2013

Knowledge Sharing and Knowledge Management System Avoidance: The Role of Knowledge Type and the Social Network in Bypassing an Organizational Knowledge Management System

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Abstract

Knowledge sharing is a difficult task for most organizations, and there are many reasons for this. In this article, we propose that the nature of the knowledge shared and an individual's social network influence employees to find more value in person-to-person knowledge sharing, which could lead them to bypass the codified knowledge provided by a knowledge management system (KMS). We surveyed employees of a workman's compensation board in Canada and used social network analysis and hierarchical linear modeling to analyze the data. The results show that knowledge complexity and knowledge teachability increased the likelihood of finding value in person-to-person knowledge transfer, but knowledge observability did not. Contrary to expectations, whether the knowledge was available in the KMS had no impact on the value of person-to-person knowledge transfer. In terms of the social network, individuals with larger networks tended to perceive more value in the person-to-person transfer of knowledge than those with smaller networks.

Keywords: knowledge management; knowledge; social networking

Introduction

Knowledge and intellectual capital are key organizational assets (e.g., Hansen & von Oetinger, 2001; McFadyen & Cannella, 2004; Reinholt, Pedersen, & Foss, 2011; Winter, 1987). Similar to other organizational assets, it is important to manage knowledge to ensure its effective use. But unlike most other assets, the greatest value of knowledge occurs when it is shared, as this improves work, enhances decision making, and facilitates the development of new knowledge (Cohen & Levinthal, 1990; Jennex, 2005; Roberts, Galluch, Dinger, & Grover, 2012).

A great deal of research offers anecdotal and empirical evidence that knowledge sharing is not an easy task. Knowledge has historically been shared from person-to-person, particularly for complex information (Bystrom, 2002; Nonaka, 1994). Many organizations have implemented knowledge management systems (KMS), only to find that employees do not use them (Hansen & von Oetinger, 2001). In some cases, employees avoid the formal KMS and continue to share knowledge person-to-person, but in other cases, employees simply do not share knowledge (Wasko & Faraj, 2005). Key problems cited include motivating employees to share knowledge (Reinholt et al., 2011; Wasko & Faraj, 2005), fostering positive attitudes around knowledge sharing (Bock, Zmud, Kim, & Lee, 2005), instilling trust (He, Fang, & Wei, 2009; McEvily, Perronne, & Zaheer, 2003), creating effective processes for knowledge sharing (Durcikova & Gray, 2009), and assessing success because use alone is often not the best measure of the value of the KMS (Jennex & Olfman, 2006). In essence, personal and institutional factors (Bock et al., 2005; Kankanhalli, Tan, & Wei, 2005; Wasko & Faraj, 2005) and aspects of the KMS (Gallivan, Eynon, & Rai, 2003) can increase or inhibit knowledge sharing. An individual's social network and the nature of the knowledge to be shared can influence whether an individual chooses to share knowledge, either through a formal KMS or person-to-person outside of a KMS (Nadler, Thompson, & Van Boven, 2003; Nonaka, 1994; Winter, 1987; Zander & Kogut, 1995).

In this article, we examine how an individual's social network and the nature of the knowledge to be shared impact employees' perceptions of the value of person-to-person knowledge sharing, whether it is face-to-face, over the phone, or via digital communication. We investigate three dimensions of knowledge (teachability, observability, and complexity) and whether codified knowledge is available in a KMS. Specifically, we address the following question: Do characteristics of the knowledge, the nature of the social network, and the amount of relevant codified knowledge in an organizational KMS affect the perceived value of knowledge received from colleagues via person-to-person communication?

Theoretical Background

There are the following two high-level approaches to managing knowledge sharing within organizations: codification and personalization (Hansen, Nohria, & Tierney 1999). With the codification approach, organizations essentially code the knowledge and store it in documents in a KMS. Codification enables consistent access to the knowledge by a large number of people and is deemed a fairly efficient approach when knowledge is relatively static. A codification approach is useful for organizations whose strategic focus is on the standardization of knowledge and sharing knowledge through documents. When facing a question, the knowledge seeker finds relevant knowledge documents in the KMS and acquires knowledge by reading the documents. Codification strategies can pose challenges as knowledge is inherently associated with a specific context when it is first created because it is closely tied to the originating user, task, organizational unit, and so on (Hansen et al., 1999; Hutchins, 1991; Szulanski, 2000). If the knowledge in the knowledge documents was not developed in the same context as the user's context, then the user must understand the context in which the knowledge was created and assess how close his or her target context

is to the original context. The knowledge must be deconstructed from its original context and put in a general form to be transferred and then reconstructed in the user's target context making whatever adjustments are needed for the new context. This deconstruction, sharing, and reconstruction can be challenging.

With the personalization approach, organizations manage connections to those who have the knowledge as opposed to managing the knowledge itself. The personalization approach is useful for organizations in which the strategic orientation is expertise. The KMS role is to connect knowledge seekers to the people who have the needed knowledge. Rather than sharing knowledge documents, a personalization approach connects the people who have the knowledge to those who need it; knowledge is received from a person, not a document. The exchange process is therefore more interactive than with a codification-based KMS (Massey & Montoya-Weiss, 2006), enabling the knowledge user to work together with the knowledge source to jointly and interactively contextualize the knowledge into the knowledge user's context, whether that interaction is face-to-face, over the phone, or via digital communication. Although valuable, this interactive approach can be quite time consuming.

Knowledge management strategies are typically not one or the other of these approaches, but often encompass aspects of both. In fact, Jennex and Olfman's (2006) KM success model proposes that both are essential to achieving benefits from KMS. However, despite the benefits, individuals are capable of bypassing the KMS and using their own social networks to acquire knowledge (Hansen & von Oetinger, 2001). Social ties to others are often used to span knowledge gaps that cannot be filled by an organization's KMS (Hansen & von Oetinger, 2001). Thus, if the KMS does not provide needed knowledge or does not provide knowledge in an easy-to-consume form (e.g., with the appropriate context), users can simply seek knowledge from individuals they know, regardless of the organization's KMS. This is particularly true for new employees, who often need personal help in contextualizing knowledge to fit the organization's culture (Jennex, 2008).

As with an organizational KMS, the content and structure of social networks influence knowledge sharing. In terms of content, the nature of the knowledge must be conducive to being shared in a person-to-person format. Foremost, it must be easy to communicate and easy to understand (Zander & Kogut, 1995). In terms of structure, a network of contacts must exist through which to convey knowledge. The network of ties surrounding an individual affects not only the amount of knowledge shared but also the ease of knowledge sharing (Reagans & McEvily, 2003), the willingness to share (Reinholt et al., 2011), and the value of knowledge received (Cross & Sproull, 2004). The direction of knowledge flow in the network is also important (Gray & Meister, 2004; Wasko & Faraj, 2005); for knowledge to be shared, individuals must be willing to both seek and provide knowledge.

Together, the nature of knowledge and the structure of individual social networks are key factors influencing knowledge-sharing practices in organizations. However, very little is known about how these factors work together to influence the use of person-to-person knowledge sharing outside of an organization's codification-based KMS.

Research Model

The research model is depicted in Figure 1. It proposes that dimensions of knowledge combine with characteristics of the communication network to influence the value of person-to-person knowledge sharing.

Network Size

An important component of individuals' to receive value from person-to-person knowledge transfer outside of a formal KMS is the existence of a network of ties through which to share knowledge. Advice networks are comprised of connections among individuals who seek knowledge from others (i.e., a seeking tie). Knowledge seeking is determined in large part by whether an individual is aware of another's knowledge, has access to that other person, and values that other person's knowledge (Borgatti & Cross, 2003). Individuals who are aware of many others' knowledge and make the effort to contact those others are expected to highly value person-to-person knowledge sharing.

Access to a knowledge network often varies by job experience. Jennex (2008) found that new employees often lack understanding of an organization's context and culture, which is necessary to use codified knowledge in a KMS. Thus, they are more likely to use personalization-based KMS to find experts with needed knowledge than to use the KMS to access the knowledge itself. As employees' understanding of the organizational context grew, they were more likely to use knowledge from the KMS. In contrast, Arling and Chun (2011) found that even when employees were experienced in an organization, they valued and leveraged person-to-person knowledge sharing for its ability to help them understand new contexts within the organization. The authors studied multiple methods of knowledge sharing in a large scientific and engineering company. They found that in-person knowledge seminars and online knowledge community forums were highly valued as methods of acquiring new knowledge. Both facilitated the creation of new ties in individuals' knowledge networks and enhanced their awareness of existing knowledge in the organization. Through these new ties, individuals were better able to understand knowledge that had been created in different contexts. This in turn increased their ability to modify and apply that knowledge to their own projects, thereby enhancing learning and improving the quality of projects. We therefore hypothesize the following:

- **H1**: The size of an individual's social network is positively associated with the value of person-to-person knowledge sharing.

Knowledge Dimensions

Zander and Kogut (1995) propose the following five dimensions of knowledge that can affect the ability to efficiently share knowledge outside the bounds of an organizational KMS: codifiability, procedural complexity, teachability, system dependence, and observability. *Codifiability* is the degree to which knowledge can be encoded and stored. *Procedural complexity* refers to the variety of procedural resources that must be combined to create knowledge. *Teachability* captures the degree to which the knowledge can be shared via training, either in school or on the job. *Observability* refers to the degree to which knowledge can be imitated or copied by observing others in the performance of a task. *System dependence* refers to the degree to which knowledge is dependent on and derived from many different people. Knowledge that is less complex, more codifiable, more teachable, and more observable should be easier to share (Zander & Kogut, 1995). Likewise, the greater the extent to which a task is system dependent, the more likely knowledge will be shared because of the variety of parts that are needed in its completion (Zander & Kogut, 1995).

Zander and Kogut (1995) examined the impact that the five knowledge dimensions had on the speed at which innovations spread among firms. They found that only codifiability and teachability had significant impacts on inter-organizational knowledge transfer. In contrast to Zander and Kogut's approach, our focus is on intra-organizational knowledge transfer; we examine the person-to-person sharing of knowledge within the same organization, whether face-to-face, over the phone, or via digital communication. There are important differences as we move from *inter*-organizational knowledge transfer to *intra*-organizational knowledge sharing. With inter-organizational transfer, one organization is trying to imitate, and thus take

advantage of another organization's knowledge. The knowledge must be extracted from products or announcements in the public domain. Knowledge transfer thus diminishes the value of knowledge in the first organization. In contrast, with intra-organizational knowledge sharing, individuals exchange knowledge to improve their organization. Knowledge sharing thus enhances the value of knowledge in the organization. Although there may be differences in the settings (i.e., inter vs. intra-organizational), we believe that these same five dimensions provide a solid foundation upon which to study intra-organizational knowledge sharing.

As originally proposed by Zander and Kogut (1995), knowledge codification refers to whether knowledge for a given task can be and has been codified. Given the focus on intra-organizational knowledge sharing, we examine whether the knowledge has been codified and therefore exists in a KMS. If there is little codified knowledge available in a KMS to support a task, the KMS offers little value and the value of person-to-person knowledge sharing outside the KMS should be high. In contrast, as the amount of task-relevant codified knowledge available in an organizational KMS increases, the value of person-to-person knowledge sharing outside the KMS should decrease because knowledge is now available in the KMS. We therefore hypothesize the following:

- **H2**: The existence of codified knowledge is negatively associated with the value of person-to-person knowledge sharing.

The procedural complexity of the knowledge task is a second important dimension. Because procedural complexity refers to the variety of resources that must be combined, as it increases, people are more likely to seek knowledge from other people rather than from a codification-based KMS (Bystrom, 2002). For simple tasks, the needed knowledge is often available in a small number of official sources (e.g., documents in a KMS) that are relatively quick and simple to locate. As complexity increases, the number of different sources from which knowledge is needed increases so that the knowledge seeker is more likely to rely on people rather than documents. Likewise, as complexity increases, there is a greater need for interactivity to better contextualize the knowledge (Massey & Montoya-Weiss, 2006), so the value of person-to-person knowledge sharing increases. We therefore hypothesize the following:

- **H3**: The procedural complexity of the knowledge is positively associated with the value of person-to-person knowledge sharing.

Teachability is directly related to person-to-person knowledge sharing. There are multiple approaches to teaching knowledge, the most common of which is the traditional training or classroom environment. Even when codified knowledge in the form of a textbook is used to share knowledge, a great deal of research supports the value of interaction and active participation as a means of enhancing knowledge acquisition. Contextualizing knowledge is important, especially for new employees who often lack a deep understanding of organizational culture (Jennex, 2008). Person-to-person knowledge transfer is richer than the use of codified knowledge, which may increase the likelihood of its use (Jennex & Olfman, 2006). In an organizational setting, teaching as a mechanism for person-to-person knowledge transfer can be valuable. If knowledge is easy to teach, then it is more likely to be shared from person-to-person (Zander & Kogut, 1995), thus increasing the value of person-to-person knowledge sharing. Conversely, if knowledge is difficult to teach, it is less likely that the knowledge will be shared from person-to-person and the value of person-to-person knowledge sharing should decrease. We therefore hypothesize the following:

- **H4**: The teachability of the knowledge is positively associated with the value of person-to-person knowledge sharing.

Observability requires that the knowledge needed for a task can be gained by watching someone perform the task (Winter, 1987). When knowledge is observable, there is less need for person-to-person interaction to share knowledge because individuals can watch and learn from others performing the task. However, if an observer cannot extract the underlying knowledge by watching someone perform their job, then person-to-person interaction and explanation is essential to sharing knowledge (Zander and Kogut, 1995). We therefore hypothesize the following:

- **H5**: The observability of the knowledge is negatively associated with the value of person-to-person knowledge sharing.

The final dimension of knowledge is system dependence. If task knowledge is derived from a larger number of people, processes, or systems, then those seeking that knowledge are more likely to seek knowledge from many different sources, more of which are likely to be people rather than documents in an organizational KMS (Bystrom, 2002). Thus the value of person-to-person knowledge sharing should be high. Conversely, if knowledge is not highly system dependent, then a few sources, mostly documents, will likely suffice and the value of person-to-person sharing should be lower. We therefore hypothesize the following:

- **H6**: The system dependence of the knowledge is positively associated with the value of person-to-person knowledge sharing.

Method

This research was conducted at a workman's compensation board (WCB) in one of the 10 Canadian provinces. The WCB assesses the safety of working conditions and trains organizations on how to create a safer working environment. At the time of the study, the WCB had extensive codified knowledge both in paper manuals and in a simple repository-based KMS and was in the process of assessing the viability of implementing a new, more powerful, KMS that provided more features.

Participants

The participant pool in this study consisted of the 180 prevention officers and managers whose job it was to assess and respond to safety concerns in organizations throughout the province. Each of the 180 eligible employees received an e-mail requesting their participation in an online survey. We received complete responses from 68 employees, resulting in a 38% response rate. The majority of our sample were prevention officers (59 respondents, about 87%). Four respondents were regional managers, three were senior officers (akin to managers), and two did not provide a job title. On average, the respondents had 10.7 years of job experience. The respondents were overwhelmingly male (87%). These demographics are consistent with the organizational distribution of employees, thus suggesting that nonresponse issues did not unduly bias the sample.

Measures

Each officer and manager is responsible for four distinct job tasks: accident reports, inspections, education, and consulting. Although some knowledge is common to all four tasks, each task also has a separate and distinct set of knowledge associated only with it. Therefore, we measured the knowledge characteristics and the value of knowledge sharing separately for each of these four tasks.

There were five sets of measures. All items and their reliabilities are presented in Table 1. We computed the value of each measure by taking the average of the items for that measure; thus missing values were omitted. This means that each measure has the same 1–7 point scale as the items on the survey.

The first set of measures is for the dependent variable, the value of person-to-person knowledge sharing. This was assessed from the perspective of the knowledge receiver, because the receiver is the best person to judge whether he or she has benefited from knowledge sharing (Ko et al., 2005). We used a set of 10 items drawn from Ko et al. (2005) that were elaborated on and expanded for use in this context. Each item was asked four times, once for each job task (i.e., accident reports, inspections, education, and consulting).

The second set of measures was for the independent variable assessing the extent of codified knowledge available. We asked respondents about the existence of codified knowledge available for each of the four job tasks (i.e., accident reports, inspections, education, and consulting). The items were drawn from Zander and Kogut (1995) and slightly adapted to the WCB environment.

The third set of measures was for the independent variables assessing the characteristics of the knowledge. We asked respondents to assess the teachability, procedural complexity, observability, and system dependence of knowledge for each of the four job tasks. All items were drawn from Zander and Kogut (1995) and slightly adapted to the WCB environment. For example, instead of stating "new manufacturing personnel" the items were changed to state "new prevention officers."

The fourth set of measures was for the independent variable assessing the extent of the individual's social network. Respondents were asked to list the names of the individuals they sought advice from for each of the four job tasks. This egocentric, open response method of listing contacts was used rather than a predefined list because of the large number of potential contacts for each respondent (180 WCB officers and managers). We counted the number of individuals listed to determine the size of the individual's social network.

Finally, we also asked each respondent to report his or her gender and the number of years' experience he or she had as a prevention officer, which we used as controls. Prior research suggests that job experience influences whether individuals use a KMS or person-to-person interaction for knowledge sharing (Jennex, 2008). There are three key ways to measure "job experience": *organizational tenure*, the length of time with the organization; *job tenure*, the length of time in the current job in the current organization; and *job experience*, the length of time within the profession (McEnrue, 1988). We chose job tenure because it has been used in a majority of prior research (for a review, see Naumann, Widmier, & Jackson, 2000). We believed the relationship between experience and the value of knowledge transfer would be nonlinear so we used the log of the number of years of experience.

Analysis

We began by conducting a factor analysis on the survey items to ensure they loaded on the constructs as intended. We used a principal components approach with varimax rotation to assess convergent and discriminant validity. According to Straub, Boudreau, and Gefen (2004), for a principal components analysis all loadings should be greater than 0.4 and all cross-loadings should be less than 0.4. The factor analysis showed that all items loaded as expected on the six major constructs with minimal cross-loading (see Table 2). All items also demonstrated adequate reliability, except for system dependence (see Table 1), which had a Cronbach's alpha of 0.41, compared with an alpha of 0.64 in Zander and Kogut's (1995) original study. Because of its low alpha, we removed system dependence from the study.

As an aside, we note that our sample of 68 is small when compared to the number of items in the factor analysis. However, researchers in statistics have provided guidelines based on a subject-to-variable (STV) ratio. Specifically, MacCullum et al. (2001) recommend a STV ratio of at least 4, whereas Bryant and

Yarnold (1995) recommend a STV ratio of at least 5. Our STV is approximately 11, thus providing sufficient sample size for conducting the factor analysis.

To create total scores for each construct, we averaged the responses for each item comprising a construct as has been done in prior survey-based research in knowledge management (e.g., Wasko & Faraj, 2005). This produces a measure that uses the same scale as the original questionnaire items (i.e., a 1–7 point scale), thus providing a consistent scale across constructs ranging from 3 to 10 items. It also omits missing values in the calculations.

The survey provided four matched sets of independent and dependent variables from each survey respondent (one set for each of the four tasks performed), so we could not use standard regression techniques to analyze the data (Hoffman, 1997; Raundenbush & Bryk, 2002; Snijders & Bosker, 1999). With traditional regression, there is a problem with the unit of analysis. If the data are analyzed at the lowest level (i.e., the four knowledge tasks), then the impact of the individual must be omitted. Because there is likely to be significant correlation among the four knowledge-sharing scores for a specific individual, this approach can erroneously inflate the significance and cause type 1 errors. If the data are analyzed at the second level (individual in our case), then we cannot include the knowledge characteristics (complexity, teachability, and observability) in the model, except in aggregate, which removes precision.

To address the problems associated with regression analysis for our data, we used hierarchical linear modeling (HLM), which is designed to analyze this type of multilevel data (Hoffman, 1997; Raundenbush & Bryk, 2002; Snijders & Bosker, 1999; also see Cross & Sproull, 2004, for an application in knowledge sharing). In our case, we have a two-level model: the lowest level (level 1) is the knowledge task, which has the matched set of the value of person-to-person knowledge sharing and the five independent variables (i.e., extent of network, extent of codified knowledge, procedural complexity, knowledge teachability, and knowledge observability); the second level (level 2) is the individual knowledge worker and his or her job experience and gender. Because we have two sets of models, one for level 1 and one for level 2, we now can calculate R^2 at both level 1 and level 2 (Snijders & Bosker, 1999).

We have only four knowledge tasks per person, so we can treat a maximum of three variables as random effects factors (which means that they are different for each individual employee). We chose to model the intercept, extent of network, and extent of codified knowledge as random effects factors and model the three knowledge characteristics as fixed effects factors, which means that they are treated exactly like standard regression coefficients—there is *one value* for each coefficient that is calculated for everyone in the sample and that coefficient remains constant across all individuals.

We began by ensuring that the data were appropriate for the use of HLM. The ICC was 0.234, indicating significant interclass correlation so that the use of HLM is called for. The variance of the dependent variable was homogeneous, $\chi^2 = 37.91$, $df = 63$, $p =$ ns, so we used a homogeneous variance model with restricted maximum likelihood.

Model Building

We followed the HLM analysis process recommended by Hoffman (1997) and Snijders and Bosker (1999). Table 3 summarizes the results of each step in this process. Step 1 shows the results of an unconditional or baseline model. Step 2 builds a random coefficient model by adding the five level-1 independent variables. The resulting model has significantly lower deviance, AIC, and BIC than the unconditional model indicating that this model is a better fitting model than the unconditional model. This model has a Level 1 R^2 of 26% and a Level 2 R^2 of 25%. Step 3 builds a level 2 intercept-only model that adds job experience and gender as independent variables for the level 1 intercept; that is, a model to explain mean individual

performance. Once again, there is a significant decrease in deviation, AIC, and BIC, indicating that this model better fits the data than the model in step 2. The Level 1 R^2 is 30% and the Level 2 R^2 is 31%. Step 4 (not shown in Table 3) builds a level 2 slope and intercept model that adds job experience and gender as independent variables for the impact of network size and codified knowledge. In this case, the deviance, AIC, and BIC were all significantly *higher* than the corresponding values for the model in step 3, indicating that the step 4 model is a *worse* fit than the step 3 model. Therefore, we conclude that the model shown in step 3 in Table 3 is the most efficient model.

Hypotheses Testing

Our focus is on the final model in Table 3 (Step 3). There was a significant positive relationship between the extent of the social network and the value of person-to-person knowledge sharing. H1 was supported.

There was no significant relationship between the extent of codified knowledge and the value of person-to-person knowledge sharing. H2 was not supported. There was a significant relationship between the procedural complexity and teachability of the knowledge and the value of person-to-person knowledge sharing, thus supporting H3 and H4. There was no significant relationship for observability and the value of person-to-person knowledge sharing, thus failing to support H5. H6 was not able to be tested.

We did not hypothesize about the individual-specific factors of job experience and gender but they are included in our final model (Step 3, Table 3). The results show that job experience is significantly negatively related to the value of person-to-person knowledge sharing (presumably because the individual has less to learn as experience increases) but that gender is not.

Discussion

Procedural complexity and teachability significantly increased the value of person-to-person knowledge sharing and explained 30% or more of its variance. The more complex a task is and the more teachable it is, the more valuable person-to-person knowledge sharing is, suggesting that individuals are more likely to bypass the organizational KMS (even if it contains relevant knowledge). Contrary to our expectations, observability and the existence of codified knowledge in a KMS had no effect on the value of person-to-person knowledge sharing. We also found that the longer a person had been in a job, the less likely they were to perceive value in knowledge received from others.

We find it interesting that the existence of codified knowledge had no impact on the value of person-to-person knowledge sharing. For the organization in our study, the provision of the codification-based KMS did not affect employees' value of acquiring knowledge from their colleagues through person-to-person knowledge sharing, rather than using the KMS.

The key question is why the availability of codified knowledge in the KMS had no effect on the value of going outside the KMS for knowledge? One possibility may be that there was little difference in the availability of codified knowledge; the knowledge in the KMS was equally good or equally bad for all four tasks in our study and thus its presence had no impact. However, we examined the data and found significant differences in perceptions of the existence of codified knowledge across the four knowledge tasks, $F_{(3,65)} = 14.22$, $p = 0.001$, so we do not believe that this explanation is plausible. As an additional check, we tested for multicolinearity by examining the variance inflation factors in a linear regression and found no evidence of it. Thus, the nonsignificant results cannot be attributed to multicolinearity.

Another possibility may lie in the nature of the task domain. We studied knowledge at a WCB, which is fundamentally a service business. In this environment, knowledge is more likely to be service knowledge as opposed to product knowledge. Service knowledge may be more procedural than declarative (Page &

Uncles, 2004) and therefore harder to include in a codification-based KMS (Herz & Schultz, 1999). Our finding regarding the nonsignificance of codifiability is consistent with prior research on knowledge sharing in consulting firms that found the codifiability of a knowledge domain did not influence knowledge sourcing from human or digital sources (Su & Contractor, 2011). It is important to note that our finding regarding the availability of codified knowledge having no impact on the value of person-to-person knowledge sharing outcomes may only apply to other service industry contexts.

We also found that as procedural complexity increased, the value of person-to-person knowledge sharing increased. This is consistent with Su and Contractor's (2011) finding that the complexity of a domain had a negative influence on consultants' use of digital knowledge. Interactivity is important for the successful transfer of complex knowledge (Massey & Montoya-Weiss, 2006), so the greater interactivity possible in person-to-person knowledge sharing may be an important reason users perceived it to have greater value for more complex tasks. Arling and Chun's (2011) study of scientists and engineers at PrattwhitneyRocketdyne found that the ability to interact and obtain feedback from knowledge sources was critical to the development of new knowledge. Users are better able to receive assistance in contextualizing knowledge to their own needs via person-to-person sharing than via the use of codification-based KMS. Such interactivity also aids the repair of knowledge (i.e., clarifications, corrections, elaborations) when knowledge is applied to a new context (Massey & Montoya-Weiss, 2006), thus resulting in more positive outcomes associated with knowledge sharing.

Our results were consistent with those of Zander and Kogut (1995) regarding teachability. As teachability decreased, so did the value of person-to-person knowledge sharing. As knowledge becomes more difficult to teach, the value of person-to-person sharing decreases because it becomes harder to share the knowledge by one-on-one teaching.

Observability did not influence the value of person-to-person knowledge sharing, which was unexpected. We found significant differences in observability among the four job tasks, $F_{(3,65)} = 4.93$, $p = 0.004$, so lack of variance was ruled out as a plausible explanation. We speculate that person-to-person knowledge sharing via observation does not often occur in this organization so it was not seen as important, that is, aside from training, observation of other prevention officers is not commonly performed. When knowledge is shared person-to-person, it is done orally or via text-based communication, not by observation, so observability does not influence the perceived value of person-to-person sharing. This finding may be related to the study's context of a service organization or to a larger issue in organizations that employees are reasonably busy in their own jobs and have very little time to observe others.

Our results differ from Zander and Kogut's (1995) in two important ways. First, we found procedural complexity to be an important factor affecting the value of person-to-person knowledge sharing, whereas Zander and Kogut did not. This difference may be attributable to the different settings as well as the different levels of analysis across the studies. In the WCB, coworkers are the medium through which complex knowledge can most easily be shared and explained. In the manufacturing environment, complex knowledge is not easily imitated, and thus complexity could reduce the sharing of knowledge from organization to organization.

A second important difference is that Zander and Kogut (1995) found codifiability to be significant, whereas we did not. They examined whether knowledge *could be* codified, while we examined whether knowledge *had been* codified, a potentially important difference. More explicit knowledge that is more easily codified will be more likely to be shared (Nonaka, 1994), so the *ability* to codify knowledge may be an important factor in inter-organizational knowledge sharing. However, within an organization, it is the actual codification that matters. We examined the extent to which individuals chose to receive knowledge

personally rather than through a codification-based KMS and found that the extent of relevant codified knowledge in the KMS did not affect person-to-person knowledge sharing. One would expect there to be a meaningful relationship between the two, so this is an important area for future research.

As with any empirical research, this study has limitations. The possibility of common method bias exists because all constructs were measured via the same instrument. However, the questionnaire was rather long and complex, and asked about four different tasks, which helps to diminish the potential for common method bias. A second limitation is that we studied Canadian workers. It is unclear the extent to which these results would apply to American workers or those in South America, Europe, Asia, or Africa. A third limitation of this study is the focus in one organization. Together, the second and third limitations raise questions regarding the generalizability of our results to other organizations, industries and regions, and call for future research to replicate this study in other contexts. Finally, in some social network studies inter-respondent agreement between communication partners is calculated to assess response accuracy. The 38% response rate in this survey together with the large number of potential contacts and low average number of contacts listed made the calculation of inter-respondent accuracy impractical. However, prior work suggests that responses to social network questions accurately reflect long-term social structures (Freeman, Romney, & Freeman, 1987; Marsden, 1990), which are of interest here.

Implications for Research

Understanding the value of sharing knowledge person-to-person versus via a KMS is important in understanding how to better design KMS to meet user needs. We studied one organization and one KMS, so an important direction for future research is to replicate this study in a nonservice sector organization where there is potentially less procedural knowledge. For example, prior research has examined manufacturing settings in which the knowledge is likely to take on more of a product focus (e.g., Zander & Kogut, 1995).

Another direction for future research is to consider the nature of the KMS. WCB had a simple KMS that stored codified knowledge. A KMS that used a personalization strategy might have increased person-to-person knowledge sharing and simultaneously increased the role of the KMS in this process and thus increased its value (e.g., see Jennex, 2008). Further, in contrast to that suggested by Hansen et al. (1999), Jennex and Olfman (2006) propose that a KMS can (and should) leverage an integrated strategy whereby rich knowledge is codified *and* personalization is employed; this integrated approach is likely to further increase the value of the KMS. More research is needed on the role of personalization-based KMS on person-to-person knowledge transfer.

We found that the size of an individual's social network influenced the value of person-to-person knowledge sharing. As the size of the network increased, individuals were more likely to see greater value in bypassing the organizational KMS and seeking knowledge from the people in their network. One implication is therefore how this affects the role of an organizational KMS. Are new employees with smaller work-oriented social networks more likely to use the organizational KMS? According to Jennex (2008), the answer is no, as they do not yet have the context to make sense of the codified knowledge. The question remains, however, of whether we should design and develop KMS primarily for new employees and, if we do, can more senior employees (who presumably have larger social networks) also derive value from use of the KMS (cf. Ko et al., 2005)? These are important questions for future research.

Gender had no impact on knowledge sharing. However, our sample was predominantly male, so it is possible that gender effects would have been found in a sample with more females, because prior research has found that women tend to be more people-oriented (Minton & Schneider, 1980), and more accepting of others' opinions (Roberts et al., 2012). Overall, women tend to be more oriented toward interpersonal

interaction, and would likely prefer to share knowledge interpersonally rather than via a KMS. Thus, although our results showed no significant impact of gender on the perceived value of sharing knowledge from person to person, we believe it is possible that settings in which there is a greater distribution of females could see different results.

Implications for Practice

This study provides a useful tool for examining the dimensions of knowledge used and shared within an organization. It can be used as a preliminary assessment to examine the components of knowledge that might be shared most easily, and those that are not shared as easily. The easily shared components would be ideal candidates for the first phase of KMS implementation.

Our findings suggest that regardless of the extent of knowledge in a codification-based KMS, individuals will still seek to bypass the organizational KMS and share knowledge person-to-person. Understanding the value derived from person-to-person knowledge transfer and when person-to-person sharing is preferred over person-to-document knowledge sharing may influence the nature of knowledge that organizations choose to incorporate in their KMS, as well as the incentives they consider deploying for KMS use. We found that the perceived value of person-to-person knowledge sharing increased as the procedural complexity of knowledge increased. In other words, as the needed knowledge became more complex, individuals were more likely to derive value by turning to their colleagues. In essence, successful knowledge management was unrelated to the success of the KMS (Jennex, Smolnik, & Croasdell, 2009). The implication from this is not to invest significant resources in providing knowledge with high procedural complexity via a codification-based KMS as it is likely to be expensive to do so, and users may not value it.

Conclusion

This study found that as the teachability and complexity of knowledge increased, and as the size an individual's social network increased, individuals were more likely to perceive greater value from person-to-person knowledge sharing rather than from using a codification-based KMS. This finding held, regardless of the availability of relevant codified knowledge in the KMS. This study expands on the work of Zander and Kogut (1995) in three important ways. First, it adapts the dimensions of knowledge to an internal organizational setting. In so doing, we are able to look more closely at each of the dimensions and assess their relative impacts on knowledge sharing. Second, this study develops a set of measures to assess the outcomes of the person-to-person knowledge-sharing process. Third, this study is positioned within the service industry—to examine a government agency. In this setting, the imitability of knowledge is essential to survival rather than something to be protected as in the manufacturing industry, which was the case in Zander and Kogut's study. In addition, this study incorporates the social network as an important factor influencing the value of person-to-person knowledge sharing. The results highlight the nuances that are associated with organizations attaining benefits from their KMS implementations.

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Figures

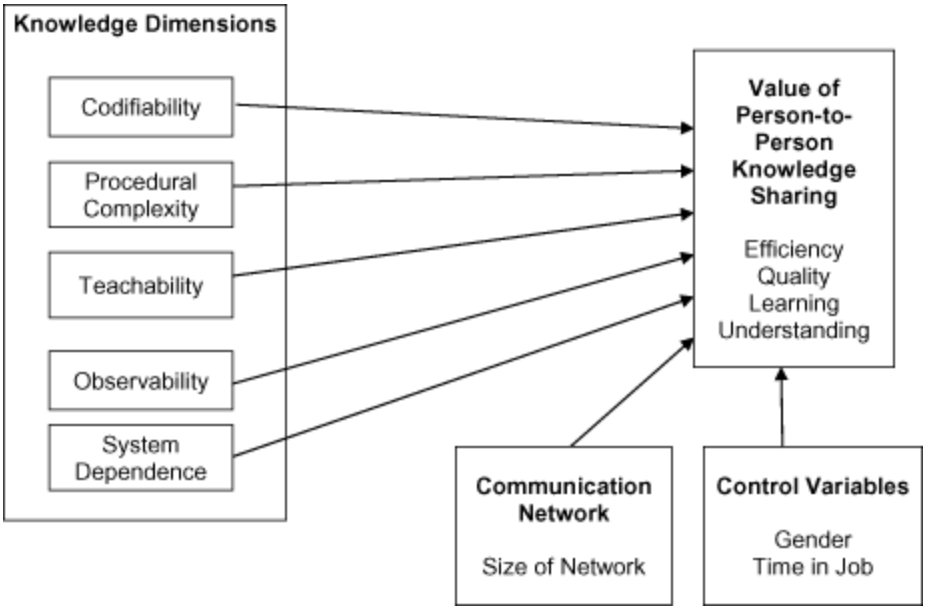

Figure 1. Research model.

Tables

Table 1. Measures

Value of Person-to-Person Knowledge Sharing (alpha = .92)	• KS1. The advice I received from other Prevention Officers helped me to learn how to gather the necessary information to complete the task. • KS2. The advice I received from other Prevention Officers allowed me to learn how employers in their workplaces will use this work product. • KS3. The advice I received from other Prevention Officers has increased my ability to ask penetrating questions about conducting this task. • KS4. The advice I received from other Prevention Officers has improved my knowledge of this work task. • KS5. The advice I received from other Prevention Officers will allow me to complete this task more efficiently in the future because I will know where to go for advice. • KS6. The advice I received from other Prevention Officers will allow me to complete this task more efficiently in the future because I will be able to conduct the task with greater independence. • KS7. The advice I received from other Prevention Officers will allow me to complete this task more efficiently in the future because I am more knowledgeable about the task. • KS8. The advice I received from other Prevention Officers will allow me to improve the quality of future work products because I will know where to go for advice. • KS9. The advice I received from other Prevention Officers will allow me to improve the quality of future work products because I will be able to conduct the task with greater independence. • KS10. The advice I received from other Prevention Officers will allow me to improve the quality of future work products because I am more knowledgeable about the task.
Existence of Codified Knowledge (alpha = .82)	• CK1. Large parts of the documentation for this task are embodied in the shared drive. • CK2. Extensive documentation describing critical parts of the process for completing this task exists within the Prevention Division. • CK3. Extensive documentation describing critical parts of the process for completing this task exists in the WCB.
Teachability (alpha = .72)	• T1. New Prevention Officers can easily learn how to do this task by talking to skilled Prevention Officers. • T2. New Prevention Officers can easily learn how to do this task by studying relevant documentation. • T3. Educating and training of new Prevention Officers to complete this task is a quick and easy job. • T4. New Prevention Officers know enough after WCB new employee training to do this task. • T5. New Prevention Officers know enough after participating in the Prevention Division mentoring program to do this task.
Procedural Complexity (alpha = .72)	• PC1. Processes for using reference materials are important to do this task. • PC2. Processes for collecting information are important to doing this task. • PC3. Processes for assembling reports are important to doing this task.
Observability (alpha = .73)	• O1. A Prevention Officer can easily learn how to do this task by analyzing existing reports. • O2. A Prevention Officer can easily learn how to do this task by using an existing report as a template. • O3. A Prevention Officer can easily learn how to do this task by observing other Prevention Officers doing this task.
System Dependence (alpha = .41)	• SD1. It is impossible for any one Prevention Officer to know everything about this task. • SD2. To obtain high work performance, it is very important that the Prevention Officers have long experience in the specific offices where they are working. • SD3. One Prevention Officer can do this job in isolation from other Prevention Officers without product quality suffering. (*Reverse coded)*

Table 2. Factor analysis

	Components					
	1	**2**	**3**	**4**	**5**	**6**
KS1	.685					
KS2	.663					
KS3	.819					
KS4	.829					
KS5	.787					
KS6	.861					
KS7	.865					
KS8	.736					
KS9	.759					
KS10	.734					
CK1		.781				
CK2		.883				
CK3		.835				
T1			.768			
T2			.549		.351	
T3			.687			
T4			.544			
T5	.384		.624			
PC1				.721		
PC2				.757		
PC3	.305			.698		
O1					.792	
O2					.842	
O3					.513	
SD1						.626
SD2						.825
SD3						.490

1. *Note*. Loadings lower than .300 are not displayed

Table 3. Results of HLM analysis on the value of person-to-person knowledge sharing

			Modeling at level 1		Modeling at level 2	
	Step 1: unconditional model		Step 2: random coefficient model		Step 3: intercept model	
	Mean	*P*	Mean	*p*	Mean	*P*
Intercept						
Intercept	4.688	.001	4.692	.001	4.688	.001
Gender					0.460	ns
Job Experience					-0.303	.005
Network Size			0.069	.022	0.065	.029
Codified Knowledge			0.056	ns	0.047	ns
Procedural Complexity			0.209	.007	0.232	.002
Teachability			0.259	.026	0.275	.019
Observability			−0.019	ns	−0.012	ns
Deviance	661.82		623.67	.001	619.46	.038
AIC	665.82		637.67	.001	633.46	.040
BIC	666.68		640.67	.001	636.46	.040
Level 1 R^2			26%		30%	
Level 2 R^2			25%		31%	