The process of knowledge retrieval: A case study of an American high-technology research, engineering and consulting company

Stefania Mariano
University of Molise, via de Sanctis sn, Campobasso, Italy, mariano@unimol.it
Andrea Casey
The George Washington University, 2134 G St NW, Washington, DC, acasey@gwu.edu

Submitted to OLKC 2006 Conference at the University of Warwick, Coventry on 20th-22nd March 2006

Introduction

> *"You know, I think there is a kind of two worlds…there is the information you collect from your customers' meetings, with your contracts, and then there is the knowledge that you collect to understand how the working environment impacts you as an individual and impact your job and I don't think that the retrieval processes for those two things are that different. I think the formality at the client, you know meeting the client…I think it is more formal then understanding the work place, I think that's why in your office a lot of the retrieval processes are around the conversations that you have or just developing your network".*
>
> - Employee of one organization practice

In consulting organizations and knowledge-intense work environments decision making requires suitable knowledge to find flexible solutions and solve problems under tight deadlines. Projects are often drawn upon the clients' needs so that the capacity to store both past expertise and knowledge about *who did what* as well as make this expertise and knowledge easily accessible to employees are learning crucial factors. A large body of research has proposed the critical role of organizational memory (Walsh & Ungson, 1991) as a central system in the storage of knowledge produced by individuals (Kim, 1993) and organizational learning processes (Casey, 1997; Casey & Olivera, 2003; DeFillippi & Ornstein, 2003; Martin de Holan & Phillips, 2003). Researchers' interests have long been concerned with the characteristics and mechanisms of organizational memory. The attention has been focused on memory retention structures (Walsh & Ungson, 1991), i.e. books, databases, and minds (Gherardi et al., 1998), and processes such as acquisition (Shrivastava & Schneider, 1984), retention (Gioia & Poole 1984; Nelson & Winter, 1982; Spender, 1996), and updating of memory (Argote et al., 1990; Goodman & Darr, 1998; Orlikowski, 1996). Moreover, research has investigated how social networks impact knowledge gathering and sharing (Cross et al., 2001; Cross & Sproull, 2004; Huber, 1982; Von Krogh, 2003).

Despite this interest, few empirical studies on organizational memory have been developed, and works on organizational memory have mostly been theoretical contributions (Walsh & Ungson, 1991). Furthermore, to date there are only a few studies (Olivera, 2000) on *knowledge retrieval*, which we define as the process by which

individuals retrieve knowledge from organizational memory with the purpose of making decisions on present issues.

This study is an empirical contribution to the organizational memory discussion. In this qualitative study we explored the individual employee's role in the process of knowledge retrieval in a professional setting using a constructivist perspective (Creswell, 2003; Lincoln & Guba, 1985). We approached the study with the intent of generating meaning from the data collected in the field (Crotty, 1998). The purpose of this research was to develop a framework for conceptualizing structures and processes of knowledge retrieval. Another goal was to identify and classify which factors are likely to influence knowledge retrieval.

This study addressed the following research questions:

*How do individuals in a professional setting retrieve knowledge from organizational memory?

*What are the retention structures used in the process of knowledge retrieval?

*What are factors influencing the process of knowledge retrieval?

This qualitative study found that people generally followed five steps to retrieve knowledge and that the type of work to accomplish and structure of the team were critical to what knowledge was retrieved and shared. Our qualitative study identified both explicit and tacit knowledge retention structures and revealed that a maximum of three individuals were usually involved in the search process of tacit knowledge.

Methodology

Qualitative research methods provide a better understanding of the study's phenomenon when additional understanding of variables is required and theories are emerging (Creswell, 2003; Yin, 2003). In this study, data collection methods were chosen to understand how employees retrieved knowledge from organizational memory (Walsh & Ungson, 1991). The assumption of the study was that meaning was constructed by human beings as they engaged with the world they interpreted (Crotty, 1998). The process was largely social and inductive (Creswell, 2003).

Data collection

This research was conducted in the United States from April through June 2005. A case study design (Creswell, 1998; Lincoln & Guba, 1985; Stake, 1995, 2000; Yin, 2003)

was used and employed three methods of data collection: interviewing (Merriam, 2001), observation (Creswell, 2003) and document analysis (Creswell, 2003; Merriam, 2001). Using these three data gathering methods provided data triangulation (Creswell, 2003; Yin, 2003) and accomplished the validity of the study. The unit of analysis was individual action. This was an embedded strategy (Yin, 2003) because IT involved more then one subunit of analysis. Data were collected across five practices (sections) of one division.

The primary researcher interviewed consultants of an American high-technology research, engineering and consulting company. This role in the organization hierarchy was chosen because employees in this role in the division had to make day-to-day problem solving decisions to accomplish their tasks.

We did purposeful sampling and our criteria for sampling were developed through the review of the literature. We worked with a small sample of people nested in context and studied in-depth (Miles & Huberman, 1994) because we seek for analytical generalization (Yin, 2003). The sample was purposive rather then random because "social processes have a logic and a coherence that random sampling can reduce to uninterpretable sawdust" (Miles & Huberman, 1994, p. 27). Based on a reputational case selection strategy (Goetz & LeCompte, 1984, cited in Merriam, 1988; Miles & Huberman, 1994), participants were chosen on the recommendation of a "key informant," which in this study was the manager of each practice, the smallest subunit of the organization's division. Our sample of 15 participants - nine male and six female - was selected from a population of 83 employees in this division. Junior, middle and senior consultants were categorized by three dates of hire intervals since tenure of employees has been proposed as a factor that influences knowledge retrieval. We conducted 12 face-to-face semistructured interviews and 2 phone calls interviews. Only in one case the questionnaire was emailed to the participant because he worked remotely and expressed a preference to receive the questionnaire by email. Interviews were conducted on site at a location convenient for participants. Interviews were no longer then one hour, were all recorded and transcribed by the primary researcher within 48 hours from the date of the session.

An open-ended interview protocol was developed based on the literature. (Merriam, 2001; Creswell, 2003). The interviews focused on the type of decisions made in their day-to-day work and encouraged interviewees to provide more details about: (a) the type of knowledge needed to accomplish decisions; (b) which factors influenced the need of knowledge; (c) the knowledge source; (d) the way to select the knowledge source; and (e) what influence did role and tenure have on the knowledge access process. We then focused on the role of social networks on knowledge retrieval. The reminder of the interview encouraged participants to provide details about the process of updating organizational memory. We concluded the interview by asking participants to express additional thoughts about knowledge retrieval.

Observations were also conducted. The primary researcher spent almost two months in the research setting. An observation protocol (Creswell, 2003) was used to record: (a) descriptive fieldnotes of the setting, behavior and activities of individuals at the research site; and (b) reflective notes (Creswell, 2003) of the researcher's role in the observation process. Observations were made on each practice's floor, in the main cafeteria of the organization building and during some practices' meetings. Consultants were observed while working in their cubicles and while having informal conversations in the hallways or in the floor's kitchen. The observations focused on how consultants retrieved knowledge from memory retention structures. In addition, any references to significant events related to social networks or factors influencing knowledge retrieval were noted.

During the research process data were also collected from public and private documents. We analyzed the organization's 2004 annual report, the organization chart, the organization's newsletters, the practices' brochures, the organization's official web-site, the organization's Intranet, the practices' hard drives and share points, some participants' personal journals and hand written notes, the email correspondence we had with participants and three internal meeting power point presentations for references to information related to the research site, memory retention structures, and consultants' role in the process of knowledge retrieval. We prepared researcher-generated documents (Merriam, 2001), i.e. photos taken during the observations and statistical data from interviews. A document summary form was used to record data (Miles & Huberman,

1994). Copies of documents' sections were also made and a summary of them was prepared.

Data Analysis

Data were analyzed with the help of the qualitative data analysis software package, Atlas.ti®. A "code-start" list of key words was developed based on research questions, assumptions, and relevant literature on organizational memory. An in-vivo process was followed where words and expressions used repeatedly by participants were added to the code list. The memo manager and the comment functions of Atlas.ti® were also used to keep track of research steps and relate comments and observations. To answer the research questions and compare results across the company's practices, the "filter" function of Atlas.ti® was used. In addition, numerical data and tables were developed (Miles & Huberman, 1994). In summary, the analysis processes produced detailed descriptions about the type of knowledge needed and retrieved, factors influencing knowledge retrieval, knowledge retention structures, social networks and memory updating. To enhance the accuracy of data analysis, we used member checks (Lincoln & Guba, 1985; Stake, 1995), peer debriefings (Creswell, 2003), and triangulation methods (Creswell, 1998, 2003; Stake, 1995, 2000; Yin, 2003) to cross-check data consistencies (Patton, 2002) and improve the credibility of the study (Lincoln & Guba, 1985). For instance, in the research process to find out the influence of consultants' role on the knowledge access, observations were useful to triangulate individual interviews data where discrepant information was expressed about a direct influence of employees' role on the knowledge access. Those observations were made in the hallways, during the organization's meetings and lunch time to observe the relationships among both senior and junior consultants and managers and employees. Observations supported the absence of a direct relationship between employee's role and knowledge access which was also confirmed by the analysis of documents and notes posted by managers and employees on share points and hard drives to make their knowledge available to others.

Findings

In these sections we present findings with respect to observations, document analysis and participants' answers to our questions about knowledge retrieval. We discuss

both structures and processes of knowledge retrieval, and we identify and classify factors influencing knowledge retrieval.

The knowledge retrieval process

The individual process of knowledge retrieval framework developed from this qualitative research is presented in Figure 1.

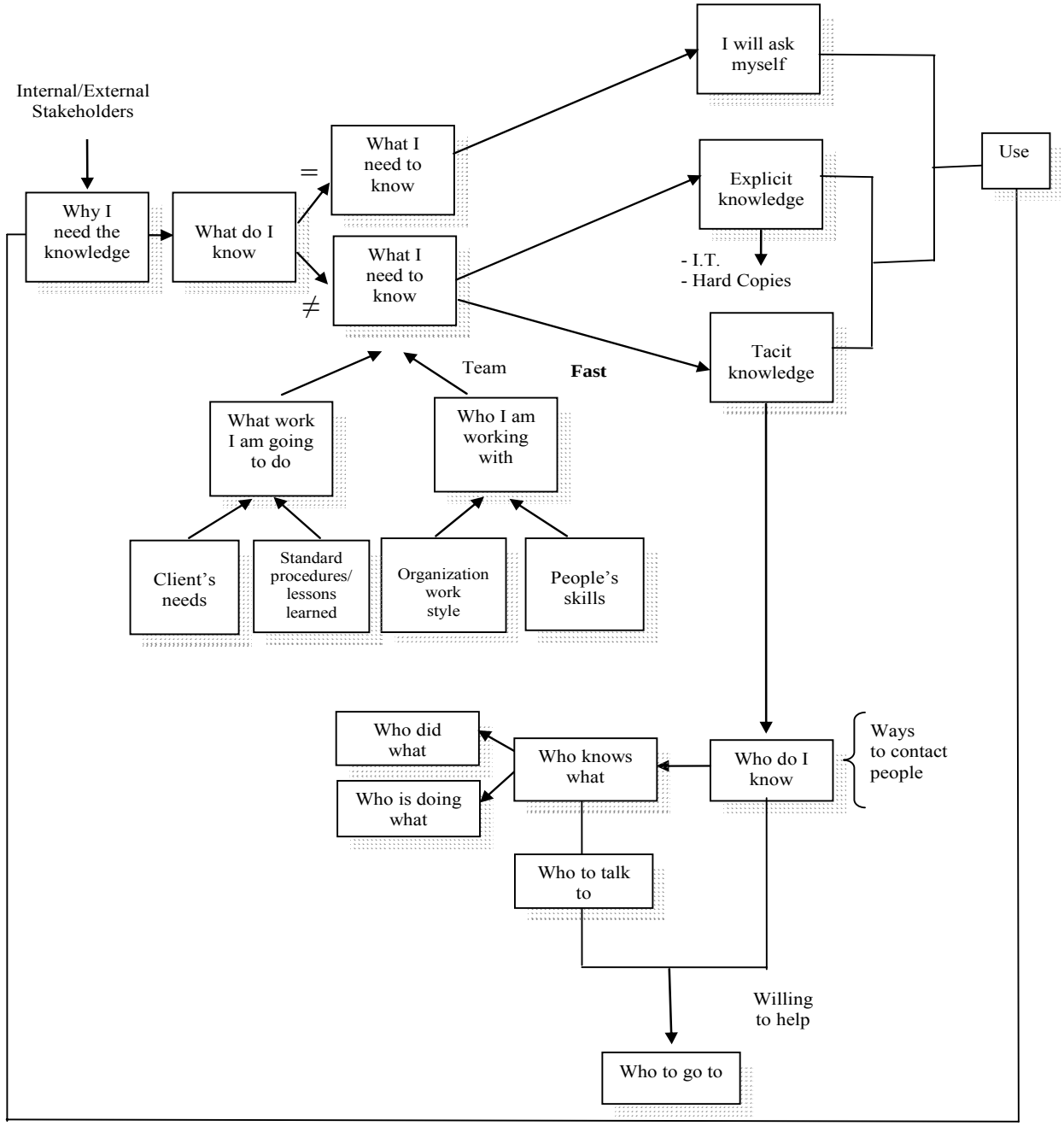

Figure 1 - The individual process of knowledge retrieval framework

Factors influencing the individual process of knowledge retrieval

Three factors were likely to influence the knowledge accessed and retrieved: (1) external and internal stakeholders, i.e. clients, coworkers and managers; (2) the work to accomplish; and (3) the structure of the team.

When asked to state the reason of the need of knowledge ("why I need the knowledge"), 87% of the interviewees discussed the clients. Interviewees claimed: "you have to anticipate the clients' needs, you have to think two or three steps before them" and "I try to anticipate what they [the clients] are going to need so before they tell me what they need I already know what they need" because, as another respondent claimed, the decision "has to do with knowing what the clients want and their expectations". In some cases (60%) interviewees mentioned coworkers' needs as a reason to retrieve knowledge: "I have two people in my team right now so I also depend on them, and getting dependent more and more on their observations" because "when you are working on a team you really have to depend on who you are working with. And rely on their credibility, what they are telling you". Twenty percent of interviewees mentioned their managers' needs as a reason to need knowledge. Of those who mentioned the managers, 2/3 were junior employees. An interviewee claimed: "I need to know they object and the vision of the people who are leading the projects. I need to know what my boss is doing on the plan and what I am doing for him…and once I know, it is fine because I want to make sure my role is helping him to do his job better".

The identification of the need of knowledge was followed by a mental process to see if what was known ("what do I know") was what needed to be known ("what I need to know"). The data analysis also indicated that what was needed to be known was influenced by the work to accomplish ("what work I am going to do") and the structure of the team ("who I am working with") since work tasks were accomplished in team almost of the time. The work to carry out depended on the client's needs and was influenced by the existence of standard procedures or lessons learned to use which helped to solve routine problems. The team was structured considering both the skills of members and the organization work style, i.e. time sold: "…it is knowing the people in the team, their capabilities and their skills, learning their availability, their history with the clients" and "making sure we have a good fit for our team and our clients".

Knowledge retention structures and process of knowledge retrieval

Several knowledge retention structures were identified. Depending on which knowledge was stored into them, they were classified as: (a) explicit knowledge retention structures; and (b) tacit knowledge retention structures.

Explicit knowledge retention structures

Explicit knowledge retention structures were utilized differently among the five practices of the division. They were: Intranet, including the company's Intranet and the practices' share points; hard drives; hard copy documents. Some interviewees (53%) mentioned people's personal laptops as valuable sources of explicit knowledge. All interviewees also cited Internet as an external source of explicit knowledge.

Intranet was accessible by anyone in the division. It provided information and knowledge of projects and proposals, company's communications, company's latest news, human resources information, and people's contacts. It was especially used to locate employees who had specific experience within the organization.

> Intranet, if I need to know something about a specific expertise in the company, like if we have a proposal coming up in particular area we can go to the Intranet and do research on past proposals and which people did that and I'll contact them directly.

Hard drives were set up in all five programs of the division as a way to store, share and retrieve resources, and establish processes and policies, templates for projects, solutions to problems, and lessons learned. Hard drives were organized by topics and requested the contribution of individuals either to post new knowledge or change/update the stored one. Hard drives helped users in two ways: first, hard drives allow users to easily retrieve knowledge of past projects to make a present decision expeditiously. Second, they contributed to build the practice's own knowledge and make it available for future users. Since hard drives were centrally structured on the practice's own network, they were not web-based and only accessible by employees of that practice from their own offices.

Share point, a software package to create electronic repositories to collect, store and access knowledge, was identified only in one practice. Such a tool helped to share and retrieve knowledge, post questions and resource files, manage the practice's calendar,

make available people's contact information, and allow the use of an instant message system to interact with coworkers. The share point was web-based so that accessible remotely by authorized individuals.

Within three practices, interviewees also referred to hard copy documents to retrieve knowledge. As for information technology tools, hard copy documents also helped to both train new employees and keep organizational memory updated, although sometimes such processes were not easy to realize. A respondent claimed:

> ….it was very difficult to train new people, you have people who don't understand, so it is very difficult, you lose all that experience and that was one of the reasons why an employed 3 years ago created the handbook, so all the information is in one place because you hear the same things, the new people say "I did not know that, no one told me that" or "I can't find that from the shared drive 'cause it's so big". So I have only one space to look for and it is so much easier. But it's not updated. I tried to update that, but it's not billable work, it's not time sold and you do that on your own time, so when during the fall it was slow, I updated that a lot, but my manager has to approve it before we give it to a new person. I think it's a good idea, we just need to use it.

In addition to those centralized knowledge retention structures, in four practices (80%) interviewees mentioned people's personal laptops as valuable not-centralized explicit knowledge retention structures:

> …a lot of people have many valuable things on their computers and we are starting to migrate at this point to a central repository.

Only in one practice participants did not mention people's personal laptops as valuable explicit knowledge retention structures. From data analysis it turned out that such a practice had effectively introduced the use of its own hard drive. Counterintuitively we may say that effective information technology repositories influenced employees' working style. A participant of that practice claimed:

> I think we are better at what we do now, we are more detail-oriented, we have more processes and policies. Like the AAR, and the hard drive… you have to store more stuff on the hard drive now, you know, if I have just written this piece of paper and I have just probably left it on my desk, I will

> put it on the hard drive, so the using of the hard drive for everything which contributes to build our own knowledge. In the past we didn't which is why we lost all the knowledge when people left.

Other interviewees (27%) also mentioned people's email folders as repositories to store and retrieve explicit knowledge:

> Well anything which is stored, is primarily on personal hard disks and secondarily there is something on people's desk and valuable sharing disks, and we have some shared disk spaces and then the email. Sometimes people need to know something and they go get it through the email and eventually they'll have an answer through the email.

Finally, although Internet was an external resource of knowledge, participants expressed their attitude to use it especially to educate themselves about a new topic, to make a preliminary research before asking other people:

> First of all I would start with a quick web search…and then with other sources and then I won't spend a lot of time there, but in that way I would think of what people are talking about those certain things in the business and pick up a lot of terminology. Then I would talk to other people I know know about the subject, but generally to speak about that, I would have done the first step. In that way I could formulate some questions…

In order to preserve the effectiveness of explicit knowledge retention structures, on the one hand employees were asked: (1) to be trained to learn how to both use and update the repositories; (2) to have an attitude to implement standards procedures/templates when updating the repositories; and (3) to be willing to always update the repository when new knowledge was introduced. On the other hand, managers had to support an organizational culture where employees were encouraged to accomplish such steps, avoiding the inconsistency of repositories and contributing to the use of them. A participant expressed his opinion about the use of an inconsistent repository:

> …if it doesn't have good updates…it's not going to be used. So...it's a sort like the chicken and the eggs and which comes first…there is inconsistency in what people put in into it and there is inconsistency in who is using the system...so because it is inconsistence that makes the process of gathering

> the knowledge inefficient because I am looking for things that may not even be there. And because of the inconsistency that forces the process to be very informal, so I just walk and I talk to them.

Tacit knowledge retention structures

Tacit knowledge retention structures were individuals' heads and social networks. From data analysis it turned out that participants had an attitude to employ tacit knowledge retention structure more then explicit knowledge retention structures to access and retrieve knowledge. All participants stated that tacit knowledge retention structures were indispensable source of knowledge. The organizational structure was indeed defined as "flat" with a "not very strong hierarchy." Employee's role was thus not considered as a factor influencing the knowledge access and retrieval.

> …it's not necessarily about your position but it is more about the question you ask and your desire to know things. I would argue that even if you are the most junior person, if you really want to know information I would think you would get that information if you ask.

Asking a coworker to find knowledge was preferred to consulting documents or electronic repositories, i.e. Intranet, share points, and hard drives.

> That tool [Share Point] doesn't produce my judgment process so I have to add something at that. It helps my judgment process but it does that very poorly…people's insights have much more to say. For me that's more important. There would be nothing new, nothing up to date and it's better to get the knowledge from the best sources…I would prefer collaborative duplications than sharing disks…It's not just about the storing, it's about the interactions.

Employees' informal relationships helped to find knowledge and build a network of trustable experts willing to help.

> …within my personal network of people that I know and trust, I will ask them if they know somebody who I can go talk to. And if they don't have the knowledge I will say: "Who do you think I should go to, who do you know may have this, who do you sense may have that type of information and knowledge?"

In the search process to find the expert - "who knows what" - three people were usually involved: (1) "who do I know", the first own network's contact; (2) "who to talk to" the second person to ask if the first one did not have the knowledge. Generally this second person had the knowledge or knew other people's expertise; and (3) "who to go to" the expert, who had experience and was willing to help. We also found that the experience was related to what an individual did in the past - "who did what" - as well as what that person was doing in the present - "who is doing what."

"Who knows what" and "who to go to" had both the experience and the credibility. "Who to talk to" was a person to trust who had *business contact knowledge* because knew what other people know. Participants reported pointing to "who to go to" because he was a person willing to help. However, he might not be the absolute optimum choice if someone else had a better knowledge but was not willing to help.

To contact other people, participants used three ways: face-to-face meetings, phone calls, emails. The use of instant message systems was not found in some practices (80%) of this organization division probably due to governmental security reasons. Three factors effected the selection of the way to contact coworkers: (1) *individuals* in terms of both knowledge seeker's individual own preferences and the relationships he had with the person to contact; (2) the *content*, in terms of the type of answer to get; and (3) the *work environment*, in terms of both physical access to other cubicles and offices and time sold which influenced the need to get knowledge expeditiously. Generally for critical knowledge either face-to-face meetings or phone calls were the preferred ways to contact people. Participants used expressions such as "too busy", "rapidly", "urgent" or "deadlines". A participant claimed: "basically, it is just to get the information very effectively and very quickly and there isn't anything else" and another participant made the point that he was "…forced to try the best solution, in the fastest time. That kind of solution is knocking at the door of the person, without being announced". Even participants who preferred to use IT tools rather than personal contacts made the point that people were usually the fastest resource to get knowledge: "…sometimes I got frustrated [about Intranet] and I took a short cut and asked someone else if they knew". From research data it turned out that getting the knowledge as fast as possible was one of the participants' first priorities because: "…even though the shared drive is wonderful, to

try to get something that you need, I think our managers are probably the quickest and best source" and also because "…other people can synthesize for you and get to the bottom line more quickly than you can…".

Informal connections and actors involved in the search process to find the person who has the knowledge to retrieve are shown in Figure 2.

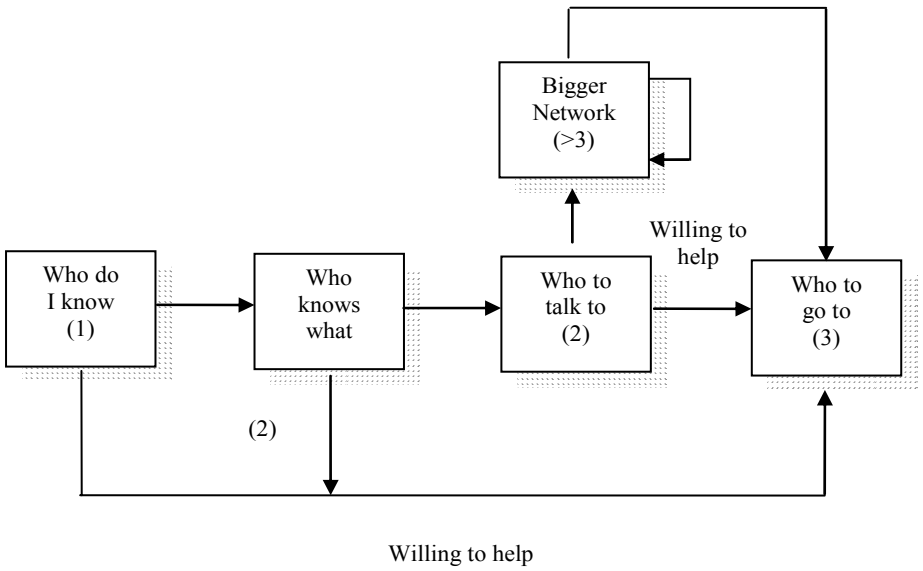

Figure 2 - Who to go to

Conclusion

This research reported a case study analysis (Yin, 2003) of the process of knowledge retrieval in a professional setting. We constructed a framework through qualitative data collected in the field (Crotty, 1998). This framework contributed to the development of the under-researched topic of knowledge retrieval from organizational memory (Olivera, 2000) and provided empirical evidence on critical factors that appeared to influence such a process.

Our participants described several knowledge retrieval steps which we identified as "why I need the knowledge", "what do I know", "what I need to know", the selection of the suitable knowledge retention structure, and the final step of the retrieved knowledge use. Findings indicated that the type of work to be accomplished (Allen, 1977) and the structure of the team were critical to what knowledge was retrieved and shared. The work

to accomplish depended on both clients' needs and the existence of standard procedures or lessons learned to apply to solve routine problems. People's skills and organization work style influenced the structure of the team.

We found four centralized explicit knowledge retention structures, i.e. Intranet, hard drives, share points, hard copy documents; one not centralized explicit knowledge retention structures, i.e. people's personal laptops, including email folders; and one external explicit knowledge retention structure, i.e. Internet. The present analysis is congruent with Huber's (1991) thoughts that Intranet was especially used to locate employees who had specific experience within the organization, and Zack's (1999) study which indicated that share points and hard drives were integrative applications to store and retrieve information of past projects, developing organizational memory (Alavi & Tiwana, 2003). This research study also found that share points and hard drives were used to create know-how (Alavi & Tiwana, 2003) and develop procedures (Alavi & Tiwana, 2003) to best accomplish a future task, although those repositories were differently employed among the five practices of the division. These findings suggest that factors influencing the process of knowledge retrieval may contribute in different ways to how people develop, select, and use explicit knowledge retention structures.

The electronic repositories helped to preserve the organization against the disruptive effect of turnover (Argote et al., 1990), ensuring the organizational learning. Using Olivera's (2000) words, electronic repositories served "a variety of functions, such as storing large amounts of information, making information accessible to individuals, providing means for communications, generating records of interactions and transactions, and automating processes" (p. 814). It was found that electronic repositories were periodically updated by the members of the organization (Orlikowski, 1996), although such an updating process was not easy to execute, due to a lack of rules to follows, confirming that lessons learned databases were often "written from the perspective of the people who lived the experience rather then that of the potential user" (Dixon, 2004, p. 21). Our study provides insights on potential ways to maintain explicit knowledge retention structures updated through an active involvement of employees asked: (1) to be trained to learn how to both use and update the repositories; (2) to have an attitude to

implement standards procedures/templates when updating the repositories; and (3) to be willing to always update the repository when new knowledge was introduced.

In addition, we found two dispersed tacit knowledge retention structures, i.e. individuals' heads and social networks. All participants considered other employees as an indispensable source of knowledge. When combined with findings of Simon (1997) and Cross and Sproull (2004), the results of this study showed that a maximum of three individuals were usually involved in the search process of tacit knowledge. The preference to obtain knowledge from other individuals rather than from documents or electronic repositories (Allen, 1977; Cross et al., 2001; Daft & Huber, 1987; O'Reilly, 1982) did not depend on the employee's role and was explained by three reasons: (1) inconsistency of repositories; (2) possibility to obtain knowledge already synthesized by others (Cross & Sproull, 2004), so that "less costly then searching through a database" (Olivera, 1999, p. 21); and (3) necessity to get knowledge expeditiously. The willingness to help emerged as a decisive factor when searching for the person to go to, together with the knowledge source's experience. Coworkers were contacted in different ways, depending on the preference of the knowledge seeker, the relationships with the other person, the content of the answer to acquire, the physical access to the other offices, and the organization work style, e.g. time sold which influenced the need to get knowledge expeditiously. Among the ways to contact people, the use of Instant Messages was not found in some program. Such a limitation influenced the process of knowledge retrieval in terms of contacting a knowledge source or transferring knowledge from one allocation to another (Alavi & Tiwana, 2003).

Employees retrieved accessible knowledge (Dixon, 1997) - knowledge constructed in the dialogue between organization's members - on a one-to-one base. Collective meaning - "meaning that organizational members hold in common" (Dixon, 1997, p. 26) - was not equally developed among the five practices, e.g. in terms of templates or lessons learned made available. This finding shows a different attitude of employees to make available their personal knowledge and suggests the need to promote a culture to support knowledge sharing through the help of managers (Scarbrough & Swan, 2003). Leaders should thus focus on strengthening or positively modifying the attitude of employees to share tacit knowledge, making their own knowledge accessible to other

coworkers. This will be essential for those organizations where employees' day-to-day decisions are not routine decisions and people's expertise represents a decisive source of knowledge to best accomplish a work task. Another implication is that when an organization wants to preserve its memory, rules and templates should be implemented to teach employees how to convert their own tacit knowledge into explicit knowledge to make it available to the other members.

This study had some limitations. First, this study did not focus on the process of knowledge storage but only on the process of knowledge access and retrieval. Second, this study only looked at the process of knowledge retrieval during decision making or problem solving activities. Finally, this study collected data through individual interviews at the consultant level. It did not focus on other levels of analysis, e.g. managerial level, which would have probably given different perspectives or results.

Implications for Future Research

Future research should be conducted in other organizational settings to determine if similar factors influence the process of knowledge retrieval. For instance, do client, coworkers and managers always affect the knowledge that is retrieved? Does the type of work to accomplish always influence the process of knowledge retrieval? Does the structure of the team always have a direct influence on the process of knowledge retrieval?

Also, future studies should investigate the extent to which effective knowledge repositories might influence the employees' first preference to seek out their colleagues to find knowledge. How would effective knowledge repositories influence that attitude?

Another potential area for research is the influence of the organization work style in knowledge retrieval. This research study revealed that time sold had a great impact on both the structure of the team and the process of knowledge retrieval. How do other organizational work styles impact the process of knowledge retrieval? How does time sold impact knowledge retrieval in other professional settings?

Research could provide answers that might help organizations to better understand which factors have a positive impact on knowledge retrieval so that employees' future decisions can be made expeditiously with a broader understanding of the entire process.

Acknowledgements

The authors would like to thank two anonymous reviewers for their helpful comments on an earlier version of this work.

References

Alavi, M., & Tiwana, A. (2003). Knowledge management: the information technology dimension. In M. Easterby-Smith, & M. A. Lyles (Ed). *Handbook of organizational learning and knowledge management* (p. 104-121). Malden, Ma: Blackwell Publishing Ltd.

Allen, T. J. (1977). *Managing the flow of technology: technology transfer and the dissemination of technological information within the R&D organization.* Cambridge, MA: MIT Press.

Argote, L., Beckman, S. L., & Epple, D. (1990). The persistence and transfer of learning in industrial settings. *Management Science*, *36* (2), 140-154.

Casey, A. (1997). Collective memory in organizations. *Advances in Strategic Management, 14,* 111-146.

Casey, A., & Olivera, F. (2003, August). *Organizational memory remembered: a look back and future directions*. Paper presented at the annual meeting of the Academy of Management, Seattle, WA.

Creswell, J. W. (1998). *Qualitative inquiry and research design: choosing among five traditions.* Thousand Oaks, CA: Sage Publications.

Creswell, J. W. (2003). *Research design. Qualitative, quantitative, and mixed methods approaches.* Thousand Oaks, CA: Sage Publications.

Cross, R., & Sproull, L. (2004). More than an answer: information relationships for actionable knowledge. *Organization Science, 15* (4), 446-462.

Cross, R., Parker, A., Prusak, L., & Borgatti, S. (2001). Knowing what we know: supporting knowledge creation and sharing in social networks. *Organizational Dynamics, 30* (2), 100-120.

Crotty, M. (1998). *The foundations of social research: meaning and perspective in the research process*. London: Sage.

Daft, R. L., & Huber, G. P. (1987). How organizations learn: a communication framework. *Research in the Sociology of Organizations, 5*, 1-36.

DeFillippi, R., & Ornstein, S. (2003). Psychological perspectives underlying theories of organizational learning. In M. Easterby-Smith & M. A. Lyles (Ed). *Handbook of organizational learning and knowledge management* (p. 19-37). Malden, Ma: Blackwell Publishing Ltd.

Dixon, N. M. (1997). The hallways of learning. *Organizational Dynamics, 25* (4), Spring, 23-34.

Dixon, N. (2004). Does your organization have and asking problem? KM Review, 7 (2), May-June: 17-24.

Gherardi, S., Nicolini, D., & Odella, F. (1998). Toward a social understanding of how people learn in organizations: the notion of situated curriculum. *Management Learning, 29* (3), 273-297.

Gioia, D. A., & Poole, P. P. (1984). Script in organizational behavior. *Academy of Management Review, 9*, 449-459.

Goetz, J. P., & LeCompte, M. D. (1984). *Ethnography and qualitative design in educational research.* New York: Academic Press.

Goodman, P. S., & Darr, E. D. (1998). Computer-aided systems and communities: mechanisms for organizational learning in distributed environment. *Management Information systems Quarterly, 22* (4), 417-440.

Huber, G. P. (1982). Organizational information systems: determinants of their performance and behavior. *Management Science, 28*, 669-718.

Huber, G. P. (1991). Organizational learning: the contributing processes and the literatures. *Organization Science, 2* (1), 88-115.

Kim, D. H. (1993). The link between individual and organizational learning. *Sloan Management Review, 35* (1): 37-51.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry.* Newbury Park, CA: Sage.

Martin de Holan, P., & Phillips, N. (2003). Organizational forgetting. In M. Easterby-Smith, & M. A. Lyles (Ed). *Handbook of organizational learning and knowledge management* (p. 393-409). Malden, Ma: Blackwell Publishing Ltd.

Merriam, S. B. (1988). *Case study research in education: a qualitative approach.* San Francisco: Jossey-Bass.

Merriam, S. B. (2001). *Qualitative research and case study applications in education.* San Francisco: Jossey-Bass.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: a sourcebook of new methods* (2nd ed.). Newbury Park, CA: Sage.

Nelson, R., & Winter, S. (1982). *An evolutionary theory of economic change.* Cambridge, MA: The Bellhop Press of Harvard University Press.

Olivera, F. (1999). *Memory systems in organizations*. Unpublished doctoral dissertation. Carnegie-Mellon University, Pittsburg, PA.

Olivera, F. (2000). Memory systems in organizations: an empirical investigation of mechanisms for knowledge collection, storage and access. *The Journal of Management Studies, 37* (6), 811-832.

O'Reilly, C. A. (1982). 'Variations in decision makers' use of information sources: the impact of quality and accessibility of information. *Academy of Management Journal, 25,* 756-771.

Orlikowski, W. J. (1996). Improving organizational transformation over time: a situated change perspective. *Information Systems Research, 7* (1), 63-92.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.) Thousand Oaks, CA: Sage.

Scarbrough, H., & Swan, J. (2003). Discourses of knowledge management and the learning organization: their production and consumption. In M. Easterby-Smith, & M. A. Lyles (Ed). *Handbook of organizational learning and knowledge management* (p. 495-512). Malden, Ma: Blackwell Publishing Ltd.

Shrivastava, P., & Schneider, S. (1984). Organizational frames of references. *Human Relations, 37*, 795-809.

Simon, H. A. (1997). *Administrative behavior: a study of decision-making processes in administrative organizations*. New York: The Free Press.

Spender, J. C. (1996). Organizational knowledge, learning and memory: three concepts in search of a theory. *Journal of Organizational Change, 9* (1), 63-78.

Stake, R. E. (1995). *The art of case study research.* Thousand Oaks, CA: Sage.

Stake, R. E. (2000). Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 435-454). Thousand Oaks, CA: Sage.

Von Krogh, G. (2003). Knowledge sharing and the communal resource. In M. Easterby-Smith, & M. A. Lyles (Ed). *Handbook of organizational learning and knowledge management* (p. 372-392). Malden, Ma: Blackwell Publishing Ltd.

Walsh, J. A., & Ungson, G. A. (1991). Organizational memory. *Academy of Management Review, 16* (1), 57-91.

Yin, R. K. (2003). *Case study research. Design and methods.* Thousand Oaks, CA: Sage Publications, Inc.

Zack, M. H. (1999). Managing codified knowledge. *Sloan Management Review, 40* (4), 45-58.