that the shared variance between a construct and measure is equal to or greater than that between the construct and error variance (Gray & Meister, 2004). The PLS loadings of the items, shown in Table 1 are greater than 0.7, except for one of the items measuring individual domain familiarity (loading = 0.629) and one of the items measuring the frequency of forum participation (loading = 0.584) for the repository survey. As pointed out by Fisher and Grégoire (2006, p. 323) and Duxbury and Higgins (1991), “this guideline is often relaxed in context of comparative studies to ensure that the same scales are used across different samples”. These measures are thus retained to ensure the consistency of scales across both the repository and online forum survey. As the items used in the survey involved different scales (ranging from dummy variables to likert scales and

continuous variables), those constructs using different scales were adjusted by standardizing to a Z-score before the PLS analysis was conducted (De Vaus, 2002).

Insert Table 1 about Here

The internal consistency of the scales and convergent validity is then assessed using composite reliability. This measure is similar to Cronbach's alpha, but is more appropriate for PLS models as it uses loadings generated by the structural equation model (Fisher & Grégoire, 2006). The composite reliability of all the multi-item constructs exceeded the 0.7 guideline suggested by Nunnally (1967).

Finally, the discriminant validity of the constructs was assessed by comparing the square root of the average variance extracted (AVE) for each construct to its correlation with other constructs. Tables 2A and 2B display the correlation analysis of the constructs used to test the hypotheses for the repository and discussion forum survey respectively. The highlighted diagonal cells are the square root of AVE and the off-diagonal cells are the correlations between constructs. The tables show that the values in the diagonal cells are higher than all the other cells in the same row, showing evidence of high discriminant validity for the constructs. In addition, the AVEs exceed 0.5, which indicates that at least 50% of the variance in indicators have been accounted for (Chin, 1998). An examination of the cross loadings using the PLS component based analysis (Gefen & Straub, 2005) was also conducted (See results in Appendix B), and it shows that all items load higher on the construct it is intended to measure than other constructs, indicating good discriminant validity.

Insert Tables 2A and 2B about Here

Structural Models and Test of Hypotheses

The hypotheses were tested by examining the size and significance of the path coefficients of the structural model in the PLS analysis. To test hypothesis 4, an interaction term was created consisting of the cross product of standardized construct scores for the three items measuring complexity and the two items measuring follow-up with knowledge providers, resulting in a six item measure of the interaction term (Chin, Marcolin, & Newsted, 2003). The results of the PLS model are displayed in Tables 3A and 3B and summarized in Figures 2A and 2B. To compare the path coefficients across the respondents for the repository survey and the online forum survey, an unpaired t test was conducted to determine the significance of the difference in path coefficients across the two sample (Duxbury & Higgins, 1991; Fisher & Grégoire, 2006).⁴

Insert Tables 3A and 3B, and Figures 2A and 2B About Here

The PLS results show that the knowledge seeker's familiarity with the domain was significantly related to the usefulness of the knowledge retrieved from repositories (Fig. 2A, PLS path coeff. = 0.222, $p < 0.05$), but was not significantly related to the usefulness of knowledge retrieved from online forums (Fig. 2B, PLS path coeff. = 0.078, $p > 0.10$). The t-test comparing the coefficient of the familiarity construct between the respondents of the repository and the online forum survey shows that the coefficients are significantly different ($t = 9.03$, $p < 0.001$), thus confirming Hypothesis 1.

The PLS results show that the similarity of job type between the knowledge seeker and knowledge provider is associated with higher usefulness ratings for users of the repository (Fig. 2A, PLS path coefficient=0.166, $p < 0.05$), but for online discussion forums, knowledge seekers

⁴ The formula used for the unpaired t-test was:
$$\frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

found that knowledge provided by those with dissimilar job types are more useful (Fig. 2B, PLS path coefficient=-0.322, $p<0.01$). The t-test comparing the coefficient of the job type between the respondents of the repository and the online forum survey shows that the coefficients are significantly different ($t = 36.32$, $p<0.001$), providing support for Hypotheses 2a and 2b.

Hypothesis 3, which stated that the more complex the knowledge, the more difficulty users would have in reusing the knowledge, however, was not supported for both repositories and online discussion forums. The PLS results show that knowledge complexity was not significantly related to the usefulness of knowledge retrieved from both the repository (Fig. 2A, PLS path coefficient=-0.146, $p>0.10$) and the online forum (Fig. 2B, PLS path coefficient=0.012, $p>0.10$).

Finally, the results show that following up with the knowledge provider helped users to obtain useful knowledge from both knowledge repositories and online discussion forums. Users of the online discussion forum who followed up with members of the CoP who responded to their inquiry found that the information they obtained to be more useful when their inquiries were highly complex (Fig. 2B, PLS path coeff. = 0.366, $p<0.01$). Similarly, users of the knowledge repository who followed up with the authors of the documents that they reused found the knowledge to be more useful when the knowledge was complex (Fig. 2A, path coefficient = 0.406, $p<0.01$). These results provide support for H4.

DISCUSSION

This study shows the importance of examining how the perceived costs of using different ICTs to support knowledge sharing influence how users perceive the usefulness of knowledge obtained from different sources. The results show that the same factor (such as familiarity with the knowledge domain, or similarity in job type as the knowledge provider) may influence

knowledge sharing differently depending on whether the knowledge is sourced from a knowledge repository or an online discussion forum.

First, the results show that both knowledge repositories and online discussion forums create opportunities to link knowledge seekers to knowledge providers, and to approach the knowledge provider for more information. Knowledge seekers who capitalize on the linkage with the knowledge provider to follow-up for more intensive discussion appeared to find the knowledge obtained from either the knowledge repository or the online discussion forum to be more useful when sharing complex knowledge. This highlights the key role that ICTs supporting knowledge sharing play in helping to create connections between knowledge seekers and providers.

As part of the interviews that were conducted earlier in the study, insights were obtained into why people would follow up with the authors of the knowledge assets or those who responded to their inquiries. There was a range of reasons why such follow-up would take place. One key reason was to obtain a greater understanding of the potential solution. Another reason was that individuals who provide knowledge are viewed as leaders and experts in the domain. As highlighted by one interviewee, she noted: "People contact you when they see you have submitted intellectual capital. They regard you as a thought leader. That increases your connections throughout the company, increases your opportunities for new kinds of customer engagements and, of course, gives you status in your area of expertise." Interviewees highlighted that the act of contacting others helped the knowledge seekers to learn more about the topic. As highlighted by an interviewee: "The most value we've seen is how it makes connections between people. It's about an individual seeing something that has already been done and contacting the solution provider to learn more. "

In some cases, such follow up may even lead to collaborations to work in an area. One interviewee, for example, highlighted one project where a group from Copenhagen, Denmark, contacted him for help on a project based on his submission in the repository. As the Danes began to interact with the author, the latter demonstrated such a high degree of expertise that they became an integral part of his team. The interviewee explained: "I was working with the System 390 group based in Atlanta and this assignment was based on software sales support and the billing cycles and reducing their complexity. Part of the job was to automate business processes. The folks in Copenhagen contacted us based on the work we were doing and the engagement expanded and then began to include those people because they had a very similar need. So we got a call from Copenhagen and suddenly they became an integral part of our work. They called us because they were struggling in Europe with similar process issues...basically high customer dissatisfaction with all the different billing plans...all the methods of tracking invoices based on usage, location (licenses) and other complicated criteria. Customers want it all simplified..the whole software licensing and bill process is extremely complicated. Along with our colleagues from Denmark, who found us using the repository, we were together able to develop a solution that leveraged on the original intellectual capital I had submitted."

While there was no significant relationship between knowledge complexity and the usefulness of knowledge obtained, the results showed that knowledge seekers who followed up with the knowledge provider when they are seeking to use complex knowledge were even more likely to benefit from this strategy compared to those using less complex knowledge. This implies that users were able to effectively use the knowledge sourced from both repositories and online discussion forums, regardless of the complexity of the knowledge. This highlights that the complexity of the knowledge did not serve as a deterring factor in preventing individuals from

noting the usefulness of the knowledge. This is likely because individuals who were seeking knowledge to solve a problem on hand had the incentive to expend the time and effort to understand complex knowledge if they felt it could help them to solve their problem. Our results, however, showed that it is especially effective to approach the knowledge provider for more details and information when users are seeking to use highly complex knowledge, for knowledge seekers of both knowledge repositories and online discussion forums. This is likely because complex knowledge benefits even more from the complementary knowledge that individuals obtain by following up with the knowledge providers. By following up with knowledge providers sourced from the knowledge repositories and online forums, individuals are effectively seeking out complementary content to the original knowledge, or additional knowledge that is interrelated and interdependent with the original knowledge contents (Huang et al., 2007). This increases the utility and value that individuals derive from the usage of the original knowledge obtained from both the knowledge repositories and the online forums.

This study also shows that the differences in the perceived costs of using knowledge repositories versus online forums imply differences in how users can most effectively gain useful knowledge or information from each ICT. First, the greater cognitive processing required for the knowledge repository meant that familiarity with the knowledge domain played a more significant role in the reuse of knowledge from repositories, compared to online forums. Second, the greater difficulty in assimilating knowledge embedded in documents that are not systematically structured for the purpose of knowledge sharing poses a challenge in reusing knowledge from knowledge repositories. Hence, sharing a common language and training with the author who has a similar job type appeared to significantly help knowledge seekers to reuse knowledge from the repository. On the other hand, knowledge seekers posting inquiries on

online discussion forums tend to be wary of evaluation apprehension in posting their queries (Bordia et al., 2006; Borgatti & Cross, 2003), hence they seek solutions that they cannot easily find. They thus benefit more from discussion with individuals with diverse background and experience. These results show the importance of examining the perceived costs of using the ICT for knowledge seeking as the same factors may have different impact on how users effectively use knowledge or information from different types of ICTs.

Contributions to Research

This study contributes to research in several ways. First, it adds to our understanding of how individuals form impressions of the perceived usefulness of a knowledge management system. Prior research has examined the perceived usefulness of knowledge management systems (KMS) as a whole (Boh & Wong, Forthcoming; He, Fang, & Wei, 2009), but not focused on individual episodes of knowledge reuse. Prior research has shown that the perceived usefulness of KMS has significant influence on individuals' intentions to use the KMS (He et al., 2009). By focusing on the perceived usefulness of knowledge retrieved from knowledge repositories and online forums in individual episodes of knowledge reuse, this study provides more detailed insights into how individuals form their overall impressions of the perceived usefulness of a knowledge management system.

Second, this study underscores the importance of understanding the ICT used to support knowledge sharing when we examine knowledge sharing in virtual communities. This study shows that the perceived costs of using the ICT should be considered when theorizing about the influence of various factors on the usefulness of knowledge obtained. For example, the cognitive costs of using knowledge repositories highlight the importance of familiarity of the knowledge domain by the knowledge seeker and the importance of following up with the author to obtain

complementary knowledge about the knowledge documented in the repository. Another key dimension of cost is the evaluation apprehension that individuals face, especially when posting inquiries publicly on online forums. As highlighted by prior research, the fear of openly admitting one's ignorance can be a significant barrier to using the online forum to obtain knowledge, despite the advantages of being able to obtain personalized information (Sharratt & Usoro, 2003). The findings of this study thus imply that future research should explicate the perceived costs of using the ICTs to support knowledge sharing and consider such perceived costs when theorizing and making hypotheses relating to knowledge sharing.

Third, it highlights the key role that ICT plays in enabling knowledge sharing in virtual CoPs. Several authors have highlighted the inadequacy of traditional KM technologies in managing knowledge and encouraging knowledge sharing. McAfee (2006, p. 22) states that "current technologies for knowledge workers aren't doing a good job of capturing knowledge." While prior research has recognized the increasing availability of social media tools to encourage collaboration within the organization (Baltatzis, Ormrod, & Grainger, 2008; Paroutis & Saleh, 2009), traditional KM tools like knowledge repositories tend to be viewed as platforms that are meant solely to codify and store knowledge. In fact, researchers have defined knowledge repositories as databases that "enable individuals to easily search for and access explicit knowledge without having to contact the person who originally developed it" (Teigland & Wasko, 2009, p. 16).

This paper, however, highlights that ICT like repositories and online discussion forums can be used not only to codify and store knowledge, but also to create linkages between individuals. This implies that future research may wish to adopt a wider perspective in examining the role of ICTs in knowledge sharing. As highlighted by Su and Contractor (2011), most research to date

has focused on the examination of knowledge seeking from human and digital knowledge sources separately. Our research shows that both sources of information are complementary to one another. Hence, researchers should not view such traditional knowledge sharing platforms solely to be mechanisms for codifying and storing knowledge, but also as means to create linkages in a community.

Implications for Management

This study also has various implications for the design of ICT used to support knowledge sharing in virtual CoPs. First, organizations need to recognize the role that ICT can play in creating linkages between individuals. In recent years, organizations are expanding beyond knowledge repositories and online discussion forums, adopting Web 2.0 technologies in organizations such as wikis, blogs and group-messaging software, in addition to existing platforms such as knowledge repositories and intranet platforms and portals (McAfee, 2006). Recent studies, however, has shown that the adoption of such Web 2.0 technologies often depend on history, or the established ways of sharing knowledge (Paroutis & Saleh, 2009). Hence, it is important to examine the usage of existing platforms for knowledge sharing in order to better understand how that may influence the adoption of newer Web 2.0 technologies. Moreover, recent research examining organizations' use of new Web 2.0 technologies for knowledge sharing has also shown that many of the same principles and findings underlying the use of traditional knowledge management systems and platforms are equally applicable in understanding knowledge sharing and collaboration using such newer technologies. For example, Hsu and Lin (2008) found that ease of use and enjoyment, altruism and reputation were key factors motivating people to blog, similar to the findings of studies that have examined individuals' motivations to contribute to knowledge repositories and online forums (Kankanhalli, Tan, & Wei, 2005a; Wasko & Faraj,

2000, 2005). Ip and Wagner (2008) also had similar findings as Lin and Huang (2008) in showing the importance of technology-task fit in the use of social networking sites as in the use of knowledge management systems. Hence, the findings relating to the usage of knowledge repositories and online forums remain relevant in the face of newer technologies such as blogs and wikis being introduced as tools for knowledge sharing and collaboration.

Mcafee (2006) differentiated between two types of ICT that are currently used for communication: channels, such as e-mails and person-to-person instant messaging, which provides mainly for one-to-one or one-to-few communication; and platforms, such as intranets and information portals, which centralizes production of content and has wide visibility across a large group of audience. Mcafee (2006, p. 23) argues that the older forms of technologies for such channels and platforms are not effective for knowledge management and collaboration, but new platforms like wiki and blogs are appearing to focus on not just the capture of knowledge, but on capturing the “practices and output of knowledge workers”.

Our research shows that individuals use both the channels and platforms in a complementary manner, using platforms to locate potential experts and contacting them one-on-one via emails or direct communication channels to obtain more personalized and complementary information to the knowledge located via the platforms. This highlights that it is important for designers of knowledge management systems not to view the technologies that support collaboration and knowledge sharing in an isolated manner – i.e. a tool is either a platform or a channel. Rather, various ICT tools may be used in a complementary manner and can possibly be integrated such that repositories can be linked to communication systems to facilitate communication between the document authors and repository users. For instance, the repository may be linked to instant messaging systems such that clicking on a link on the document will automatically allow users to

link up with authors via the instant messaging system. This may also apply to newer technologies; there may be potential for complementarity between newer technologies and more traditional ICT used to support knowledge sharing. As prior research has shown (Paroutis & Saleh, 2009), the inertia to change the old or established way of doing things appear to be one of the key barriers to the adoption of Web 2.0 technologies for knowledge sharing and collaboration. If technology designers can effectively integrate the use of old and new technologies, this will facilitate the use of new technologies for knowledge sharing. One example could be the use of a wiki or blog to document questions and experiences that people have using a contribution of the repository to their projects. This way, organizations can build upon the existing infrastructure they already have for knowledge sharing.

Second, the results highlight that organizations should focus on different factors to bring about the successful use of different types of ICT. For online discussion forums, encouraging participation from a wide and diverse group of individuals would help to increase opportunities for interaction between individuals from a diverse range of background, which appears effective in facilitating knowledge sharing in this context. As CoPs refer to communities of users who have a common interest, members of a CoP may not necessarily be in the same occupation, but they may be of diverse occupations. Hence, one of the key recommendations of this study is to encourage organizations to organize CoPs in such a way that they involve employees who may be of different functional background and job scopes, but who may be interested in the same topic. For knowledge repositories, on the other hand, the key to success would be to create shared languages and common frameworks amongst community members so as to enable them to better understand and assimilate the information embedded in documents.

Limitations and Future Research

In this paper, I focus on the comparison between the sourcing of knowledge from knowledge repositories and from posting inquiries in online discussion forums. Nevertheless, there is also significant variance in the characteristics of one type of ICT across systems implemented by different CoPs. For example, the search and retrieval capabilities of knowledge repositories may differ, and the extent to which users are active in online discussion forums may also differ across CoPs. In generating the theory and hypotheses, I have abstracted the key components of the perceived costs of using the two types of ICTs in my comparison – namely, the cognitive difficulties associated with the use of repositories and the evaluation apprehension associated with posting queries on online forums. The ways that the ICTs are implemented may result in a higher or lower level of the perceived costs identified. For example, knowledge repositories that are large and difficult to search may cause time-pressed consultants to only make instrumental and peripheral uses of the knowledge repository, rather than substantially use the knowledge from the repositories to improve the quality or creativity of the solution (Su & Contractor, 2011), due to the higher cognitive costs of using the repository. In contrast, knowledge repositories that are concentrated on a few domains have better ability to signal the quality of the contributions and may decrease the cognitive cost of using the repositories (Hansen & Haas, 2001). Future research would benefit from exploring how the detailed characteristics of the IT systems (e.g. search and retrieval capabilities) impact knowledge sharing.

Individuals have preferences to source for information from particular sources, and individuals may also search and access multiple sources of information before they may be able to find an effective solution to the problem they are facing. Hence, the sample that was used may include people who are biased towards using repositories or online discussion forum in their

CoP. Nevertheless, as this study focuses on comparison between the users of knowledge repositories and online discussion forums, rather than the examination of all the possible sources of information accessed by individuals in their search process, I believe that the sample is sufficient for the purpose of this study.

CONCLUSION

This paper examines the use of two key types of ICTs – knowledge repositories and online discussion forums to support knowledge sharing in virtual CoPs. Based on the perceived cost of using these two types of ICTs, the study hypothesizes about the key factors that would influence the usefulness of knowledge obtained from the knowledge repository versus the online forum. The results showed that familiarity with the knowledge domain played a more significant role in influence the usefulness of knowledge obtained from the knowledge repository, due to the higher cognitive cost associated with the reuse of knowledge from a repository. Interestingly, this study found that users of knowledge repositories benefit from reusing knowledge that are provided with individuals with similar background and experience, whereas users of online discussion forums benefit more from discussions with individuals with different background and experience. Finally, the study also showed that both knowledge repositories and online discussion forums create opportunities to link knowledge seekers to knowledge providers. Knowledge seekers who capitalize on the linkage with the knowledge provider to follow-up for more intensive discussion found the knowledge obtained from both the knowledge repository and the online discussion forum to be more useful when sharing complex knowledge.

REFERENCES

- Agarwal, R., & Karahanna, E. 2000. "Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage". *MIS Quarterly*, 24 No. 4: 665-694.
- Alavi, M., Kayworth, T. R., & Leidner, D. E. 2005. "An Empirical Examination of the Influence of Organizational Culture on Knowledge Management Practices". *Journal of Management Information Systems*, 22 No. 3: 191-224.
- Alavi, M., & Leidner, D. E. 2001. "Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues". *MIS Quarterly*, 25 No. 1: 107-136.
- Ardichvili, A., Page, V., & Wentling, T. 2003. "Motivation and barriers to participation in virtual knowledge-sharing communities of practice". *Journal of Knowledge Management*, 7 No. 1: 64-77.
- Argote, L. 1999. *Organizational learning: Creating, retaining and transferring knowledge*. Norwell, MA: Kluwer.
- Ba, S. 2001. "Establishing online trust through a community responsibility system". *Decision Support Systems*, 31 No. 4: 323-336.
- Baltatzis, G., Ormrod, D. G., & Grainger, N. 2008. "Social networking tools for internal communication in large organizations: Benefits and barriers". *19th Australasian Conference on Information Systems* No.
- Barrick, J. A., & Spilker, B. C. 2003. "The relations between knowledge, search strategy, and performance in unaided and aided information search". *Organizational Behavior and Human Decision Processes*, 90 No.: 1-18.
- Bechky, B. A. 2003. "Sharing meaning across occupational communities: The transformation of understanding on a production floor". *Organization Science*, 14 No. 3: 312-330.
- Blandin, J., & Brown, W. 1977. "Uncertainty and management's search for information". *IEEE Transactions on Engineering Management*, 24 No. 114-119.
- Bock, G. W., Kankanhalli, A., & Sharma, S. 2006. "Are norms enough? The role of collaborative norms in promoting organizational knowledge seeking". *European Journal of Information Systems*, 15 No. 4: 357-367.
- Boh, W. F. 2008. "Reuse of Knowledge Assets from Repositories: A Mixed Methods Study". *Information & Management*, 45 No.: 365-375.
- Boh, W. F., & Wong, S. S. Forthcoming. "Knowledge Sharing via Repositories, Personal Networks, versus Institutionalized Routines". *Journal of Association Information Systems* No.
- Bollen, K. 1989. *Structural Equations with Latent Variables*. New York: Wiley-Interscience.
- Bordia, P., Irmer, B. E., & Abusah, D. 2006. "Differences in sharing knowledge interpersonally and via databases: The role of evaluation apprehension and perceived benefits". *European Journal of Work and Organizational Psychology*, 15 No. 3: 262 – 280.
- Borgatti, S. P., & Cross, R. 2003. "A relational view of information seeking and learning in social networks". *Management Science*, 49 No. 4: 432-445.
- Brown, J. S., & Duguid, P. 1991. "Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation". *Organization Science*, 2 No. 1: 40-57.
- Brown, J. S., & Duguid, P. 1998. "Organizing knowledge". *California Management Review*, 40 No. 3: 90-111.
- Brucks, M. 1985. "The Effects of Product Class Knowledge on Information Search Behavior". *Journal of Consumer Research*, 12 No. 1: 1-15.
- Carlson, J. R., & Zmud, R. W. 1999. "Channel expansion theory and the experiential nature of media richness perceptions". *Academy of Management Journal*, 42 No. 2: 153-170.
- Chin, W. W. 1998. The partial least squares approach for structural equation modelling. In G. A. Marcoulides (Ed.), *Modern Methods for Business Research*: 295-336. Mahwah, NJ: Lawrence Erlbaum.

- Chin, W. W., Marcolin, B. L., & Newsted, P. R. 2003. "A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study". *Information Systems Research*, 14 No. 2: 189-217.
- Chiu, C. M., Hsu, M. H., & Wang, E. T. G. 2006. "Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories". *Decision Support Systems*, 42 No. 3: 1872-1888.
- Cohen, W. M., & Levinthal, D. A. 1990. "Absorptive Capacity: A New Perspective on Learning and Innovation". *Administrative Science Quarterly*, 35 No. 1: 128-152.
- Constant, D., Sproull, L., & Kiesler, S. 1996. "The kindness of strangers: On the usefulness of weak ties for technical advice". *Organization Science*, 7 No. 2: 119-135.
- Cross, R., & Borgatti, S. P. 2004. *The ties that share: Relational Characteristics that Facilitate Information Seeking, Social Capital and Information Technology*. Cambridge: MIT Press.
- Cross, R., & Sproull, L. 2004. "More than an answer: Information relationships for actionable knowledge". *Organization Science*, 15 No. 4: 446-462.
- Daft, R. L., & Lengel, R. H. 1986. "Organizational Information Requirements, Media Richness and Structural Design". *Management Science*, 32 No. 5: 554-571.
- Daft, R. L., Lengel, R. H., & Trevino, L. K. 1987. "Message Equivocality, Media Selection, and Manager Performance: Implications for Information Systems". *MIS Quarterly*, 11 No. 3: 355-366.
- De Vaus, D. A. 2002. "Surveys in social research". No.
- Duxbury, L. E., & Higgins, C. A. 1991. "Gender differences in work-family conflict". *Journal of Applied Psychology*, 76 No. 1: 60.
- Fisher, R. J., & Grégoire, Y. 2006. "Gender differences in decision satisfaction within established dyads: Effects of competitive and cooperative behaviors". *Psychology and Marketing*, 23 No. 4: 313-333.
- Garud, R., Jain, S., & Kumaraswamy, A. 2002. "Institutional Entrepreneurship in the Sponsorship of Common Technological Standards: The Case of Sun Microsystems and Java". *The Academy of Management Journal*, 45 No. 1: 196-214.
- Garud, R., & Nayyar, P. R. 1994. "Transformative Capacity - Continual Structuring by Intertemporal Technology-Transfer". *Strategic Management Journal*, 15 No. 5: 365-385.
- Gefen, D., & Straub, D. 2005. "A practical guide to factorial validity using PLS-Graph: Tutorial and annotated example". *Communications of the Association for Information Systems*, 16 No.: 109.
- Gefen, D., Straub, D. W., & Boudreau, M. 2000. "Structural equation modeling and regression: Guidelines for research practice". *Communications of the AIS*, 4 No. 7: 1-76.
- Goodman, P. S., & Darr, E. D. 1998. "Computer-aided systems and communities: Mechanisms for organizational learning in distributed environments". *MIS Quarterly*, 22 No. 4: 417-440.
- Gosain, S. 2003. *Mobilizing software expertise in personal knowledge exchanges*. Paper presented at the Academy of Management Meeting, Seattle, WA.
- Gray, P. H., & Durcikova, A. 2005. "The Role of Knowledge Repositories in Technical Support Environments: Speed Versus Learning in User Performance". *Journal of Management Information Systems*, 22 No. 3: 159.
- Gray, P. H., & Meister, D. B. 2004. "Knowledge sourcing effectiveness". *Management Science*, 50 No. 6: 821-834.
- Gray, P. H., & Meister, D. B. 2006. "Knowledge sourcing methods". *Information & Management*, 43 No. 2: 142-156.
- Hansen, M. T. 1999. "The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits". *Administrative Science Quarterly*, 44 No. 1: 82-111.
- Hansen, M. T. 2002. "Knowledge networks: Explaining effective knowledge sharing in multiunit companies". *Organization Science*, 13 No. 3: 232-248.

- Hansen, M. T., & Haas, M. R. 2001. "Competing for attention in knowledge markets: Electronic document dissemination in a management consulting company". *Administrative Science Quarterly*, 46 No. 1: 1-28.
- Hansen, M. T., Mors, M. L., & Lovas, B. 2005. "Knowledge sharing in organizations: Multiple networks, multiple phases". *Academy of Management Journal*, 48 No. 5: 776.
- Hansen, M. T., Nohria, N., & Tierney, T. 1999. "What's your strategy for managing knowledge?". *Harvard Business Review*, 77 No. 3: 196-206.
- He, W., Fang, Y., & Wei, K.-K. 2009. "The role of trust in promoting organizational knowledge seeking using knowledge management systems: An empirical investigation". *Journal of the American Society for Information Science & Technology*, 60 No. 3: 526-537.
- Heslin, R., & Streufer, S. 1968. "Task Familiarity and Reliance on Environment in Decision Making". *Psychological Record*, 18 No. 4: 629-637.
- Hislop, D. 2002. "Mission impossible? Communicating and sharing knowledge via information technology". *Journal of Information Technology*, 17 No. 3: 165-177.
- Hobday, M. 2000. "The project-based organization: An ideal form for managing complex products and systems?". *Research Policy*, 29 No. 7: 871-893.
- Hsu, C.-L., & Lin, J. C.-C. 2008. "Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation". *Information & Management*, 45 No. 1: 65-74.
- Hsu, M. H., Ju, T. L., Yen, C. H., & Chang, C. M. 2007. "Knowledge sharing behavior in virtual communities: The relationship between trust, self-efficacy, and outcome expectations". *International Journal of Human-Computer Studies*, 65 No. 2: 153-169.
- Huang, M.-H., Wang, E. T. G., & Seidmann, A. 2007. "Price Mechanism for Knowledge Transfer: An Integrative Theory". *Journal of Management Information Systems*, 24 No. 3: 79-108.
- Huber, G. P. 2001. "Transfer of knowledge in knowledge management systems: Unexplored issues and suggested studies". *European Journal of Information Systems*, 10 No. 2: 72-79.
- Ip, R. K. F., & Wagner, C. 2008. "Weblogging: A study of social computing and its impact on organizations". *Decision Support Systems*, 45 No. 2: 242-250.
- Kankanhalli, A., Tan, B. C. Y., & Wei, K.-K. 2005a. "Understanding Seeking From Electronic Knowledge Repositories: An Empirical Study". *Journal of the American Society for Information Science and Technology*, 56 No. 11: 1156-1166.
- Kankanhalli, A., Tan, B. C. Y., & Wei, K. K. 2005b. "Contributing knowledge to electronic knowledge repositories: An empirical investigation". *MIS Quarterly*, 29 No. 1: 113-143.
- Kankanhalli, A., Tanudidjaja, F., Sutanto, J., & Tan, B. C. Y. 2003. "The role of IT in successful knowledge management initiatives". *Communications of the Acm*, 46 No. 9: 69-73.
- Lave, J. C., & Wenger, E. 1991. *Situated Learning: Legitimate Peripheral Participation*. New York: Cambridge University Press.
- Lee, F. 1997. "When the going gets tough, do the tough ask for help? Help seeking and power motivation in organizations". *Organizational Behavior and Human Decision Processes*, 72 No. 3: 336-363.
- Lee, K., & Thomas, J. O. 2008. *Understanding consultants' information seeking practices: Knowledge management's touchpoint*. Paper presented at the Conference on Human Factors in Computing Systems (CHI '08) New York.
- Leonard-Barton, D. 1995. *Wellsprings of Knowledge*. Boston: Harvard Business School Press.
- Levin, D. Z., & Cross, R. 2004. "The Strength of Weak Ties You Can Trust: The Mediating Role of Trust in Effective Knowledge Transfer". *Management Science*, 50 No. 11: 1477-1490.
- Lin, T.-C., & Huang, C.-C. 2008. "Understanding knowledge management system usage antecedents: An integration of social cognitive theory and task technology fit". *Information & Management*, 45 No. 6: 410-417.

- Lowendahl, B. R., Revang, O., & Fosstenlokken, S. M. 2001. "Knowledge and value creation in professional service firms: A framework for analysis". *Human Relations*, 54 No. 7: 911-931.
- Ma, M., & Agarwal, R. 2007. "Through a Glass Darkly: Information Technology Design, Identity Verification, and Knowledge Contribution in Online Communities". *Information Systems Research*, 18 No. 1: 42-67.
- Maister, D. H. 1993. *Managing the professional service firm*. New York: The Free Press.
- Markus, M. L. 2001. "Toward a theory of knowledge reuse: Types of knowledge reuse situations and factors in reuse success". *Journal of Management Information Systems*, 18 No. 1: 57-93.
- McAfee, A. P. 2006. "Enterprise 2.0: The dawn of emergent collaboration". *Management of Technology and Innovation*, 47 No. 3.
- Mennecke, B. E., & Valacich, J. S. 1998. "Information is what you make of it: The influence of group history and computer support on information sharing, decision quality, and member perceptions". *Journal of Management Information Systems*, 15 No. 2: 173-197.
- Menon, T., & Pfeffer, J. 2003. "Valuing internal vs. external knowledge: Explaining the preference for outsiders". *Management Science*, 49 No. 4: 497-513.
- Nemeth, C. J. 1986. "Differential contributions of majority and minority influence". *Psychological Review*, 93 No.: 23-32.
- Nunnally, J. C. 1967. *Psychometric Theory*. New York: McGraw-Hill.
- Orlikowski, W. J. 1993. "Learning from Notes: Organizational issues in groupware implementation". *The Information Society*, 9 No. 3: 237-250.
- Orr, J. 1990. Sharing knowledge, celebrating identity: War stories and community memory in a service culture. In D. S. Middleton, & D. Edwards (Eds.), *Collective remembering: Memory in society*: 169-189. Beverly Hills, CA: Sage Publications.
- Paroutis, S., & Saleh, A. A. 2009. "Determinants of knowledge sharing using Web 2.0 technologies". *Journal of Knowledge Management*, 13 No. 4: 52-63.
- Phang, C. W., Kankanhalli, A., & Sabherwal, R. 2009. "Usability and Sociability in Online Communities: A Comparative Study of Knowledge Seeking and Contribution". *Journal of the Association for Information Systems*, 10 No. 10: 721-747.
- Prahalad, C. K., & Ramaswamy, V. 2004. "Co-creating unique value with customers". *Strategy & Leadership*, 32 No. 3: 4-9.
- Ranft, A. L., & Lord, M. D. 2002. "Acquiring new technologies and capabilities: A grounded model of acquisition implementation". *Organization Science*, 13 No. 4: 420-441.
- Reagans, R., & McEvily, B. 2003. "Network Structure and Knowledge Transfer: The Effects of Cohesion and Range". *Administrative Science Quarterly*, 48 No. 2: 240-267.
- Robert, L. P., & Dennis, A. R. 2005. "Paradox of richness: A cognitive model of media choice". *Ieee Transactions on Professional Communication*, 48 No. 1: 10-21.
- Schultze, U., & Vandenbosch, B. 1998. "Information overload in a groupware environment: Now you see it, now you don't". *Journal of Organizational Computing and Electronic Commerce*, 8 No. 2: 127-148.
- Sharratt, M., & Usoro, A. 2003. "Understanding knowledge-sharing in online communities of practice". *Electronic Journal on Knowledge Management*, 1 No. 2: 187-196.
- Short, J., Williams, E., & Christie, B. 1976. *The Social Psychology of Telecommunications*. New York: Wiley.
- Simonin, B. L. 1999. "Ambiguity and the process of knowledge transfer in strategic alliances". *Strategic Management Journal*, 20 No. 7: 595-623.
- Stein, E. W., & Zwass, V. 1995. "Actualizing organizational memory with information systems". *Information Systems Research*, 6 No. 2: 85-117.

- Su, C., & Contractor, N. 2011. "A multidimensional network approach to studying team members' information seeking from human and digital knowledge sources in consulting firms". *Journal of the American Society for Information Science and Technology*, 62 No. 7: 1257-1275.
- Szulanski, G. 1996. "Exploring internal stickiness: Impediments to the transfer of best practice within the firm". *Strategic Management Journal*, 17 No. Winter Special Issue: 27-43.
- Teigland, R., & Wasko, M. 2009. "Knowledge transfer in MNCs: Examining how intrinsic motivations and knowledge sourcing impact individual centrality and performance". *Journal of International Management*, 15 No. 1: 15-31.
- Teigland, R., & Wasko, M. M. 2003. "Integrating Knowledge through Information Trading: Examining the Relationship between Boundary Spanning Communication and Individual Performance". *Decision Sciences*, 34 No. 2: 261.
- Wasko, M. M., & Faraj, S. 2000. "'It is what one does': why people participate and help others in electronic communities of practice". *Journal of Strategic Information Systems*, 9 No. 2-3: 155-173.
- Wasko, M. M., & Faraj, S. 2005. "Why should I share? Examining social capital and knowledge contribution in electronic networks of practice". *MIS Quarterly*, 29 No. 1: 35-57.
- Wenger, E. 1998. *Communities of Practice: Learning, Meaning and Identity*. Cambridge: Cambridge University Press.
- Wickramasinghe, N. 2002. *Practising what we preach: are knowledge management systems in practice really knowledge management systems?* Paper presented at the System Sciences, 2002. HICSS. Proceedings of the 35th Annual Hawaii International Conference on.
- Wood, M. S. 2009. "Does one size fit all? The multiple organizational forms leading to successful academic entrepreneurship". *Entrepreneurship Theory and Practice*, 33 No. 4: 929-947.
- Zander, U., & Kogut, B. 1995. "Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities - an Empirical-Test". *Organization Science*, 6 No. 1: 76-92.

Figure 1A. Research Model for Knowledge Reuse from Knowledge Repositories

Figure 1B. Research Model for Use of Knowledge from Responses to Inquiries in Online Discussion Forums

Figure 2A. Research Model for Knowledge Reuse from Knowledge Repositories

Figure 2B. Research Model for Use of Knowledge from Responses to Inquiries in Online forums

Note: + $p < .10$; * $p < .05$, ** $p < .01$

Table 1. Item Descriptives and PLS Variable Loadings

Variable	Item No.	Repository Survey				Online forum Survey			
		Mean	S.D.	Loading	t-Stat	Mean	S.D.	Loading	t-Stat
Usefulness of Knowledge Obtained	1	0.485	0.502	0.844	29.89	0.591	0.494	0.745	14.79
	2	0.427	0.497	0.812	20.04	0.420	0.496	0.846	21.76
	3	0.369	0.485	0.871	32.95	0.523	0.502	0.805	17.36
	4	3.709	1.072	0.896	56.98	3.034	1.208	0.934	75.49
Individual domain familiarity	1	3.495	1.267	0.629	1.95	3.739	1.023	0.940	3.38
	2	9.197	8.236	0.992	2.99	8.599	4.857	0.829	2.85
Similarity in job type	1	0.311	0.465	1.000	0.00	0.295	0.459	1.000	0.00
Knowledge complexity	1	2.990	1.052	0.901	4.51	2.955	1.222	0.790	3.47
	2	3.098	1.086	0.787	3.54	3.068	1.122	0.980	5.42
	3	2.735	1.218	0.993	4.23	3.205	1.243	0.943	3.72
Follow-up w. kg provider	1	0.194	0.397	0.958	79.25	0.352	0.480	0.976	11.84
	2	1.194	0.486	0.948	42.24	1.614	0.808	0.890	6.99
Complexity*Follow-up	1	0.561	1.082	0.915	22.93	0.293	0.877	0.767	14.83
	2	0.569	1.070	0.892	27.88	0.355	0.901	0.936	41.20
	3	0.613	1.161	0.907	30.07	0.339	0.921	0.848	21.85
	4	0.478	1.148	0.928	58.87	0.260	0.956	0.701	9.52
	5	0.465	1.093	0.928	64.73	0.293	0.933	0.873	14.50
	6	0.518	1.213	0.928	62.22	0.298	0.912	0.796	13.22
Prior Knowledge of Source	1	1.165	0.596	1.000	0.00	1.409	0.955	1.000	0.00
Frequency of repository use	1	0.845	0.801	0.857	4.07	0.693	0.778	0.830	3.74
	2	1.058	0.777	0.917	4.22	0.727	0.754	0.952	5.55
Frequency of forum participation	1	0.282	0.584	0.965	2.64	0.716	0.742	0.700	2.31
	2	0.534	0.739	0.584	1.99	1.091	0.672	0.992	3.12

Table 2A. Correlations of Factors for Repository Survey

	No. of Items	Composite Reliability	1	2	3	4	5	6	7	8	9
1. Usefulness of Knowledge	4	0.916	0.856								
2. Individual domain familiarity	2	0.809	0.131	0.830							
3. Similarity in job type	1	NA	0.202	-0.061	NA						
4. Knowledge complexity	3	0.925	0.110	-0.088	-0.019	0.898					
5. Follow-Up w. knowledge provider	2	0.952	0.460	-0.173	0.061	0.592	0.953				
6. Complexity*Follow-Up	6	0.969	0.544	-0.148	0.097	0.389	0.666	0.916			
7. Prior Knowledge of Source	1	NA	-0.05	-0.084	0.025	0.114	-0.051	-0.073	NA		
8. Frequency of Repository Use	2	0.881	0.110	-0.022	-0.067	-0.097	-0.108	-0.023	0.033	0.888	
9. Frequency of Forum Participation	2	0.768	-0.075	-0.196	-0.009	0.082	0.036	0.048	0.078	0.157	0.798

Table 2B. Correlations of Factors for Online Discussion Forum Survey

	No. of Items	Composite Reliability	1	2	3	4	5	6	7	8	9
1. Usefulness of Knowledge	4	0.902	0.835								
2. Individual domain familiarity	2	0.879	-0.059	0.886							
3. Similarity in job type	1	NA	-0.386	0.116	NA						
4. Knowledge complexity	3	0.933	-0.022	0.048	0.082	0.908					
5. Follow-Up w. Knowledge Provider	2	0.932	0.284	-0.044	-0.108	0.370	0.934				
6. Complexity*Follow-Up	6	0.926	0.452	-0.153	-0.214	-0.055	0.399	0.824			
7. Prior Knowledge of Source	1	NA	0.052	-0.047	-0.069	0.026	0.092	-0.204	NA		
8. Frequency of Repository Use	2	0.887	-0.148	0.141	0.000	0.050	0.002	-0.187	-0.025	0.893	
9. Frequency of Forum Participation	2	0.845	-0.145	0.162	-0.121	0.163	0.070	-0.054	0.123	0.374	0.860

Table 3a. PLS results for Repository

	Path Coefficient (Standard Error)
Individual Domain Familiarity	0.222* (0.112)
Document / Inquiry Complexity	-0.146 (0.142)
Similarity in job type	0.166* (0.082)
Follow up with knowledge provider	0.209 (0.251)
Complexity*Follow-Up	0.446* (0.199)
Frequency of Forum Participation	-0.073 (0.085)
Frequency of Repository Use	0.155 (0.103)
Prior Knowledge of Source	0.025 (0.050)
Used Repository first	0.222* (0.112)
Used Discussion Forum first	-0.146 (0.142)

Table 3b. PLS results for Online Discussion Forum

	Path Coefficient (Standard Error)
Individual Domain Familiarity	0.078 (0.108)
Document / Inquiry Complexity	0.012 (0.139)
Similarity in job type	-0.322** (0.101)
Follow up with knowledge provider	0.105 (0.118)
Complexity*Follow-Up	0.366** (0.115)
Frequency of Forum Participation	-0.196 (0.153)
Frequency of Repository Use	-0.015 (0.087)
Prior Knowledge of Source	0.122 (0.138)
Used Repository first	0.078 (0.108)
Used Discussion Forum first	0.012 (0.139)

Appendix A. Survey Items for Survey

Construct	Item No.	Knowledge Repository	Online forum
Usefulness of Knowledge Obtained		How did this piece of intellectual capital help you in your project?	
	1	Saved time on the project (Y/N)	
	2	Prevented me from making the same mistakes others made (Y/N)	
	3	Increased customer satisfaction (Y/N)	
	4	Please rate the usefulness of the piece of intellectual capital that you downloaded (1~5)	
Individual Domain Familiarity	1	How familiar are you with the domain area that this piece of intellectual capital describes / the domain area for this task that you sent the knowledge inquiry for? (1~5)	
	2	No. of years in this domain area: _____ (#)	
Document / Inquiry Complexity		To what extent do you believe that practitioner would	
	1	Need to spend a lot of time to ... (1~5)	
	2	Need to understand many different areas to ... (1~5)	
	3	Be easily able to ... (1~5)	
		... make use of the document	... respond to the inquiry
Follow up with knowledge provider		How did this piece of intellectual capital help you in your project?	
	1	Helped me to identify a critical expert who can provide advice and explanations (Y/N)	
	2	Please indicate how much time you spent in follow-ups with the author of the intellectual capital / the respondent, if any. (1~4) Select from: - None - Less than 1 hour - 1-3 hours - More than 3 hours	
Prior Knowledge of Source	1	To what extent do you know the author of this asset / this respondent? (1~4) - know him/her well - have communicated with him/her before - heard his/her name before - do not know him/her	
Frequency of repository use	1, 2	Please indicate the extent of participation in the following activities: (1~3) - None - Make use of reuse collection (lessons learned) about once every 2-3 months - Make use of reuse collection (lessons learned) almost every month	
Frequency of forum participation	1, 2	Please indicate the extent of participation in the following activities: (1~3) - None - Respond to inquiries (Make inquiries) about once every 2-3 months - Respond to inquiries (Make inquiries) almost every month	

Note: Coding in parentheses is as follows: #—continuous variable; Y/N—dummy variable; 1~5—five-point Likert scale; 1~4—four-point Likert scale; 1~3—three-point Likert scale.

Appendix B

Table B1. PLS Components Based Analysis: Cross Loadings for Repository Survey

	Document usefulness	Individual domain familiarity	Document complexity	Follow-Up with Author	Complexity * Follow-Up	Frequency of Using repository	Frequency of Participating in Online Forum
Useful01	0.844	0.068	0.208	0.384	0.431	0.078	-0.014
Useful02	0.812	0.162	0.070	0.324	0.393	0.081	-0.111
Useful04	0.871	0.093	0.143	0.462	0.513	0.123	-0.046
Useful05	0.896	0.126	-0.013	0.396	0.509	0.089	-0.082
Familiarity01	0.023	0.629	-0.261	-0.403	-0.350	0.231	-0.065
Familiarity02	0.140	0.992	-0.053	-0.122	-0.105	-0.063	-0.204
Complexity01	0.024	-0.062	0.901	0.548	0.312	-0.061	0.203
Complexity02	-0.009	-0.147	0.791	0.543	0.308	0.005	0.160
Complexity03	0.119	-0.101	0.998	0.594	0.396	-0.097	0.063
Followup01	0.461	-0.119	0.520	0.958	0.851	-0.153	0.051
Followup03	0.413	-0.216	0.614	0.948	0.798	-0.047	0.016
Followup01*Complexity01	0.479	-0.180	0.379	0.785	0.915	0.069	0.063
Followup01*Complexity02	0.516	-0.173	0.391	0.778	0.896	0.005	-0.027
Followup01*Complexity03	0.451	-0.204	0.408	0.789	0.911	0.060	0.024
Followup02*Complexity01	0.510	-0.100	0.310	0.808	0.929	-0.055	0.100
Followup02*Complexity02	0.551	-0.089	0.327	0.801	0.932	-0.124	0.039
Followup02*Complexity03	0.491	-0.115	0.337	0.817	0.932	-0.064	0.068
RepositoryFreq01	0.084	-0.045	-0.024	-0.023	0.032	0.857	0.108
RepositoryFreq02	0.108	0.000	-0.135	-0.152	-0.061	0.917	0.165
ForumFreq01	-0.078	-0.193	0.099	0.034	0.050	0.112	0.965
ForumFreq02	-0.025	-0.103	-0.013	0.025	0.019	0.216	0.584

Table B2. PLS Components Based Analysis: Cross Loadings for Online Forum Survey

	Document usefulness	Individual domain familiarity	Document complexity	Follow-Up with Author	Complexity * Follow-Up	Frequency of Using repository	Frequency of Participating in Online Forum
Useful01	0.846	-0.136	0.003	0.210	0.311	-0.141	-0.194
Useful02	0.745	-0.010	0.009	0.185	0.372	-0.136	-0.071
Useful04	0.805	-0.027	-0.030	0.202	0.281	-0.086	-0.036
Useful05	0.934	-0.021	-0.042	0.322	0.515	-0.134	-0.156
Familiarity01	-0.062	0.940	-0.058	-0.107	-0.171	0.163	0.176
Familiarity02	-0.038	0.830	0.207	0.071	-0.081	0.065	0.096
Complexity01	-0.012	0.122	0.790	0.301	-0.018	0.117	0.041
Complexity02	-0.010	0.089	0.980	0.357	-0.048	0.075	0.157
Complexity03	-0.027	-0.009	0.943	0.347	-0.066	0.002	0.195
Followup01	0.325	-0.036	0.367	0.976	0.437	0.000	0.087
Followup03	0.154	-0.054	0.319	0.890	0.257	0.004	0.025
Followup01*Complexity01	0.313	-0.015	0.001	0.377	0.767	-0.038	0.021
Followup01*Complexity02	0.465	-0.095	-0.024	0.445	0.936	-0.106	-0.021
Followup01*Complexity03	0.456	-0.116	-0.035	0.403	0.848	-0.136	-0.008
Followup02*Complexity01	0.193	-0.117	-0.028	0.199	0.701	-0.165	-0.017
Followup02*Complexity02	0.347	-0.178	-0.080	0.236	0.872	-0.238	-0.110
Followup02*Complexity03	0.359	-0.242	-0.105	0.230	0.796	-0.266	-0.132
RepositoryFreq01	-0.088	0.045	0.086	0.002	-0.083	0.830	0.360
RepositoryFreq02	-0.160	0.173	0.023	0.001	-0.217	0.952	0.329
ForumFreq01	-0.027	0.145	0.173	0.170	-0.091	0.178	0.700
ForumFreq02	-0.157	0.156	0.152	0.049	-0.044	0.386	0.992