

Rocks in the Stream: An Exploration of Knowledge Flow Inhibitors within Organizations

Abstract: This study analyzes the flow of knowledge within firms at the individual level. Managers participate in semi-structured interviews. Content analysis identifies factors that obstruct or modulate the flow of knowledge such as knowledge filtering and packaging. These must be understood in order to create more effective knowledge flow within organizations.

Résumé : Cette étude analyse la circulation des connaissances dans les organisations au niveau individuel. Les gestionnaires participent à des entrevues semi-structurées. Une analyse du contenu identifie les facteurs qui entravent ou modulent la circulation des connaissances, comme le filtrage et l'intégration des connaissances. Ces facteurs doivent être compris de manière à créer une circulation des connaissances plus efficace dans les organisations.

1.0 Introduction

As the field known as knowledge management matures, American industry has come to understand the value of knowledge. This is not to say that this understanding is universal or constant throughout the landscape of organizations, but it exists. One reason for this uneven acceptance of the value of knowledge might be the lack of a standard definition of knowledge. Popular definitions of knowledge center on its position at the top of the data – information – knowledge hierarchy (Davenport 1997). A more useful definition of knowledge is an understanding or set of justified beliefs about relationships among concepts relevant to a particular area (Becerra-Fernandez, Gonzalez and Sabherwal 2004). Further definition of knowledge must also include its creation through experience or study (Awad and Ghaziri 2004). Knowledge is also defined as containing a significant organization and synthesis component, specifically its ability to organize data, information, and prior knowledge for synthesis with pre-existing knowledge (Langlois 1983). With such wide ranging attributes, it is understandable that industry has a difficult time identifying knowledge explicitly. What is important is that industry can recognize the role knowledge plays in their operations and success.

To fulfill this mission, the essential characteristics of knowledge must be understood within the context of an organization. To do this, we must recognize that as organizations vary, so do their policies on the use of knowledge, such as those governing its transmission and storage. We must also recognize that the manner in which an individual uses knowledge differs from the way an organization does (Mueller and Dyerson 1999). Therefore, to fully understand the knowledge aspects of an organization, we must understand how variation in organizational characteristics affect organizational knowledge and how individual knowledge affects, and is affected by, the organization's knowledge policies.

2.0 Rationale

The rationale behind this study stems from two sources. Through many informal conversations with practitioners, the magnitude of the problem of knowledge flow has been made apparent. However, the literature dealing with knowledge flow tends to center on its high level aspects, thus passing over important details, or approaches the topic with a quantitative methodology, thereby missing the qualitative aspects of the problem. A brief review of the current literature provides the context within which the present study is undertaken.

Paraponaris (2003) studies the knowledge flows within the research and development areas of multinational corporations (MNC). He finds that the lack of mobility between the various areas is counterproductive to the flow of knowledge between those organizations. He further points out that the technology utilized by these firms to harness knowledge and provide it to those in need often lacks a properly defined collaborative space. This hampers the accumulation of knowledge within the firm. Along similar lines, Schulz (2003) performs a study in which the movement of knowledge from the local area (universities, competitors, related industries) into the firm is measured and analyzed. The results of this analysis suggest that the density of knowledge surrounding the firm has less to do with its ability to absorb and create knowledge than first anticipated. He also asserts that the amount of knowledge taken in by a firm from the surrounding environment is directly related to its relevance.

Knowledge flows within MNCs are also the focus of a study by Gupta and Govindarajan (2000). The authors find that five elements influence the flow of knowledge between the headquarters and subsidiaries of these organizations: value of the knowledge, motivational disposition of the knowledge source, the quality of communication channels, the motivational disposition of the receiving unit, and the receiving unit's absorptive capacity. Though each factor works independently, the authors also suggest that there is a significant amount of interaction between them.

The literature discussed so far is representative of the high-level approach taken by many current authors. This portion of the knowledge flow literature describes how firm-level issues affect the flow of knowledge. Much of this literature is concerned with internal factors such as employee mobility, technology in the form of collaborative storage space or communication channels, and distance between corporate assets. Other research discusses issues such as the firm's ability to absorb knowledge from outside its walls. The common thread in this stream of literature, besides the topic area, is its focus on firm or industry level, rather than individual level, interactions. Though enlightening, it does little to explain the mechanisms by which knowledge flows, preferring to concentrate upon the results of this flow. Largely, this body of literature overlooks the operational realities of transferring knowledge within a firm on a level that can be managed and optimized, preferring to view these issues on an aggregate level.

A number of quantitative studies have been accomplished on various facets of knowledge flow. For example, Aranda and Molina-Fernandez (2002) study the flow of knowledge from customers to a sample of Spanish engineering firms. The questionnaires administered to managers of these firms measured their perception of the knowledge flows that take place between their customers and their firm, and between members of the firm. Their results indicated that organizational innovation was largely dictated by the barriers to external knowledge flows, the perception that the innovation was necessary,

and the firms' ability to integrate knowledge. Madsen, Mosakowski and Zaheer (2002) also measured knowledge flow, using the changes in personnel in the banking industry as a proxy for the flow of tacit knowledge. Their findings suggest that the mobility of tacit knowledge is related to the recent activities of the firm. Firms that have recently undergone a growth period, during which knowledge inflow was expanded, tended to decrease after that expansion.

The quantitative studies undertaken in the field of knowledge flow provide a picture of where knowledge flows either within a firm or between firms. This body of literature measures the flow of tacit knowledge within a firm, as well as into and out of a firm, using quantitative methods. This approach forces the researcher to identify proxies for the flow of tacit knowledge that can be measured and manipulated mathematically. These proxies can be questions on a survey or the movement of personnel within a firm, but in either case they are not capturing the essence of the knowledge flow. They are able to report only on the manifestations of this flow. The studies conducted at the industry or MNC level do not provide the level of detail that is required to study the actual knowledge flow mechanisms important to managers faced with improving the flow of knowledge within the firm. The quantitative studies, even those that measure at the firm level, are unable to adequately describe the intricacies of dyadic or group level knowledge flows, though they are able to document their magnitude. The literature is lacking research that utilizes qualitative methods at the department or individual level that is capable of discovering the difficulties encountered in transmitting knowledge within a firm and uncovering the reasons and possible avenues for improvement.

3.0 Methodology

In order to begin to address the shortcomings in the literature noted in the previous section, this study uses qualitative methods at the lowest levels of the organization to gather data on the knowledge flows between individuals and small groups within a firm. The use of qualitative methods allows a number of important results to emerge. First, it allows the researcher to gather data on why specific events occur, rather than how many of those events occurred. Understanding why events happen leads to a much deeper understanding of the phenomenon under study, removing the need for the researcher to depend on deductive reasoning to explain them. Second, qualitative methods allow events to be recorded other than those originally planned for. This often forces the researcher to consider new aspects of the problem under study rather than being able to rest solely on what others have previously recorded. Since the study of knowledge flow is a rather new discipline, a researcher should expect to find aspects of it that have not been observed before.

By studying the flow of knowledge at the individual and department level, this study provides a view of knowledge flows that contains sufficient detail to be useful in their management. At this level of measurement, the reasons that knowledge flows behave as they do can be understood and acted upon, rather than trying to understand their behavior by viewing them from a macro level.

As mentioned in the introductory section, the purpose of this study is to analyze the flow of knowledge within an organization. In light of the current state of the literature, this purpose can be focused a bit further. The aim of this research is to understand the flow of knowledge between individuals within an organization.

Specifically, I expect to answer the following research question: What factors inhibit the flow of knowledge between individuals in an organization?

In order to assess the characteristics of knowledge flow at the desired level of granularity, I decided to use the semi-structured interview method. This allowed me to lead the discussion in the directions I considered to be important, but also allowed both me and the subject the flexibility to introduce new ideas, stray from the question when necessary, and pursue the topic to its natural depth.

Two subjects were chosen for this stage of the research. One is the Vice President of Operations (VPO) for a mutual savings bank in the New York metropolitan area. His firm represents the service industry. The other subject is the manager of Information Technology (IT) for a large chemical and film manufacturer. These subjects were chosen in order to study the flow and use of knowledge within firms with significantly different characteristics.

There are a number of characteristics that set these two organizations apart aside from one being a service firm and one a manufacturer. The bank is smaller, measured by number of employees, than the manufacturer by a factor of ten. The other difference is geographic. The bank is located in a very large urban setting and the manufacturing firm is located in a mid-sized city. On a more important note, the bank is spread over three counties, the manufacturer is global with a presence on six continents.

Each interview was conducted in the subject's office during normal working hours. This allowed me to observe the daily flow of knowledge received by, and dispersed from, the subject. It also allowed me to take note of the physical surroundings within which the subject works, which might play a part in the knowledge flows being studied. Each interview took approximately one hour. The interview was recorded with permission of the subject, transcribed manually, and the resulting text was subjected to content analysis. During the content analysis phase, a number of themes were identified and these are discussed in the findings section of the paper.

4.0 Findings

The findings section describes the process of content analysis and the themes that emerged during the content analysis. The themes have been further sectioned into obstructive themes and modulating themes. The obstructive themes denote issues that restrict or obstruct the flow and use of knowledge within an organization. The modulating themes are issues that serve to change the knowledge, thereby affecting how it is perceived and used.

4.1 Content Analysis

The transcripts of the interviews were subjected to content analysis. The transcripts were analyzed for themes and these themes were coded. Eight themes were originally identified in the data: knowledge categorization, organizational processes, channels, geography, trust, need to know, innovation, and quantitative vs. qualitative. Further coding created several subcategories, but the most important to this research are those created from the knowledge categorization theme. After more intensive analysis, knowledge is categorized into the following: tacit vs. explicit, technical vs.

organizational, systemic vs. dyadic, and speed vs. depth. The most important of these themes are discussed in the following sections.

4.2 Obstructive Themes

Obstructive themes represent the factors identified in the data that serve to obstruct or restrict the flow of knowledge. These factors can exist at any point in the knowledge transfer process, and they can be of an individual or organizational nature. As discussed below, individual obstructing factors center on an individual's ability or willingness to participate in knowledge sharing activities. Organizational obstructing factors tend to involve communication channels and organizational procedures. Certain obstructive factors, such as geography, do not belong strictly in either category, but are related to both. They are individual in nature in that the individual is located far from the rest of the organization. The organizational aspect exists because of the firm's desire to operate across large distances.

Both subjects understood the difference between tacit and explicit knowledge. The VPO expressed an opinion that the tacit knowledge that comes with experience, the "hand-me-down style of knowledge," is more valuable in their environment. Since it is such a stable environment, much of the competitive ability of the bank must come through innovation. This innovation is often borne of experience in the industry. This experience, then, becomes more valuable to the individual, and the firm, than the explicit knowledge that is fairly constant across the industry. This experiential type of knowledge must be maintained on the part of the bank by the employment of effective employee development and retention practices. Otherwise, the loss of experiential knowledge becomes an obstruction to the use and development of the bank's knowledge base.

The IT manager also understood the value of tacit knowledge, but he split knowledge along a different dimension. He sees a difference in how technical knowledge flows as opposed to organizational knowledge. Organizational knowledge is defined as knowledge that all employees should possess such as knowledge of the firm's product line, share price, or human resource policies. Technical knowledge pertains to the specific job or task assigned to the individual (Scott 1998). For the IT manager, technical knowledge might consist of knowledge pertaining to specific information technologies or other technical issues.

Both firms have an infrastructure in place to broadcast organizational knowledge. Both firms utilize printed manuals, e-mail, voice-mail, and an intranet. An intranet is an internal network that utilizes the same technology as the World Wide Web, but it is only available within the firm. However, this infrastructure does not support the transfer of technical knowledge as well. One of the forces that help the spread of organizational knowledge is the organization itself. Members of the organization know that they can find this type of knowledge in standard formats and in pre-defined places. Technical knowledge, which tends to be more dyadic rather than systemic according to the IT manager, does not have the "benefit of the organizational top down structure." The organizational infrastructure acts as an obstruction to the flow of technical knowledge. This means that his organization has had to "invent other ways" of moving that knowledge.

The dyadic knowledge flows that the IT manager depends upon for technical knowledge flow happen on a “very ad hoc” basis. The only formal one to one communication that happens between a supervisor and the worker is the monthly review process. This, he says, is a poor mechanism for sharing tacit, technical knowledge because of the company-imposed structure of the meeting. Rather, he depends upon something he calls Centers of Excellence (COE). COE are informal, virtual groups of employees that have a great deal in common in terms of their knowledge needs. These groups communicate via the same channels as the organizational knowledge, but they impose an extra layer of structure that allows them to communicate in a more organized fashion. For instance, the company’s e-mail system, Lotus Notes, allows users to set up virtual communities that will facilitate the flow of knowledge by providing a common storage “space” for the archiving of the group’s collective knowledge. This space can be moderated, monitored, or searched, depending upon the group’s needs. In effect, the employees have modified an existing tool for their use in transmitting knowledge.

The technology that supports the COE, however, is only part of the solution. The other aspect of a successful COE in this organization is trust. The members of the organization are expected to trust that the knowledge being posted is relevant and accurate and that the other members of the group will use it properly.

One last division in the types of knowledge recognized by the subjects is related to the effect of distance on knowledge flow. The IT manager explained that there is an inverse relationship between the depth of the knowledge to be transferred and the speed with which it is transmitted. This relationship is negatively influenced when factors such as distance and culture are considered. He explained that as a manager of a global organization, he is often required to communicate with people all around the world. He avoids e-mail when trying to discuss complex issues, preferring to use the telephone. However, the time difference between the US and Europe dictates that there is a very small overlap between work days. For the company representative in Shanghai, there is no overlap. Unless special arrangements are made, the conversation is completely asynchronous. This means that, unless a great deal of time is taken in crafting the message, the depth of the knowledge transmitted might be compromised. An additional difficulty is the difference in time it takes to communicate with the domestic locations of the firm compared to the overseas locations:

“If I have something important to communicate, I can be reasonably assured of getting it into people’s hands here in minutes or hours. But, it’s very likely that it isn’t until the next business day, for Asia, that they will get it. Now, if they didn’t understand it, or they have questions, it’s my next business day before I find that out, and their second business day before it’s clarified for them. Two full days, for what took minutes or a small number of hours here. That’s a fairly big impact when it comes to time critical information such as the things that happen in my emergency management role.”

Beyond the overarching corporate structure that restricts the flow of technical knowledge at the chemical manufacturer, a number of other organizational issues surfaced that have the potential to disrupt the flow of knowledge within the firm. One of the crucial organizational aspects identified by both subjects is the manner in which they interact with their people. The VPO stated that he had an “open door policy” that

allowed, and even encouraged, anybody to stop by for a short conversation. He feels that these short conversations are a very valuable tool for him to use to find out what problems his people are having, as opposed to scheduled meetings in which the agenda is more rigid. The IT manager practices the same policy, but felt that not all of his peers were equally able to take advantage of this policy with respect to their ability to gather or disseminate knowledge. The problem is caused by the widely varying backgrounds of the managers. Not every manager is equally technically competent in the area he or she is managing. The IT manager feels that, since he is very technically inclined and has a great deal of experience in his field, he is better able to communicate ideas with his people than a manager who is not as qualified. His qualifications allow him to ask more specific and probing questions, better understand the needs of the employee, and better respond to requests for assistance. However, the limited experience of some of his peers acts as an obstruction to the flow of knowledge in the firm.

The VPO noted that much of the bank's organizational knowledge, from Human Resources policies to regulations from the Federal Deposit Insurance Corporation (FDIC), is posted on the intranet. When asked why the intranet is not used more to communicate things like best practices between branches, he pointed out that the intranet is under the control of the IT group. Therefore, anything that is to be posted must be submitted and approved by that group. This bottleneck provides enough resistance to the process that few in the bank see the intranet as an effective tool for the flow of technical knowledge.

The VPO also mentioned that one of the company's tasks is to keep the organizational knowledge current. This must be done in the face of constantly changing regulations, and it consumes a great deal of time. A related challenge is to persuade people in the organization to read the regulations regularly. This might prevent errors that occur when people think they know the regulations well enough so that they do not have to look them up, when in fact they are mistaken. Realistically, the need for frequent updating and the reluctance of people to read them act as an obstruction to the flow of knowledge in the bank.

Both firms understand the benefit of knowing what their people know, in other words a knowledge catalog of their workforce. The bank has no formal procedure for this, but saw the need for this knowledge when they opened a branch in a neighborhood that is heavily populated by people of Italian and Chinese origin. The bank searched for employees with the ability to speak either Italian or Mandarin. A knowledge catalog would have made that process easier.

The chemical and film manufacturer does have a formal knowledge cataloging process in place, but the IT manager pointed out that the categories of knowledge to be kept track of are so general as to have no applicability when managing his department's skills. He indicated that the main use of the system is to account for the training costs rather than the actual cataloging of skills and knowledge. Therefore, he takes it upon himself to informally keep track of his peoples' skills and abilities, noting them during the formal review process but also tracking them between reviews using the open door policy mentioned earlier. For both subjects, the lack of an organizational knowledge catalog obstructs the flow and usage of knowledge by restricting the organization's ability to locate it.

The processes used by the bank to transfer knowledge seem uniform throughout the organization. For instance, the branch managers meet regularly to discuss important issues, and strategic committees meet to address the long-term goals of the firm. However, the IT manager noted that the knowledge transfer processes used in his firm are not consistent between divisions, or even between departments in the same division. This might be the result of the manner in which the firm has grown with each product line becoming its own entity under the corporate umbrella. Or, it might be due to a lack of enthusiasm on the part of upper management to identify and standardize these processes. As the IT manager stated, unless he forms an informal relationship with counterparts in other divisions, knowledge that he has that would be helpful to them would never get across the divisional divide. Clearly, the lack of corporate-wide knowledge channels poses an obstruction to the flow of knowledge.

The IT manager emphasized that the effect that a missing person can have on the flow of knowledge can be significant. If knowledge is supposed to flow through an organization in a predetermined path, a missing person in the chain can significantly delay or impede that knowledge from flowing. For instance, if a manager is out on vacation, he or she must be sure to make specific plans to continue the flow of knowledge through his or her e-mail, voice-mail, or whatever channel is typically used. This often necessitates that the manager's e-mail or voice-mail accounts be left accessible by another member of the organization, anathema to many, including most IT security people. If the absence is unplanned, the situation worsens because it is very rare for these plans to be put in place before they are needed. Typically, they are created and discarded on an ad hoc basis. Even when these plans are in place, the parsing and interpretation of the content of these messages, a typical task for a middle manager, is missing for the length of the manager's absence.

As noted earlier, both organizations use the common communications channels to transmit their knowledge, such as e-mail, voice-mail, and meetings. The IT manager also explained the use of Lotus Notes in his organization as both a communications tool and a knowledge repository. In this firm's context, this knowledge repository is used to store the technical knowledge of a specific person or group in a form that is searchable, retrievable, and editable by anyone with a proper need to know. A shortcoming of this tool is its lack of access from beyond the corporate network. Currently, Lotus Notes is only available on a computer that has the client software already installed on it, which most employees' home machines do not. This limits the amount of access employees have to the knowledge base when away from the office. This is especially significant for a global organization such as this, whose employees travel often and are expected to be available at home when necessary. This access issue is a serious obstacle to knowledge flow, though one which is to be improved by the software vendor.

Geography has already been mentioned as an impediment to good communication. Whether the distance is measured in miles, such as the bank's dispersion of regional and branch managers, or thousands of miles as is the case with the global manufacturing firm, distance complicates communication of knowledge. Both subjects also pointed to the shortcomings of trying to use electronic tools to mitigate those complications. This is a strong statement coming from an IT manager whose job it is to make sure the people in his firm have adequate telecommunications capability. I noted that the time difference between the various locations in the manufacturing firm often

causes a major delay in communication. However, delays only constitute a portion of the problems caused by distance.

When communicating over long distances, the ability to communicate non-verbal communication is obviously curtailed, even with the use of videoconferencing (Kankanhall et al 2003). However, the reduction in contact time brought about by the time zone and cost restrictions of long distance communications, also limits the amount of time available to “work around to the subject” as the IT manager terms it. To continue the point:

“You tend to be more direct on communications, get right to business. It’s a little bit hampering not to have the benefit of making small talk and so on. You say good evening and so on, but you pretty much have to get right to business.”

The IT manager terms this “careful communication.” Words must be chosen carefully to avoid colloquialisms and slang. He goes so far as to suggest that the conversation should eliminate sentences that use commas. This reduces the chances that messages are completely or partially misunderstood, which would require that additional time and effort be used to clarify them.

The time differential also has a significant impact on when communication can take place. It is not uncommon for the IT manager to receive calls at home from his counterparts in China. Typically, these calls come in the early or late evening. While he does not generally complain about this, he says that many do. He describes a belief among many in his industry that the workday only exists between 8:00 AM and 5:00 PM. This is completely false, he says, and the culture of industry needs to change to reflect these new conditions. In a typical week, he is required to come in early and stay late at least one day. He reports that this cultural shift has been slow to happen in this country. However, it is more of a problem with his European counterparts. His Asian counterparts are typically much more willing to take part in business activities before or after normal working hours.

4.3 Modulating Themes

During the course of the research, two themes emerged that, unlike those identified in the previous section, serve to change the knowledge being transferred rather than inhibit its movement. Likewise, they can change the way knowledge is utilized by the decision-maker in an organization. These two themes can be labeled knowledge filtering and knowledge packaging. Before discussing these themes, I would like to explore the concept of modulating factors.

I define modulating factors as anything that changes, or modulates, the knowledge being transmitted. Modulating factors can emanate from the sender of knowledge, the channel through which knowledge is sent, or the receiver of knowledge. Simple examples of modulating factors are any coding or interference in the channel that changes the message or knowledge being sent. The modulating factors uncovered in this research have to do with the sender. These factors are under the control of the sender, though they might only be subconscious in nature. But, these factors change the knowledge from what was meant by the sender into something else which, though related, is somehow different and is of less or more value to the receiver.

The first modulating factor discussed in this research is identified by the VPO of the bank. When discussing the flow of knowledge from his office to the people who report to him, he mentioned that he employs a “filter.” This filter is used, according to him, to decide which knowledge goes to which person. The filter described here is not based on trust or whether the employee is well liked. These are based on emotion and are the realm of interpersonal relationships. Rather, the filter employed here is simply one that decides whether the employee has a need to know.

As employed by this subject, the filter has both a deliberate and an unintended aspect to it. In some instances, the VPO makes a decision not to share a particular piece of knowledge with an employee because he did not think it was necessary for him or her in their job. Or, he did not want to add to the burden of the employee. Other times, he simply does not think to give it to the employee. There is no premeditation or evaluation, it simply was not thought of. In any case, the VPO runs the risk of not giving the proper knowledge to the person who needs it. If this should occur, there are a number of risks to the employee and the bank.

If the employee observes that they have been “left out of the loop” or not given certain knowledge, this might introduce doubt. This doubt might be in their own worth to the firm, in their supervisor’s ability to manage, or in the firm’s ability to develop its personnel. In any case, this doubt can be destructive to the morale of the employee with the requisite damage to organizational performance.

This filtering mechanism is a modulating factor because of the way it changes the knowledge passed. The VPO has the knowledge to pass, and there is no impediment such as geography or language to restrict its flow, but the filtering mechanism might either edit the knowledge to meet the perceived need, or restrict its flow altogether. This editing is based on the VPO’s experience and knowledge of the employee and the situation. The VPO’s input is crucial to the flow of knowledge as he is the source, yet a risk exists that his knowledge of the situation is incomplete, resulting in an improper transfer of knowledge.

The modulating factor from the IT manager’s perspective is that of knowledge presentation. When discussing the use of qualitative knowledge versus quantitative, he stated that the presentation of knowledge has a large impact on its credibility. He points out that a great deal of the decision-making he does is tied to the use of qualitative knowledge because of the cost and time to acquire quantitative information. However, he feels that the usefulness of qualitative knowledge is directly tied to its presentation and pedigree.

The wording of the documents backing the qualitative information used for a capital acquisition, for example, must be clear and credible. Moreover, the documents must be translatable up the chain of command. Often, what starts as a two page memo to the line supervisor becomes a paragraph at the CIO level, but it must still convey the necessary knowledge and credibility. This lack of perceived credibility is often what turns a decision-maker to quantitative information that has, presumably, been verified and checked by an objective authority.

The modulating factor here, again, rests with the sender of the knowledge. The sender might have the correct knowledge in mind to send, but is unable to craft the document that will convey that knowledge effectively. Or, the sender might not know what subset of the knowledge held is the proper knowledge to send. As with the VPO's filtering mechanism, this knowledge packaging mechanism operates on both a conscious and sub-conscious level, and is often unpredictable.

5.0 Discussion

The purpose of this study is to identify and understand the factors that negatively affect knowledge flow and usage within organizations. By identifying these factors, this study adds to the growing body of literature surrounding knowledge flow and extends the findings of previous authors. This section relates the findings of this study to the current literature.

Infrastructure, especially the information technology infrastructure, is identified by both subjects as having a particularly serious impact on the flow of knowledge within the firm. The VPO indicated that the intranet provided by the bank was an efficient conduit of organizational knowledge but was an ineffective messenger of technical, or job related, knowledge. The IT manager also stressed the importance of their e-mail system, Lotus Notes, in the flow of knowledge within his firm, especially its ability to support Communities of Excellence (COE). Also noted is the part that initiative plays in these groups. The COE described by this subject were not established by the firm. They were founded by individuals within the firm who believed that the knowledge they had was useful and necessary to others. This initiative was the driving force behind the establishment of the necessary infrastructure as well as the procedures that guide the usage of the technology.

Ardichvilli, Page, and Wentling (2003) studied the Communities of Practice (COP) at the Caterpillar Corporation. COP as defined by the authors are the same as the COE described by the IT manager. Using semi-structured interviews, these authors tracked the flow of knowledge into and out of these COP. They also tried to understand the factors that inhibited these flows. Their findings were that certain conditions must be met in order for these COP to flourish. Among the most important conditions are the availability of appropriate infrastructure and an environment of trust. An appropriate infrastructure must exist within which these groups can interact, but the exact specifications of this infrastructure are specific to each group.

Ardichvilli, Page and Wentling (2003) also noted that when employees consider their job-related knowledge as organizational property, they are much more likely to allow this knowledge to flow. Based on the findings in the present study, this conclusion can be extended to state that the properly motivated employee will act to remove the barriers to knowledge flow, just as the founders of the COE did by removing the technical and organizational barriers to the flow of knowledge within the manufacturing firm. Their conviction that the flow of knowledge is important enough to go to the effort of establishing the COE might also stem from the corporate culture of innovation and exploration. Conversely, the bank does not use their intranet to spread its technical knowledge because of certain organizational barriers, namely, the control of the intranet by the Information Systems department. The conclusion might be that the nature of the

industry or of the company does not require a greater flow of knowledge, so those barriers remain in place.

It should be noted that the improved knowledge flows are not without their problems. Knowledge flows without oversight or control by the firm can lead to the transmission of improper information. Each organization must decide whether these risks are worth the potential benefit. The manufacturer has decided they are, but the bank has decided they are not. As time progresses, the environment within which these organizations operate changes, and these issues must be reevaluated.

Why is there a difference between organizational knowledge flows and technical knowledge flows? Why do they need different channels and processes? In both of the firms studied in this research, organizational knowledge flows well through company-established channels, but the flow of technical knowledge requires specifically designed channels (in the case of the manufacturing firm) or depends upon face-to-face contact when no other suitable channel exists (as is the case with the bank).

Lindsay et al (2003) performed a study of knowledge flows within international service firms, and their results suggest that the “knowing how” type of knowledge is more valuable than the “knowing what” type, and that since it is deemed more valuable it will flow in a different manner. This supports the different treatments of knowledge in the present study if “knowing how” is construed as technical knowledge and “knowing what” is interpreted as organizational knowledge. However, their value proposition was taken from the perspective of the satellite offices of the firm, not the headquarters. It is possible the satellite office will value technical knowledge higher than organizational knowledge, but it is unclear if that statement is equally valid when applied within the headquarters of the firm. Moreover, the authors do not specify how the channels should differ for the different categories of knowledge. Their study supports the differences in treatment found between the two categories of knowledge in this study, but does not explain it.

A clue as to the reason that different channels are required for different types of knowledge comes from the IT manager. While discussing the use of Lotus Notes to support the COE, he explains that the members of the community have the ability to post threaded conversations and follow-up questions, as well as static document posting. He also mentioned that instant messaging software is becoming increasingly popular within his area of responsibility. These methods of knowledge transfer are very interactive and allow for a two-way flow of knowledge. In contrast, the mechanisms used to transmit organizational knowledge such as memos, intranet pages, and mass e-mails, constitute a one-way flow of knowledge. The conclusion to be drawn is that as the knowledge to be transferred becomes more technical in nature, the channel through which it flows must become more bi-directional.

Bi-directional flows require both parties to participate. This participation can be stressful to many in the organization, especially when the interaction between them is available for viewing by the entire group. The IT manager mentioned that the firm encourages trust among its employees, and that a certain amount of trust is required among members of the COE. This is supported by the findings of Ardichvilli, Page, and Wentling (2003) who found that lack of trust was a major contributor to failures of COP at Caterpillar.

What is management's role in promoting knowledge flow? The data shows that management can play a role in creating the proper environment for knowledge to flow, such as creating formal communications structures and managing the development of the employee, but that certain aspects of knowledge flow extend beyond the direct reach of management. These findings are supported by the literature.

Mueller and Dyerson (1999) conclude that it is important to establish the technology to support the knowledge base of an organization, but "the fact remains that it is the employees who are the most important carriers of knowledge." Their study was performed within the financial industry in London and focused on the role played by various levels of management in the preservation of the firms' knowledge. They concluded that while much of the knowledge flow through the firm's borders is out of the hands of management, managers can do a great deal to foster the creation of knowledge within the firm. They point specifically to the idiosyncrasy of knowledge and its seemingly haphazard distribution within the firm as an area ripe for managerial intervention. This is the situation being addressed by the IT manager's attempt to inventory the skills of the people in his department. They also state that the behavior of the employee can be modified to enhance the knowledge gathering ability of the firm, much as the IT manager and VPO encourage the flow of knowledge between themselves and their employees.

This research has extended the literature on knowledge flow by finding evidence that the level of interactivity of the communication channel is a key to its ability to transfer technical knowledge. The success of the channel is also tied to the trust put into the organization by the employees involved. The current study also supports previous findings about the importance of the employee's initiative and desire to share knowledge to the overall success of a firm's knowledge policies.

Two themes that are identified in this research but not supported by the literature are the modulating themes of knowledge filtering and knowledge packaging. Further research will determine the importance of these themes and their impact on knowledge flow.

The subjects of this study struggle with maintaining and promoting the flow of knowledge within their organization on a daily basis. Their struggle, however, is less with the knowledge than with the frustration caused by the obstacles in its path. They understand the value of the knowledge and the reason it should be passed on, but are often frustrated by the fact that it will not pass freely and without distortion. Like rocks in a stream, some obstacles change the flow and some stop it completely, some obstacles are apparent and some hide beneath the surface, and the effects of the obstacles are often not predictable.

Managers should be aware that knowledge obstacles can originate in three places. The first is with the receiver of the knowledge such as the cultural or language differences found in overseas knowledge flow. The second is with the organization, which is evident in the lack of appropriate knowledge flow channels at the bank. The third type of obstacle lies with the manager, such as the filtering applied when passing knowledge down the organization. This awareness must be coupled with the realization that the other parties in the knowledge transaction may not recognize these factors.

6.0 Conclusion and Directions for Future Research

With this research, I identify some of the factors that restrict or modify the flow and use of knowledge in commercial organizations. By using the structured interview method, I have uncovered some of the underlying causes of the problems inherent in intra-firm knowledge flow. I have shown that a desire to share knowledge is a necessary, but not sufficient, condition for the efficient flow of knowledge to occur. Firms, and the individuals within them, have to expend additional energy to identify and overcome a number of obstacles and inhibitors.

The factors that play a part in reducing or eliminating the effectiveness of knowledge flow can be classified into two categories, obstructive factors and modulating factors. Obstructive factors serve to stop or greatly reduce the flow of knowledge. Modulating factors change the knowledge as it flows. This categorization should be helpful to researchers and practitioners. Researchers can use it as a starting point for further research into the interactions between factors. Practitioners will be better able to understand and address these factors if they have a better appreciation of the role each plays in the knowledge flow system.

The utility of this research lies in its ability to identify the reasons that knowledge flow within a firm is compromised and the causal factors that underlie these restrictions. This understanding is the key to finding more effective mechanisms through which knowledge can flow and instituting organizational policies that support, rather than hinder, the flow of knowledge.

Future research should center on two fronts. First, the observations made in this paper are limited in scope and scale and must be broadened. Many of the factors identified should be researched from the other perspective, that of the knowledge receiver. For example, future research should ascertain the scope of the managerial filtering process and how it is perceived by those on the receiving end of it. Additional interviews with a wider sample of people in both organizations are necessary, as are interviews with representatives of firms in other industries and of other sizes. To complete the picture, these same inquiries should be made in a non-profit environment to provide a better understanding of the effect the profit motive has on knowledge flow.

The second research front exists within the planning process. How can we incorporate knowledge flows and knowledge usage into the organizational planning process? What part of the organization should be responsible for knowledge planning? Should there be a separate office of organizational knowledge with its own strategy? Firms have taken each of these paths, and there has been little done to evaluate the effectiveness of each approach. Only by continuing this path of research can we begin to understand the usefulness of knowledge in today's "knowledge organizations."

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