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**BARRIERS TO COLLABORATIVE INFORMATION SEEKING IN  
ORGANIZATIONS**

A Thesis in  
Information Sciences and Technology  
by  
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## ABSTRACT

There has been increasing interest in the fields of Computer Supported Cooperative Work (CSCW) and Information Sciences to understand the role of collaboration during information seeking activities. This interest has led to the emergence of the research area of collaborative information seeking (CIS). Although researchers are starting to identify various triggers and activities that underlie CIS, we still know very little about the *barriers* to CIS.

Consequently, in this thesis, I focus on identifying and understanding these barriers to CIS within the context of organizational work. I do this through two sequential research studies. In study 1, I focus on identifying the categories of CIS barriers and the practices that gave rise to those barriers. In study 2, I focus on one of the findings from study 1 about the barriers to expertise seeking within organizations. For both these studies, I used “critical-incident” technique for collecting data from participants through the micro-task platform, Mechanical Turk (M-Turk). I employed “constant comparative” method to analyze the data. Through these studies, I identified four major categories of CIS barriers. I also identified the underlying practices that led to these barriers.

This thesis contributes to our understanding of the barriers to CIS. By understanding these barriers, we can design better tools and processes to augment and facilitate CIS.

## TABLE OF CONTENTS

LIST OF FIGURES .....	vi
LIST OF TABLES .....	vii
ACKNOWLEDGEMENTS .....	viii
CHAPTER 1 .....	1
Introduction .....	1
Research Question .....	3
Organization of the Thesis .....	5
CHAPTER 2 .....	7
Information Behavior .....	7
IIB and CIB – Differences and Transition Points .....	9
Collaborative Information Seeking (CIS) .....	14
Social Stream of CIS Research .....	17
Technical Stream of CIS Research .....	18
Research Questions .....	21
CHAPTER 3 .....	23
Research Approach .....	23
Research Design .....	23
Data Collection .....	24
Data Analysis .....	26
Trustworthiness and Quality Control .....	28
CHAPTER 4 .....	30
Categories of Barriers .....	33
Organizational Barriers .....	34
Technological Barriers .....	35
Individual-level Barriers .....	37
Team-level Barriers .....	38
Implications .....	39
Temporal aspects to CIS Barriers .....	40
Expertise Seeking in CIS .....	42
Conclusion .....	43
CHAPTER 5 .....	44
Participant Information .....	45

Type of Information .....	46
Triggers for Expertise Seeking.....	49
Mediums and Practices.....	51
Action Generation.....	51
Identifying Expertise .....	53
Unfolding of activities.....	58
Barriers to Expertise Seeking.....	60
Structural barriers .....	62
Temporal Barriers.....	63
Cultural Barriers .....	64
Technological Barriers .....	65
Discussion and Implications.....	66
Scheduling and Awareness functionalities .....	66
Beyond breakdowns .....	68
Annotating Intermediate Information during Expertise Identification.....	69
Participants' Responses .....	69
Conclusion.....	72
CHAPTER 6 .....	73
Temporal asymmetries .....	73
Horizontal coordination.....	75
CHAPTER 7 .....	78
Conclusion.....	79
REFERENCES .....	80

## LIST OF FIGURES

Figure 1. Nested model of Information Behavior .....	8
Figure 2. Individual vs. Collaborative Information Behavior .....	13
Figure 3. Mediums of CIS .....	32
Figure 4. Participants' highest level of education .....	45
Figure 5. What kind of information were the participants looking for? .....	47
Figure 6. Mediums used during Action Generation .....	52
Figure 7. Mediums used during Identifying Expertise .....	54
Figure 8. Mediums used during Selecting and Locating Expertise .....	56
Figure 9. Mediums used during establishing contact with experts .....	57
Figure 10. A Framework for understanding expertise seeking activities .....	59
Figure 11. What activities hindered expertise seeking the most? .....	60
Figure 12. What changes would participants' like to introduce within their organization? .....	70

## LIST OF TABLES

Table 1. Models of Information Behavior.....	9
Table 2. Differences between IIB and CIB .....	12
Table 3. Differences between IIB and CIB (Adapted from Reddy & Jansen, 2008).....	13
Table 4. Examples of the data coding process .....	27
Table 5. Whom did participants talk to when they were looking for information? .....	31
Table 6. Categories of Barriers.....	33
Table 7. Categories of barriers to expertise seeking .....	61
Table 8. Illustrative quotes on the envisioned changes .....	71

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## **CHAPTER 1**

### **Introduction to Collaborative Information Seeking**

#### **Introduction**

Modern organizational settings are characterized by an increasing interdependence among actors, artifacts and activities (Karsten, 1999). Work is rarely completed by individual actors working in isolation; instead, work is becoming more collaborative (Karamuftuoglu, 1998; Reddy & Jansen, 2008). Furthermore, organizations have become information-intensive but the information is often fragmented across multiple actors, artifacts, and systems (Hansen & Jarvelin, 2000, 2005). Consequently, collaborative information seeking (CIS) has become an increasingly important part of organizational work activities (Reddy & Dourish, 2002).

However, as a research stream, CIS has been overlooked for a number of years. One reason for this is that the research areas of information seeking and collaboration were studied within different disciplinary silos. On the one hand, most of the research related to information seeking was conducted within the Information Sciences discipline. On the other hand, a significant portion of conceptual as well as technical studies on collaboration was conducted within the CSCW and Organizational Studies disciplines. Since there was not much of cross-pollination amongst these disciplines, CIS – although very relevant to practice - was largely overlooked within the academic community.

Another reason for this is largely historical. In the past, researchers viewed information seeking primarily from an individual user's perspective (Leckie, Pettigrew, & Sylvain, 1996), and have conceptualized it as an intrinsically individual activity (Ellis, 1989, 1993; Kuhlthau, 1991; Leckie, et al., 1996; Wilson, 1981, 1999). For example, Wilson (1981) viewed information seeking as “the purposive seeking for information which arises as a consequence of the

recognition of some *need* perceived by the *user*” (p.4, italics added). Similarly, Kuhlthau’s (1988) and Ellis’ (1993) models too conceptualize information seeking as an individual activity. Such a conceptualization not only has an underlying bias towards traditional interaction patterns between an individual user and a technology, but also places an implicit assumption on viewing organizational work as a series of individual activities (Reddy & Jansen, 2008).

For these reasons, researchers have not paid as much attention to CIS as they have to individual information seeking. This, in turn, has lead to the design of technologies and processes that primarily support individual information seeking. The underlying conceptualizations of information seeking beneath many information retrieval (IR) systems were viewed primarily from an individual user’s perspective (Sonnenwald & Pierce, 2000).

Nevertheless, more recently, researchers have recognized how collaboration and information are mutually entangled with each other (Gorman, Ash, Lavelle, Lyman, Delcambre, Maier, Weaver, & Bowers, 2000; Poltrock, Grudin, Dumais, Fidel, Bruce & Pejtersen, 2003). As a consequence of this recognition, researchers are now increasingly investigating the dynamics that unfold at the interplay between collaboration and information. In doing so, they have also become aware that organizational work cannot be reduced to a series of individual activities, and have recognized the need to move beyond traditional interaction patterns between an individual user and a technology (Golovchinsky, Adcock, Pickens, Qvarfordt, & Back, 2008; Golovchinsky, Morris, & Pickens, 2010; Golovchinsky, Qvarfordt, & Pickens, 2009; Morris & Horvitz, 2007; Shah, 2010; Twidale & Nichols, 1998).

This growing interest in the topics related to the collaborative aspects of information is partly reflected in the increasing number of research studies published and workshops conducted pertaining to this research area (CIBWorkshopNotes, 2009; Fidel, Bruce, Pejtersen, Dumais,

Grudin & Poltrock, 2000; Gorman, et al., 2000; Hansen & Jarvelin, 2005; Hertzum, 2008; Hyldegård, 2009; Karamuftuoglu, 1998; Morris & Horvitz, 2007; Paul & Reddy, 2010; Poltrock, et al., 2003; Reddy & Dourish, 2002; Reddy & Jansen, 2008; Reddy & Spence, 2008; Twidale & Nichols, 1998). Researchers have started to investigate on how people collaboratively identify their information needs, how they seek, understand and make sense of that information together, how they evaluate that information, and how they put that information into use (Foster, 2006; Reddy & Dourish, 2002; Reddy & Jansen, 2008).

Through these set of studies, researchers have found various triggers that act as *transition points* from individual to collaborative information seeking (Reddy & Jansen, 2008; Reddy & Spence, 2008). Researchers have also developed systems to support CIS activities (Ackerman & McDonald, 1996; Erickson & Kellogg, 2000; Golovchinsky, Adcock, Pickens, Qvarfordt, & Back, 2008; Krishnappa, 2005; Shah, 2010; Twidale & Nichols, 1998).

## **Research Question**

Although researchers are beginning to understand CIS better, there are still a number of unanswered questions. For instance, though we now know more about what triggers people to collaborate while looking for information (Reddy & Jansen, 2008; Reddy & Spence, 2008), we still do not know about what hinders them from collaborating while looking for information. Therefore, in this thesis, I'm interested in understanding the “barriers” to CIS within the organizational context. Consequently, I had the following research question:

1. *What hinders people from collaborating while looking for work-related information? [i.e. What are the barriers to CIS?]*
  - a. *What mediums and practices people use when they are not able to fully find the information they are looking for?*

- b. *What issues people face in the process, and why?*
- c. *What could one learn from these issues to design better tools and processes that could augment and facilitate CIS?*

I investigate the barriers to CIS through two sequential research studies. In study 1, I focus on identifying the categories of CIS barriers and the practices that gave rise to those barriers. In study 2, I try to gain an in-depth understanding about one of the findings from study 1 concerning the barriers to ‘expertise seeking’ within organizations. For both these studies, I used a critical-incident self report (Flanagan, 1954) of employees working in organizations. Participants were pooled from the micro-task platform, Mechanical Turk (Ipeirotis, 2010; Kittur, Chi, & Suh, 2008).

For study 1, I collected the CIS-related practices of 307 participants belonging to different work organizations. I asked them questions on *how they sought work-related information, the steps they took, the mediums they used, the people they talked to, the artifacts they referred and the issues they faced in the process of their information seeking*. I used a mixture of close-ended and open-ended questions to capture their responses. I employed “constant comparative” (Glaser, 1965; Glaser & Strauss, 1977) method to analyze the data. Through this process, I was able to identify a set of barriers that fell into four broad categories, namely *organizational barriers, technological barriers, individual-level barriers, and team-level barriers*. These barriers impacted the ability of individuals to collaborate in information seeking activities which in turn affected their ability to do their work. Two central findings, concerning *temporality* and *expertise seeking* were derived from study 1.

For study 2, I focused on one of the findings from study 1 concerning the barriers to ‘expertise seeking’ within organizations. I obtained responses from 273 participants working in

different organizations. I asked them question related to their expertise seeking practices, such as *how they locate experts whom they believe could resolve their information needs, how they establish contacts with them, what mediums they used to establish contact with experts, what issues they faced in the process and more*. I used a mixture of close-ended and open-ended questions to capture their responses. I employed “constant comparative” (Glaser, 1965; Glaser & Strauss, 1977) method to analyze the data. Initially, I identified the triggers and practices that underlie expertise seeking. Through this process, I was able to construe a framework of expertise seeking within organizations. Later, I identify a set of barriers that converged into four overarching categories, namely *structural barriers, temporal barriers, cultural barriers, and technological barriers*.

Together, two central findings, concerning *temporal asymmetries* and *horizontal coordination*, were derived from these two studies. This thesis contributes to our conceptual understanding of the barriers to CIS. By understanding these barriers, we can start to design better tools and processes to augment and facilitate CIS.

## **Organization of the Thesis**

The remainder of this thesis will be organized as follows:

- In chapter 2, I provide a background about theory and research on CIS. I do this by presenting a historical overview about the research area of “information behavior”, and by discussing the transition from individual information behavior (IIB) to collaborative information behavior (CIB) that happened within the research area. Then, I try to position CIS within the broader research area of CIB. Later, I review the social and technical stream of CIS research, and provide the necessary backdrop and context to the research question that motivates this thesis.

- In chapter 3, I present the research approach and methods followed for this thesis. I elaborate upon the platform that was used to pool participants, techniques used for data collection, and procedures employed for data analysis.
- In chapter 4, I discuss about the findings and implications of study 1 concerning the categories of barriers to CIS within organizations.
- In chapter 5, I discuss about the findings and implications of study 2 concerning the barriers to expertise seeking within organizations.
- In chapter 6, I try to synthesize the findings from study 1 and 2, and derive implications for theory and design.
- In chapter 7, I conclude by summarizing the key findings from the thesis.

## **CHAPTER 2**

### **Background**

Since CIS falls under the broad research area of “information behavior”, I will first provide a historical background about the early models of information behavior. I then discuss about the transition from individual information behavior (IIB) to collaborative information behavior (CIB) within the research area. Later, I position CIS within the broad umbrella of CIB, and review the social and technical streams of CIS research. Finally, I elaborate upon the research question that motivates this thesis.

### **Information Behavior**

Wilson (2000) defined “information behavior” as the “totality of human behavior in relation to sources and channels of information” (p.49). This includes both active as well as passive information seeking and information use. In general, information behavior, according to Wilson, involves the generation, acquisition, use, and communication of information.

Wilson conceptualized information searching, information seeking, and information behavior as organized in a hierarchical fashion (See Figure 1). On the one hand, he defined “information seeking” as the purposive seeking for information which arises as a consequence of some need to satisfy a goal (Wilson, 2000, p. 49). On the other hand, he conceptualized “information searching” as the micro-level of behavior that emerges due to the interactions between people and information systems (Wilson, 2000, p. 49). However, Wilson did not incorporate “information retrieval” within his model, since he argued that information retrieval occurs only within the larger context of information seeking processes. Ingwersen & Järvelin (2005) adapted Wilson’s model to include information retrieval. Through this revised model,

they too tried to construe the relationship between information behavior, information seeking and information retrieval in a hierarchical fashion (See Figure 1).



**Figure 1.** Nested model of Information Behavior

**Left.** Wilson's (1999) model. **Right.** Ingwersen and Järvelin's, (2005) model.

Other models of information behavior were also developed. These include Kuhlthau's (1991) six-stage Information Search Process (ISP) model, Ellis' (1989, 1993) eight-featured model of information seeking behavior, Dervin's (1998) theory of sense-making, Leckie & Pettigrew's (1996) model of professional information seeking and more. Table 1 provides a summary of these models.



**Table 1. Models of Information Behavior**

(Adapted from (Srivatsan 2008))

Model	Description	Source(s)
Wilson's Model	Information need as a trigger for information seeking.  Information need is not a basic need, but part of the process to satisfy three basic needs, namely <i>physiological, cognitive &amp; affective</i> .	Wilson, 1981
Sense-making Model	Information seeking is a sense-making process used by an individual actor to construct a bridge between a context and a desired situation.	Dervin, 1998
Professional information seeking model	Specific to a particular professional practice.  Roles and related tasks carried out by professionals lead to information needs, yielding to information seeking. Importance given to intervening factors.	Leckie & Pettigrew, 1996
Integrated model	Outlines five facets that shape information behavior, namely – personality, matter, energy, space, and time.	Sonnenwald & Iivonen, 1999
Process-oriented model	Multi-stage model - starting, chaining, browsing, differentiating, monitoring, extracting, verifying, and ending	Ellis, 1989
Information Search Process (ISP) Model	Process of construction that involves the thoughts, feelings, actions and experience of the person.  Activities include - initiation, selection, exploration, formulation, collection, and presentation.	Kuhlthau, 1991
Information Retrieval (IR) model	Addresses the interaction between users and information retrieval systems that serve to satisfy human information needs	Ingwersen, 1996; Saracevic, 1996; Spink, 1997
Task-oriented information seeking	Work task triggering the information needs;  Information seeking embedded within the work task.	Hansen, 2005

**IIB and CIB – Differences and Transition Points**

Most of the above models viewed information seeking, searching and retrieval as an intrinsically individual activity (Leckie, et al., 1996), and therefore, conceptualized information behavior at the individual level. For example, Wilson states that information seeking results from the “recognition of some need, perceived by the ‘user’” (Wilson, 1981, p. 4). In the above

statement, we could see Wilson conceptualizing information seeking as an intrinsically individual activity, which gets triggered when the individual user recognizes some information need.

I refer to these models as models of “individual information behavior” (IIB), since they have an underlying conceptualization that views information behavior primarily from an individual user’s perspective (Wilson, 1981), and as an intrinsically individual activity (Leckie, Pettigrew, & Sylvain, 1996). In addition, these models largely ignore the collaborative aspects of work and organizing. Reddy and Jansen (2008) states the following reasons for the dominance of IIB models: a) a bias towards traditional interaction patterns between a single user and technology; and b) organizational work is viewed as a set (or series) of individual activities; lesser emphasis was placed on the collaborative aspects of work.

However, increasingly, there are now a number of studies that have looked at collaborative aspects of information seeking, searching, retrieval and use (Attfield, Blandford, & Makri; Bruce, et al., 2003; Fidel, et al., 2000; Fidel, Pejtersen, Cleal, & Bruce, 2004; Foley & Smeaton; Hansen & Jarvelin, 2005; Hertzum, 2008; Hertzum, 2010; Hyldegård, 2006, 2009; Karamuftuoglu, 1998; Prekop, 2002; Reddy & Jansen, 2008; Reddy & Spence, 2008; Sonnenwald & Pierce, 2000). These studies have generated awareness within the research community that organizational work cannot be reduced to a series of individual activities. In doing so, they have collectively stressed upon the need to move beyond traditional interaction patterns between an individual user and a technology (Golovchinsky, Adcock, et al., 2008; Golovchinsky, Morris, & Pickens, 2010; Morris & Horvitz, 2007; Shah, 2010). Put together, these studies brought forth the transition from individual to collaborative information behavior (CIB).

One of the first definitions which dealt with the collaborative aspects of information (specifically, collaborative information retrieval) was proposed by a team of researchers from the University of Washington. They defined collaborative information retrieval as “*activities that a group or team of people undertakes to identify and resolve a shared information need*” (Pollock et al. 2003). Reddy and Jansen (2008) observed that there are two central concepts within the above definition: 1) collaboration (i.e. two or more people working together to seek information) and 2) resolving an information need.

Reddy & Jansen’s (2008) empirical study of two healthcare teams provided important initial insights about the nature of CIB. Findings from their study helped to demarcate CIB from IIB (Please refer to Table 2 for a summary of these differences). The first key distinction between IIB and CIB is the differing role communication plays. In the case of IIB, communication between people plays an important, but a limited role. More or less, it is limited to posing questions and getting answers. However, in the case of CIB, communication plays a more central role - for continuously sharing information with each other and for providing context during the entire search process. The second distinction is the difference in the nature of triggers. Triggers are defined as “*an external event within the environment that initiates collaborative information behavior amongst a formal or informal group of people*” (Reddy & Spence, 2008, p.249). IIB has various triggers, such as the gap between the *context* and a *desired situation* (Dervin 1983), or, the lack of information, which initiates a set of information seeking activities (Wilson 1981). However, CIB has more ‘complex’ triggers that act as take-off points from IIB. This complexity arises due to the complexity of the information itself or due to the fragmented nature of the sought information. It could also be due to a lack of domain expertise or lack of immediately accessible information. Indeed, it is these set of triggers that initiates the

transition from IIB to CIB. The four major identified triggers, which act as transition points from IIB to CIB, are *complexity of information need, fragmented information resources, lack of domain expertise, and lack of immediately accessible information* (Reddy and Jansen, 2008). Finally, the third major distinction between IIB and CIB is the role IR technologies play. In the case of IIB, IR technologies act as the primary medium to search for information found within the system. In the case of CIB, since information resources are fragmented across multiple sources, IR technologies play an important, but only a supporting role.

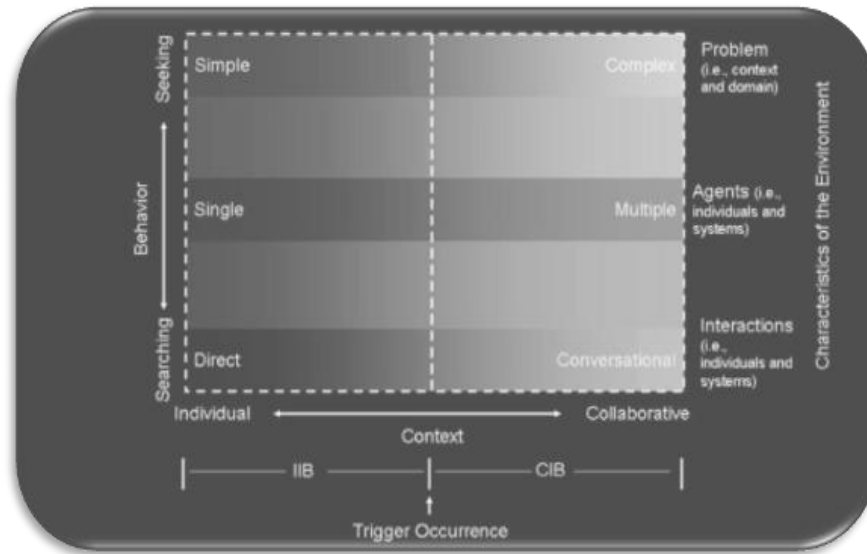
**Table 2.** Differences between IIB and CIB

(Adapted from (Reddy & Jansen (2008))

Items	IIB	CIB
<b>Communication</b>	Limited to Question & Answers	Plays a more central role
<b>Triggers</b>	Gap between the context and a desired situation.	Complexity of information need; Fragmented information resources; Lack of domain expertise; Lack of immediately accessible information
<b>IR Technology</b>	Primary medium to search for information	Plays a supporting role, since information is fragmented across multiple sources.

Based on these findings, Reddy & Jansen (2008) came up with their initial model for understanding CIB in context (See Figure 2). They conceptualized the characteristics of the environment along two axes, a behavior axis – which moves on a spectrum starting from information searching (lowest level) to information seeking (highest level), and a contextual axis – which moves on a spectrum from IIB to CIB. Through the model, they illustrate the interactions that unfold among the two axes at various levels. These interactions are further

influenced by intervening variables, such as the mode of interaction, agents, and the problem domain.



**Figure 2.** Individual vs. Collaborative Information Behavior

(Adapted from Reddy & Jansen, 2008)

This model helps describe the key differences between IIB and CIB across different levels (information seeking, searching and behavior) and identify various transition points in the form of trigger occurrences within each of these levels. A summary of these differences are given below, in Table 3.

**Table 3.** Differences between IIB and CIB (Adapted from Reddy & Jansen, 2008)

Level	IIB	CIB
<b>Information Behavior</b>	Simple information problems; direct interaction with a single system.	Complex information problems; importance of constant communication; interaction with multiple systems.
<b>Information Seeking</b>	Use of a single system. Relatively little interaction with other people or systems	Use of multiple agents (people and system). Significant interaction with other people and systems
<b>Information Searching</b>	Direct (Q&A) Interaction Mode	Conversational interaction to address exploratory search, problem resolving, decision making

Building upon these extant works, I define CIB as the “*behavior exhibited when a group or team of people work together to identify, retrieve, seek and share needed information needed.*”

This definition highlights the different activities that constitute CIB.

### **Collaborative Information Seeking (CIS)**

CIS is one of the main activities within CIB. CIS can be defined an activity in which “*two or more individuals work together to seek needed information in order to satisfy a goal*”. CIS may involve a variety of systems, people, and channels in order to address the information need, and is comprised of three micro-level activities, namely *searching*, *retrieving* and *sharing*, that unfold in a cyclical fashion. That is, after being triggered to collaborate, actors search for information from a variety of sources they are aware of, retrieve them, share it with each other, and continue searching for information till they feel that the time is ripe for evaluating and using the found information. These ‘micro-level’ behaviors are exhibited when actors interact with one another and with systems of all kinds. It consists of interactions with the system at different levels, including the cognitive and affective level (Bruce, et al., 2003; Fidel, et al., 2000; Hyldegård, 2006, 2009; Poltrock, et al., 2003) as well as at the user–system level (Gorman, et al., 2000; Hertzum, Pejtersen, Cleal, & Albrechtsen, 2002; Reddy & Dourish, 2002; Reddy & Spence, 2006).

As an illustration, consider the following vignette from Reddy and Spence (2008) - a field study of a multidisciplinary patient care team in an emergency department.

*The ED doctor, PK, is waiting for lab results for a patient in room 5. Normally, upon completion of the lab work, the results print directly to the unit secretary’s, DF’s, printer and placed on the patient chart or in the appropriate slot in the rack on her desk. However, the needed results are not in either location. PK asks DF about the labs, but DF has not seen the results either. Therefore, DF checks the status of the results in the patient record system, while PK calls the lab directly to check on the results. The patient record system shows the lab results as status of ‘pending,’ while the lab tells PK that it will be at least 15 minutes before the results are ready. PK and DF share the information*

*that they each collected. PK decides to wait until the results are finalized in the system before implementing a plan of care (p. 249).*

As we see from the above vignette, the lab result information needed by PK was not available where he thought it would be available (i.e. in the rack at the unit secretary's desk), which in turn initiated a process of *search*. This search process unfolded not in an individual but in a collaborative manner, wherein the physician PK and the unit secretary DF divided-up their search task, since each of them knew different ways to access the information (i.e. the physician calling the lab directly and the unit secretary using the information system). Through this trial-and-error process, they reach the appropriate information source that has the potential to resolve the information need. At this stage, information gets *retrieved*, and then later, *shared* across the actors. If the need is resolved, then CIS is said to be complete. The sought information is now synthesized, evaluated and put to use. If the need is not resolved, then it leads to another cycle of searching, retrieving and sharing information. Consider another set of vignettes from the same field study.

*The ED doctor, PK, is reviewing x-rays of a patient and sees some irregularities that he does not recognize. He contacts a radiologist, BM, for his expertise. PK shows BM the x-rays and tells him that he is not sure if the fracture in the shoulder is old or new. BM asks PK a series of questions about the patient's age and presenting condition. While BM reviews the x-rays, PK returns to the emergency department to ask the patient about possible past shoulder injuries. After reviewing the x-ray, BM tells PK that the fracture looks old because the edges of the bone are rounded, not sharp. PK is able to support the diagnosis with the information gathered from the patient – he had hurt his shoulder about 11 months earlier. PK and BM discuss the issue further and decide to have the patient see an orthopedic doctor (p.250).*

*A patient's pain is severe enough that the nurse, AM, starts a treatment protocol. However, she does not believe that the suggested medication is strong enough for the patient. Before deciding on a pain medication, the doctor, PK, wants to know the patient's weight, current pain level rating, symptoms and pain location. Although AM has some of this information documented, the pain level rating is not up-to-date. Therefore, another nurse, SP, volunteers to talk with the patient about the pain rating, while AM reviews the Emergency Department Flowsheet. Once the needed information is found by AM and SP, they share it with each other and PK. The gathered information is then used by the team to determine that Demerol should be administered for the pain (p.250).*

In these vignettes too, CIS unfolds in a cyclical *search-retrieve-share* fashion. In the first vignette, the physician PK lacked the expertise needed in radiology to make a proper diagnosis. This, in turn, triggered him to *search* for a specific expert. Through the help of that expert (i.e. a radiologist), the needed information was *retrieved* and *shared* among each other. The entire process was orchestrated via constant verbal communication and facilitated with the help of external artifacts. All of these helped the physician to seek the needed information and make a confident diagnosis. In the second vignette, the physician PK initiated this collaboration because the information he needed had many sub-components, such as weight, pain rating, symptoms and pain location, which he could not easily find by himself. So, PK, along with nurses AM and SP, were drawn into a *search* process. Each of them started looking for various pieces of information using different information sources (such as, asking the patient, checking the flow sheet). Then, they *retrieved* those components together, and *shared* the information with each other in order to make a diagnosis about the patient.

The above examples illustrate how CIS take place via a set of micro-level activities, namely searching, retrieving and sharing, that unfold in a cyclical fashion. These micro-level activities could be referred to as *tactical maneuvering* i.e. behavior exhibited when two or more individuals interact with each other and with systems of all kind to retrieve the needed information. Cyclical interactions between these micro-level activities that give rise to the macro-level activity of collaborative information seeking could be referred to as *strategic maneuvering* (Reddy & Jansen, 2008).

### **Streams of CIS Research**

Foster (2006) defines the research area of CIS as “the study of the systems and practices that enable individuals to collaborate during the seeking, searching, and retrieval of



information”. Accordingly, the research area too diverged into two broad streams – a social stream and a technical stream. Social stream of CIS research focused on understanding the nature and structure of CIS, and how CIS activities unfold within various organizational contexts. Technical stream of CIS research, on the other hand, focused on developing tools that could support and augment CIS activities.

### ***Social Stream of CIS Research***

Early researchers of CIS conducted field studies to understand the context within which CIS happens. For instance, Gorman et al. (2000) looked at how team members in an intensive care unit worked together to seek and share the needed information. One of the key findings of their study showed the importance of binding different information sources together, in order to address a specific request/question from a team member. Similarly, Sonnenwald & Pierce (2000) conducted a study in a hierarchical work environment (military command & control). Their findings suggested that information seeking is a dynamic activity, which involve working together to “seek, synthesize and disseminate information” (p.462). They located CIS within the wider context of group communication and emphasized the importance of interwoven situational awareness (i.e. individuals, intra-groups and inter-groups having a shared understanding of the situation) and dense social networks during information seeking activities.

Reddy & Dourish (2002) conducted a study in the medical domain, where they described the role work rhythms play during CIS. Team members who understood the work rhythm of the medical unit could collaborate and seek information in a “just in time” fashion. In another field study of patient-care teams, Spence and Reddy (2007) extended Allen’s (1977) notion of “technological gatekeepers” - a technical expert who connects the organization to the external world - and introduced the notion of “active gatekeepers” - a person who takes multiple role of

an expertise concierge, boundary spanner, and information specialist to connect information seekers with information sources.

Hyldegård (2006) looked at CIS practices within a group-based education setting in order to explore whether the existing “Information Search Process” model (Kuhlthau, 1991) holds good for group work. She found that the ISP model is insufficient to explain collaborative group work. There were many contextual and social factors, as well as the cognitive and emotional experiences, that affected the group members’ activities. Cognitive experiences of the individuals were affected not only from seeking a closure in information seeking activities, but also from the work task themselves, and from the intra-group experiences. She concluded that groups cannot be modeled as “an individual, just in another sense” (Hyldegård 2006).

Reddy and Spence (2008) studied the CIS practices of multidisciplinary patient care teams through conducting ethnographic field work. They identified seven categories of team information needs, based on the data gathered from observing and interviewing team members. They observed that there was a large percentage of organizational-related information sought by team members, in addition to the majority medical-related information.

All of these studies contributed to our understanding about the nature and structure of CIS i.e. how collaborative information seeking differs from individual information seeking, what triggers CIS activities, and how these activities unfold within various organizational contexts.

### ***Technical Stream of CIS Research***

Researchers have also developed technologies to support CIS activities (Ackerman & McDonald, 1996; Erickson, Smith, Kellogg, Laff, Richards & Bradner, 1999; Golovchinsky,

Adcock, et al., 2008; Krishnappa, 2005; Morris & Horvitz, 2007; Shah, 2010; Twidale & Nichols, 1998).

Twidale and Nichols (1998) designed one of the first interfaces to support collaborative information seeking and retrieval. They emphasized that information seeking and retrieval systems should acknowledge the need for collaboration, and, thereby, suggested that tools supporting CIS activities should incorporate ‘search process visualization’ functionality that could be customized by the users. Based on the findings derived from studies conducted in conventional as well as electronic libraries, they developed a system called ARIADNE that had features for saving, sharing and visualizing the search process (Twidale & Nichols, 1998). Similarly, Erickson, et al. (1999) developed BABBLE, a tool that facilitate social processes during collaborative information seeking activities. They term this “social translucence”, as the tool supports awareness amongst the users during various collaborative acts.

Ackerman & McDonald (2000) developed two systems called CafeConstructionKit and Collaborative Refinery, and an application that was built on top of these systems, called Answer Garden 2. While CafeConstructionKit provided mechanisms for incorporating informal communication flows between *people* and *agents* within an organization, Collaborative Refinery provided features to distill and refine this informal information. Answer Garden 2 used the services provided by these two systems to establish a *collaborative information space* via a process of what Ackerman & McDonald (2000) term as ‘graceful escalation’ and ‘collaborative refining’.

Ertzscheid (2001) developed a system called FoRSIC which focused on reducing the information overload issues of users involved in collaborative tasks. FoRSIC devises a dynamic

communication and collaboration mechanism for supporting connections between information seekers, information trainers, information tools, and information sources. Similarly, Gorman, Lavelle, Delcambre & Maier (2002) developed a technology called SLIMpad that leverages the traces left by other physicians in their information selection and use. SLIMpad gives precise information about the origin, contents and history of a particular document, as used by the physicians.

Krishnappa (2005) developed a CIS prototype called MUSE (Multi-User Search Engine), which placed an emphasis on the role synchronous communicative functionalities (such as chat) play during information seeking and retrieval process. She found that such functionalities enhance the information seeking and retrieval processes within teams. Morris and Horvitz (2007) developed SearchTogether, a publicly available browser plug-in, that allow remote users to share search queries as well as search results with each other during collaborative tasks. SearchTogether provides various functionalities, including awareness, labor division, and persistence. Finally, Paul and Morris (2009) designed and created CoSense, a system which is used for supporting sensemaking during collaborative web search activities. They achieve this by facilitating easier sensemaking handoffs by providing interactive visualizations of the search interface.

These initial CIS tools and prototypes were designed to enable UI-mediated collaborative information seeking (Golovchinsky, Pickens, & Back, 2008; Pickens, Golovchinsky, Shah, Qvarfordt, & Back, 2008). However, more recently, researchers have developed advanced tools, such as Cerchiamo (Golovchinsky et al., 2008) and Coagmento (Shah, 2010) that could facilitate algorithmically-mediated collaborative information seeking and searching. In the case of such

algorithmic-mediation, the system (instead of the users) makes judgments on the relevance of search terms', and recommends accordingly to subsequent users.

## **Research Questions**

Although both the social and technical streams have increased our understanding about CIS, there are still a number of unanswered questions. For instance, although we now know more about what triggers CIS (Reddy & Jansen, 2008; Reddy & Spence, 2008), we still do not know much about what hinders CIS (i.e. what are the barriers to CIS) within organizations.

As work becomes more and more interdependent within organizations, tasks could not be completed by just individual employees working in isolation. In addition, organizations are also increasingly operating in information-intensive environments. But, this information does not reside within a single repository; instead, it is fragmented across various actors, artifacts and systems (Karsten, 2003). Moreover, multidisciplinary teams are becoming a common feature of such organizations that operate within information-intensive environments (Fong, 2003; Page, 1993). Since people in these multidisciplinary teams often come from different backgrounds and professions, they neither have the common vocabulary to facilitate easier communication and information sharing (Dougherty, 1992), nor the shared frames and mental models to promote common ground and understanding (Dougherty & Heller, 1994; Mohammed & Dumville, 2001). Thereby, it becomes extremely difficult for seek, share and understand information needed to complete the task-at-hand. Failure to do so would yield to several negative outcomes, ranging from a poor service climate to project cost overruns to a complete failure in project and service delivery (Dougherty, 1992; Dougherty & Heller, 1994; Keil, 1995; Keil, Rai, Mann, & Zhang, 2003).

For all of these reasons, it is important to understand what hinders people from collaborating while looking for information. By understanding these barriers, we can start to design tools and processes that could support, augment and facilitate better collaboration during the moments of information seeking.

Consequently, in this thesis, I focus on understanding the barriers to CIS within the context of work organizations. Specifically, I'm interested in identifying what those barriers are, and what practices lead to those barriers. I had the following overarching research question for this thesis: What hinders people from collaborating while looking for work-related information? [i.e. What are the barriers to CIS?], and the following sub-questions: a) what mediums and practices people use when they are not able to fully find the information they are looking for? b) What issues people face in the process, and why?; c) What could one learn from these issues to design better tools and processes that could augment and facilitate CIS?

In the next chapter, I elaborate upon the research approach that I took to address my research question.

## **CHAPTER 3**

### **Research Methods**

#### **Research Approach**

Since the nature of my research is open-ended, and the phenomenon under study is nascent and not well understood, qualitative methods are used for data collection and analysis (Edmondson & McManus, 2007). Also, qualitative methods are appropriate for this study because the research goal is to understand the work processes and practices that hinder CIS. As Edmondson and McManus (2007) suggest, qualitative method could be especially useful when it comes to uncovering underlying processes and practices, since it allows for the gradual emergence of generic themes that could be iteratively refined to concrete theoretical ideas.

A grounded, interpretive approach that emphasizes the participants' point of view (Van Maanen, 1988) was adopted for this thesis. However, an interpretive approach does not imply a suspension of a researcher's judgment. Researchers play an important role in the process, in interpreting, sensemaking as well as structuring the responses of the participants (Nag, Corley, & Gioia, 2007), and in establishing connections to extant literature (Strauss & Corbin, 1998).

#### **Research Design**

I try to understand the barriers to CIS through two sequential research studies. In study 1, I focus on understanding the CIS practices of employees within organizations. Through understanding the CIS practices, I identify the major categories of CIS barriers. I use the findings from study 1 to design study 2. In study 2, I specifically focus on the barriers to 'expertise seeking' within organizations.

## ***Data Collection***

Participants with at least 24 months of full-time organizational experience were recruited through Mechanical Turk (henceforth, MTurk), a crowd sourcing platform and micro-task marketplace. MTurk enables the distribution of micro-tasks at a low-cost and high-speed to a large section of people spread across various geographies. Although MTurk is a relatively new tool for pooling subjects for academic research, its usefulness has been demonstrated in a number of research fields (Alonso, Rose, & Stewart, 2008; Ipeirotis, 2010; Sorokin & Forsyth, 2008), including HCI and CSCW (Evans & Chi, 2008; Kittur, et al., 2008).

Since I wanted to understand the mediums, sources and practices that led to CIS barriers, I wanted a relatively large sample size. Using a survey-based methodology would enable me to reach a large population. At the same time, I also wanted to gather grounded data about the information seeking practices and experiences of participants in their own voice. That is, I wanted to bring participants' voice to the foreground. In order to achieve this balance, I used a 'critical-incident' (Flanagan, 1954) self report technique that employed a mixture of open-ended and close-ended questions for capturing the practices and experiences of people, as reflected and recorded in their own words. Although responses gathered using such a technique would not be able to match the experiential insights derived from ethnographic field work, I could capture "thick descriptions" (Geertz, 1973) concerning the practices that acted as a barrier to CIS.

Since critical-incident self-reports are most accurate when it comes to recounting participant very recent experiences (Castillo, Hartson, & Hix, 1998; Flanagan, 1954), I used the following statement in study 1 to prompt participants to recollect their recent experiences - *"Recall the most recent experience you had when you were NOT able to find some work-related information that you were looking for."* Based on the statement, I asked questions about



participants' latest information seeking act, and asked them to elaborate upon the related incidents, events, and activities. I formulated subsequent questions based on the above statement. Questions were close-ended (yes/no questions, multiple choices, and rating), as well as open-ended (free-forms, comments). I asked how participants sought work-related information – *the steps they took, the mediums they used, the people they talked to, the artifacts they referred to and the issues they faced in the process*. I had a large proportion of open-ended questions – which captured free-form responses from participants – as compared to close-ended questions. For open-ended questions, I had devised incentive structures to ensure that participants share their experiences in an elaborate manner. This included a special bonus payment (\$5) for select detailed answers.

For study 2, I used the following statement to prompt participants to recollect their recent experiences - *“Recall the most recent experience you had when you were not able to “identify” and/or establish “contact” with an ‘expert’ within your organization, whom you thought had the needed ‘information’ you were looking for.”* Based on the statement, I asked questions about participants' latest expertise seeking act, and asked them to elaborate upon the related incidents, events, and activities. I formulated subsequent questions based on the above statement. Questions were close-ended (yes/no questions, multiple choices, and rating), as well as open-ended (free-forms, comments). I asked them question related to their expertise seeking practices, such as *how they locate experts whom they believe could resolve their information needs, how they establish contacts with them, what mediums they used to establish contact with experts, what issues they faced in the process and more*. Similar to study 1, I had a large proportion of open-ended questions as compared to close-ended questions. Here again, I had devised incentive

structures ensure that participants share their experiences in an elaborate manner. This included a special bonus payment (\$5) for selected detailed answers.

For study 1, I collected the CIS related practices of 307 participants and for study 2, I obtained responses from 273 participants. I will discuss the details of the participants in the later chapters.

### ***Data Analysis***

I used “constant comparative method” (Glaser, 1965) to analyze the data for both the studies. Open-ended responses were coded and analyzed by two independent coders by adhering to the guidelines specified for constant comparative method. Data coding and analysis was iteratively performed. I followed Charmaz’s (2003) approach to data coding and analysis.

Charmaz’s approach to data coding unfolds through sequence of three major steps. The first step in the process was “initial coding”, where emergent concepts were uncovered, labeled and developed. Data was analyzed line-by-line, and responses were coded using “in vivo” codes i.e. phrases and terms used by the informants. The second step in the process was “focused coding”, where the codes that emerged from the earlier stage was directed into clusters of second-order themes. The final step, “theoretical coding”, was used to strengthen or dismiss the emerging findings, and to tie the findings back to extant literature (See Table 4 for illustrative examples of the coding process). At the end of the coding process, I had a set of first-order codes, second-order themes, and third-order aggregate categories (cf. Gioia & Chittipeddi, 1991). Coding process was stopped once theoretical saturation was reached (Glaser & Strauss, 1977).

**Table 4.** Examples of the data coding process

Participant Quote	Initial Code(s)	Focused Code(s)	Theoretical Code(s)
<i>There is a hierarchy of command at my company, meaning it is taken as offensive if you do not go up the chain of command properly and often you are reprimanded if you go above your immediate supervisor, such as going to Human Resources first."</i>	Chain of command	Centralization Hierarchy	Organizational structure and processes Organizational barrier
<i>"We use multiple systems. Various groups complete the same tasks, just for a different market segment. System are not united, and it is not easy to compare what others in different market segments are doing for the same product you sell. It is hard, as sometimes people from various market segments will notice the disconnect and question our sustainability"</i>	Multiple systems	Information fragmentation. Lack of integration mechanisms.	Technological barriers
<i>"I was primarily hindered by two things: 1) a lack of time in being able to spend time tracking down others, asking my question, and awaiting their response...; 2) a lack of knowledge about who precisely to ask for the information (i.e., who would have the answer I needed)"</i>	Lack of time Lack of knowledge on who to ask	Mechanisms to connect with experts	Temporal aspects of barriers Expertise-seeking barriers
<i>The company's organization is very wide. People over here have very specific missions, sometimes related to a single task. It is so wide that each person isn't listed on the organization's chart. So it is very difficult to identify a specific person. I got stuck in a very stressful manner: I felt as if I was walking in a maze without finding the exit.</i>	Wide organization Complex organizational chart	Issues with horizontal coordination Multiple experts	Structural barriers

A modified Q-Sort approach (Stephenson, 1964) was used to calculate inter-coder reliability. The two coders were assigned several participant quotes and phrases into pre-agreed codes. Brief definitions of the codes (what they meant, what they stood for) were discussed a priori. Then, the coders were asked to assign those codes to the phrases. Similar procedure was followed for subsequent focused codes and theoretical codes.

For study 1, agreement level between the coders was 82%. For study 2, agreement level between the coders was 87%. Both the instances signify a high level of agreement among the coders, ensuring the validity and reliability of the findings.

### ***Trustworthiness and Quality Control***

As suggested by Lincoln & Guba (1999) qualitative researchers can take steps to establish trustworthiness in their own terms, and merits. *Credibility* (a notion similar to *internal validity*), was established in the study through “within-method triangulation” (Jick, 1979) through the critical-incident protocol, and through the constant comparative coding process. *Transferability* (a concept similar to external validity), was strengthened by the use of “thick-descriptions” (Geertz, 1973). Finally, *conformability* was demonstrated through a close scrutiny of data, and through maintaining a chain of evidence that would potentially allow another individual to examine the logic of analysis.

Following Kittur, Chi & Suh (2008) and Evans and Chi (2009), I took special steps to formulate the critical-incident self report to reduce invalid responses. I deployed several levels of control to ensure that the responses I got were valid and reliable. First, I followed certain heuristics to screen participants. I recruited only those participants who had a) ‘acceptance rate’ of at least 95% or above (i.e. at least 95% of their past work should have been accepted and

approved by requesters before. This criteria strengthens the relative quality of the responses), and b) at least 24 months of full-time organizational experience. I initially obtained the information concerning the work experience of the participants, and later, re-verified them during the course of the survey to ensure validity of the responses. Second, I inserted control questions and probed for highly-specific questions to reduce invalid responses. I did this through repeating two verifiable questions at different places, examining the similarity in responses, and using it as a control to eliminate incoherent and invalid responses. Third, I used CAPTCHA at the end of the survey to eliminate ‘spammers’ and ‘bots’. All of these, taken together, ensured the trustworthiness of the research study.

## CHAPTER 4

### Study 1 – Categories of CIS Barriers

Study 1 was aimed at identifying the broad categories of CIS barriers. As a first step, the mediums and practices people use when looking for information was identified. Specifically, details concerning who people generally approach when they look for missing pieces of information, how they go about doing it, and what challenges and hindrances they face in the process were identified and explicated. From these explications, I came up with a list of CIS barriers. These barriers fell into four major categories, namely *organizational barriers*, *technological barriers*, *individual-level barriers*, and *team-level barriers*. I discuss the findings and its implications in this section.

#### Mediums and Practices of CIS

A total of 341 participants responded to the survey. Among them, 22 responses were rejected for being incomplete. Later, 12 more responses were removed because they were incoherent. The resulting data set included 307 participant responses, totaling a rejection rate of 11.07%. All the 307 participants had at least 24-months of full-time organizational experience.

Among the 307 participant, only 18.2% (56 participants) were able to find all the information they were looking for by themselves, and the rest 81.8% (251 participants) said that they were able to find only partial information by themselves. Among the ones who were able to find only partial information, when asked whether they interacted with anyone (either face-to-face, or, distantly) else to get to that information, 63.5% said ‘yes’ and 36.5% said ‘no’. Thereby, majority of participants interacted with someone else when looking for work-related information.

People preferred to interact with colleagues who are in physically nearby locations, suggesting that even in days of virtual work and ubiquitous communication, Allen's (1977) famous "30 meters rule" seems to still hold true.

"I asked the people sitting near me if they could help me find the information. If they could not, I got on the telephone and asked some other people in the organization whether they could help me find the information." (participant #152)

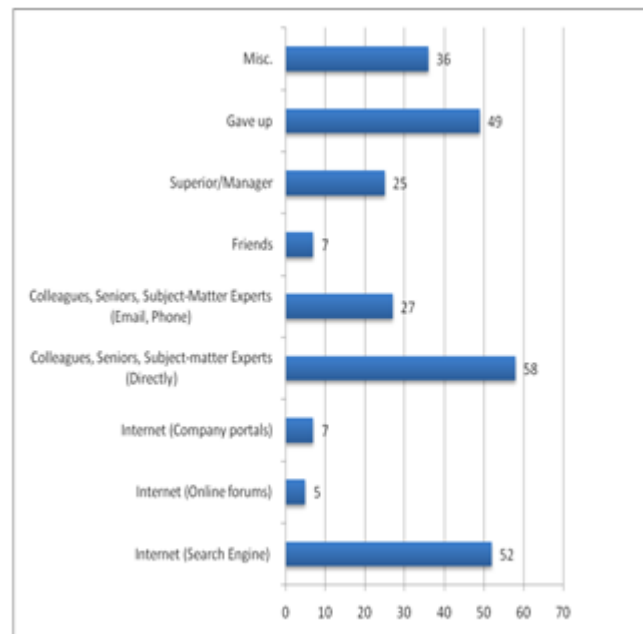
"I think the fact our company has two locations that are not within walking distance makes it hard sometimes to track down information or to collaborate.... I feel like I would be interrupting their day if I asked them for help, I would not feel that way with the people in my office."(participant #212)

**Table 5.** Whom did participants talk to when they were looking for information?

Answers	Response Percent
Colleagues within my team who were physically nearby	48.3%
Colleagues outside my team who were physically nearby	23.0%
Colleagues within my team, regardless of the location	33.7%
Colleagues outside my team, regardless of the location	21.3%
Manager	21.9%
Other	12.4%

Among participants who interacted with someone when looking for work-related information, a large number of them preferred to interact with their colleagues (See Table 5). Participants had particular preferences about who they collaborated with in their efforts to find the information. During the initial stages of information seeking, they preferred to interact with colleagues who were within their team as opposed to colleagues who were outside their team. A significant number of participants talked about leveraging technology when they were looking for work-related information. A vast majority of them preferred to use search engines to look up for information, while only very few of them used company portals and online forums. (Refer to Figure 3). However, the use of search engines had its own share of problems, as reflected below,

“I realized that search engines are crowded with far too many results, many of which are arbitrary and have nothing to do with what I am looking for. It feels as though I'm I detective so I needed to incorporate other methods of obtaining information. I asked co-workers and went to a library to try and avoid becoming reliant on the internet.” (emphasis added) (participant #23)



**Figure 3. Mediums of CIS**

Many other participants also shared their frustration about “*feeling like a detective*” while using search engines for seeking work-related information. They also agreed that within an organizational context, search engines alone are not sufficient for getting the information they were looking for.

“After I realized that I was not able to initially find the information I was looking for online, I tried to go about my internet search in a roundabout way by typing in synonyms of my search term or by searching alternate phrases entirely. After I exhausted all branches and avenues of online searching, I surveyed my co-workers and friends in person, by text, by messenger and by phone to mine them for ready information and to jot down their ideas and advice. As a last resort, off I went to the music library on the second floor to browse for information the old-fashioned through the periodicals and articles available. By the end of the day, I had assembled a good collection of information to filter through and pick and choose the best bits from to compile and form the final information I needed.” (participant #301)



As these quotes highlight, information is often spread across multiple sources (multiple people, documents, company portals, online).

“I asked my team leader that where I can find the information to process my work. I only got half answer which is not enough to complete my work. Then I started asking my colleague one by one. Though I didn't get complete answer, I completed my work based ( 90% met) on the given input.”(participant #42)

All of these reiterate the notion that CIS involves a wide variety of actors, activities, and artifacts. It may include colleagues who are co-located or distributed, and may utilize a variety of technologies. However, as we can see from the above examples, these CIS activities are not always smooth, and often are hindered by various barriers.

### Categories of Barriers

By coding and analyzing the above practices, I was able to identified a set of barriers that fit under four broad categories, namely *organizational barriers*, *technological barriers*, *individual-level barriers*, and *team-level barriers*.

Categories	Barriers	No. of Participant Responses
<b>Organizational Barriers</b>	Values & Org. Culture	144
	Incentives & rewards	112
	Org. Practices	64
	Org. Structure	48
<b>Technological Barriers</b>	Expert-Location	157
	Communication Tools	51
	Multiple, Un-integrated Systems	39
<b>Individual-Level Barriers</b>	Individual Personality/Person Perception	40
	Fear of losing face	86
<b>Team-Level Barriers</b>	Schedule Conflicts & Work Load	127
	Distance and Availability	114
	Language and Communication Issues	32

**Table 6.** Categories of Barriers

A summary of those barriers and categories are given above (See Table 6). I will now discuss these categories in detail.

### ***Organizational Barriers***

Organizational barriers refer to barriers with organizational-level characteristics. These include barriers that arise due to the *structure, culture, values, and reward system* held by an organization. For example, a number of participants stated that an organization that values individual expertise tend to make people behave in certain ways – in holding on tightly to the information they have, which in turn, hinders CIS.

“I think it's the mentality of work orders here-- the boss asks for a task to be done, and assigns that task to a specific person. The job/task is his or hers alone, and asking others for help just makes the worker look lazy or incapable of doing the job themselves.” (participant #62)

“We work on a SMART goals basis and if I spend time assisting someone else, I might consider the fact that I don't "get anything" out of it myself. That is the collaborative issue that arises most frequently.” (participant #271)

In addition to the value system, *rewards* and *incentives* also play a crucial role. An organization with few rewards and incentives for sharing information would propagate competitive behavior, which in turn, could lead to individuals holding on tightly to their information. All of these issues hinder CIS.

“Individual employees are assigned specific tasks. There is no incentive to help coworkers as that would just create more work for the individual employee. Every minute helping another employee is a minute that one cannot dedicate to one's own work.” (participant #8)

“Another organizational barrier that prevents people from collaborating is the lack of incentive to help people collaborate for other information. Individuals have such a large workload that they cannot spend time helping others searching for new information.” (participant #304)

Organizational structure also play an important role in hindering CIS. Since information is fragmented across multiple sources, individuals must have the ability collaborate easily, in order to easily the information together from multiple places. However, hierarchy and chains of command, could pose a potential problem. As and when one “..*must go through the established*

*chain of command even if you know who can best give you the information or one of the other higher ups is incompetent.”* (participant #274), CIS becomes more difficult.

“There is a hierarchy of command at my company, meaning it is taken as offensive if you do not go up the chain of command properly and often you are reprimanded if you go above your immediate supervisor, such as going to Human Resources first.” (participant #120)

If *centralization* and *hierarchy* poses a problem, *decentralization* poses a different kind of problem. As an organization gets increasingly decentralized, information becomes more and more fragmented, making it difficult for people to find appropriate and relevant information sources. Finally, organizational policies and infrastructure also act as barriers.

“The main difficulty (and strength) is that we are decentralized. Sometimes it's necessary to ask several people to find out who to actually get the answers from.” (participant #12)

“One organizational barrier is authentication and permission rights. There are many aspects of my organization's network that are prohibited to some departments, and allowed to others. This creates a serious barrier for information flow, mainly because any inter-department assistance would require both individuals relocating to a computer that is linked to both networks.” (participant #104)

In summary, a large number of participants believed that the barrier that most strongly affected their CIS was the organizational culture that placed a high value on individual expertise (cf. (Orlikowski, 1992). Also, reward structures and incentives for sharing information acted as significant barriers.

### ***Technological Barriers***

Barriers that arose due to issues with tools and technologies – a lack of a particular technology, or missing functionality within a current technology - are referred to as technological barriers. Participants highlighted that a lack of communication tools often acted as a barrier for CIS

“...barriers that prevents me from collaborating with people while looking for information is communication difficulties. When there are not proper communication routes, such as pagers, phones, and so forth, to reach doctors, respiratory therapists, occupational therapists, nutritionists, and so forth it is very difficult to provide care for a patient since I need to collaborate with them to find out treatment information.” (participant #281)

Similarly, a number of participants talked about issues pertaining to having multiple systems that does the same function, but are not tightly integrated. They said that non-integrated systems led to more *fragmentation* of information, which in turn, hindered CIS.

“We use multiple systems. Various groups complete the same tasks, just for a different market segment. Systems are not united, and it is not easy to compare what others in different market segments are doing for the same product you sell.” (participant #179)

In addition to those technological barriers, an overarching concern of participants was the need for expertise seeking systems. Participants said that their inability to find the appropriate person who could potentially help them to resolve their information need was the single major barrier to CIS. In some cases, participants said that even finding simple details, such as phone numbers and email addresses of contact points from other business units, is extremely difficult. As one participant said, “*Limited contact means between business units. No direct phone numbers or email addresses*” (participant #41) hinder their CIS to an “*extraordinary extent*”. And this especially becomes a pressing issue for people working large organizations.

“I work in a 10,000 person organization. The organization chart and points of contact are constantly changing... I have no clue who could help me. We have so many employees, I don't know who does what, what department works on what or who even to begin asking to get pointed in the right direction.” (participant #118)

If locating preliminary contact information is a fundamental issue that hinders CIS, there are also other related issues. Even after locating an initial contact point, individuals need to go through several other levels and layers and networks to get to the appropriate person who could actually be of any real help in giving relevant information.

“It also takes more time to try to find someone who can help you with the information that you need, sometimes you have to go through many people to find the one who can actually give you useful information.”(participant #176)

As a result, people stop their CIS activities, and tend to “guess” and “make do” with whatever information they have in hand.

“In the organizations where I've worked, the barriers have really always been relating to the difficulty in finding the right people with the answers I need, as well as the fast-pace that sometimes encourages making a "best guess" on the information readily available, rather than taking a lot more time to find the perfect answer.”(participant #120)

Also, since current expert-locator systems do not have in-built mechanisms that could help people to approach those experts (for example, features to find out when they are free, when to schedule a time to meet/consult the expert) (M. Ackerman & McDonald, 2000; Mark S. Ackerman & McDonald, 1996; McDonald & Ackerman, 1998), it creates other problems that hinder their CIS.

“If an expert that you need to consult with is unapproachable, it is a barrier. I have experienced people that will use excuses that they have no time to do what is in affect their job. Also, there are some who cause such an uproar if you ask for help, that you would rather struggle with the problem and seek almost any source of information but them.” (participant #14)

### ***Individual-level Barriers***

In addition to the technical and organizational barriers, there were also “individual-level” CIS barriers. By individual-level, I refer *not* to the personality-traits and dispositions of individuals, but to the attitudes, perceptions, and cognitive-frames held by people about themselves and others. An example of such barrier would be the “person perception” (Snyder & Uranowitz, 1997) held by employee -

“Perhaps a person's perception of himself/herself could prevent people from collaborating. Some people have a natural tendency to be self-reliant, which could hinder any type of collaborative efforts. Also if the organization was structured in a way that yielded a highly competitive atmosphere, I would be less likely to collaborate because of the every-man-for-himself work mantra.” (participant #102)

Few individuals do tend to be concerned about how CIS would affect their co-workers (i.e. the person whom they are collaborating to find the needed information).

“It's not so much that my organization doesn't encourage collaborative work, but rather, I feel that the individuals who work in my office are bothered when I ask questions. Whenever someone needs help, I am the first to offer my assistance because I know how it feels when help isn't offered.” (participant #84)

All of these, in turn, influence the perceptions of individuals about “collaborating” when it comes to information-seeking.

“It was a task assigned to me (contacting Con Edison regarding our company billing), so if I was to ask somebody else to assist me in finding the information I need, it would be ask if I was asking them to do my work for me. Also, my co-workers are assigned other tasks and were busy with them.” (participant #161)

### ***Team-level Barriers***

Team-level barriers most often arises in situations when participants of a team are unable to contact or connect with each other when looking for particular information. From my analysis, I found that these team-level barriers arise due to two overarching reasons. i) blurring work boundaries; and ii) schedule/time conflicts.

People within a team often have expertise in particular aspects of the work. Therefore, work-related information does not often completely reside within a single person, but is spread across a set of people. This makes collaboration (and consequently, CIS) essential to completing day-to-day activities. However, in spite of the need for collaboration within teams, there are tensions due to the blurring boundaries between individual work and team work. That is, if a good portion of information required for completing an individual's task resides within his/her teammates, and if both the individual and the teammate knows that this is the case, what exactly are the boundaries between individual work and team work? At what appropriate time intervals could that person approach his/her teammate? Many participants expressed their doubts in these

lines - regarding the *appropriate* amount of times one could approach their teammates for getting some information. In addition to that, participant reflected that workload and schedules created additional barriers.

“It is difficult when you are assigned a task to go to others who have their own workload and tasks to fulfill”. (participant #281)

“Time is always a factor..... In my organization, it is extremely (sic) hard to find time to sit down and talk to others since we do not have common planning periods” (participant #193)

Even though if an organization has a collaborative-culture, issues related to *time* and *scheduling* brings forth genuine difficulties for people to perform their CIS.

“The organization in which I am employed actively encourages collaboration so the only real barrier to collaboration is when the person that I need to collaborate with is unavailable.” (participant #4)

All of these, in turn, hindered people from working together in order to find the needed information.

## **Implications**

It is important to note that the different categories of barriers interact, and influence each other. For example, an organization that values individual expertise would tend to not only create experts who are reluctant to share their expertise, but also hinder the overall collaborative climate within that organization. Therefore, in spite of the presence of adequate and appropriate technology, CIS would still be hindered due to the overriding effects of organizational practices, values and incentives.

“The last thing you want to show your superiors is that you seem to have to ask someone else for help with your own projects.” (participant #237)

“Sometimes when asking for information, you can appear incompetent, especially if it's something that you should know but, for whatever reason, you don't know.” (participant #133)

Similarly, an organization that encourages a collaborative culture, but does not have the necessary tools, technologies and processes to facilitate that collaboration, and leverage its benefits, would also hinder CIS. Likewise, frames and perceptions held by individuals are often influenced by the organizational context - which includes the values and practices espoused by the organization. For instance, an organization that values individual expertise would have a specific effect on an individual's perception when it comes to collaboratively looking for information, as opposed to another organization that values collaboration. As one participant puts it, *"The greatest barrier is probably the stigma of not seeming confident in one's ability to 'get the job done'"* (participant #12). Clearly, the barriers to CIS are multifaceted and occur in many different ways. As I examined why these barriers occurred, I identified a strong temporal component in them which I discuss in the next subsection.

### ***Temporal aspects to CIS Barriers***

Based on the analysis, I found that CIS is driven (and hindered) by two different notions of time – a calendar-based time (“chronos”) that is determined by the larger organizational routines, and a phenomenological-based time (“kairos”) that affords people to leverage opportune moments when *“the time is right”* (Garud, Gehman, & Kumaraswamy, 2011; Hassard, 1996; Orlikowski & Yates, 2002). Such opportune moments cannot be a priori scheduled by the clock or the calendar (Garud et al., 2011). However, technologies within organizations are mostly designed to facilitate CIS based on a “calendar-based time”. For example, “scheduling systems” and “shared meeting calendars” all facilitate a priori, planned collaborative information seeking and sharing activities. Nevertheless, as increasingly seen within modern workplaces, information needs arise as a part and parcel of everyday work tasks and activities. Such information needs could not be determined in advance. Therefore, we need to think of mechanisms to resolve such



information needs “then and there”. Or else, such needs fade away, and people will either give up, or “make do” with whatever they have at hand.

As highlighted in the findings, people tend to go to their immediate colleagues at nearby locations to resolve their information needs. However, with the increasing advent of distributed teams and virtual work, such practices are becoming more difficult. Although instant messenger, email and other communication tools could be of some help here, they don’t really facilitate *collaborative* seeking and sharing of information. As one participant said,

“Sometimes questions comes up when I’m not scheduled to work that have an immediate answer, and I’m stuck, or questions come up when I am on shift that need a quick response, which I cannot get via e-mail.” (participant #204)

So, one challenge for CIS researchers is to develop mechanisms that could not only support activities centered around calendar-driven time, but also support activities centered around individual-driven perceptions of time. In short, designs that facilitates people to *seek* the needed information in order to *seize* the “opportune moment”.

“Most of my colleagues were more than willing to help when available however, so it was usually a matter of timing in order to catch them at an opportune moment to be able to have our discussion. “Right now” wasn’t always possible, but “later on” was usually anywhere between the space of a few minutes or even hours... Time and place is everything in a workplace, so as long as I managed to coordinate and respect both, I found that I was always able to find and get the information I needed in the end from cooperative co-workers, employees and friends.” (emphasis added) (participant #72)

One way to do this is to devise ‘awareness technologies’ into IR systems that would enable people to understand the work status and availability of their immediate colleagues, and to visualize the temporal routines of their organization. This would let people to understand the larger work rhythms of their colleagues (as well as their organization), enabling them to proactively *pre-adapt* their collaboration in order to seek information in a “just in time” fashion (Reddy & Dourish, 2002), and to “*catch them (colleagues) at an opportune moment*”. Another

way to do this is to incorporate mechanisms into current IR tools that could diffuse the information need into several different sources (such as discussion forums, organizational micro-blogs, project level forums etc.), record, index and rate the received responses, and devise incentive schemes for quicker and appropriate responses. Both these approaches clearly suggest the need to take the ‘social’ as well as the ‘technical’ aspects into consideration.

### ***Expertise Seeking in CIS***

As described earlier, a major barrier to CIS was finding the right people who could help them in finding the needed information. As one participant put it,

“I was primarily hindered by two things: 1) a lack of time in being able to spend time tracking down others, asking my question, and awaiting their response (particularly if they weren't available or online); 2) a lack of knowledge about who precisely to ask for the information (i.e., who would have the answer I needed).” (participant #262)

However, none of current CIS tools and prototypes has features which support expertise seeking. Among the various CIS tools and prototypes, such as ARIADNE (Twidale & Nichols, 1998), BABBLE (Erickson, et al., 1999), Cerchiamo (Golovchinsky et al., 2008) and Coagmento (Shah, 2010), I found that none of them had features that would help people to locate and connect with experts. Though I do realize that these tools are designed to support specific functions and audiences, it is still interesting that none of them had any features related to seeking experts – an important aspect of CIS within the context of organizations.

I argue that there are two possible reasons for the lack of expertise seeking functionalities within CIS tools. First, many tools use “web search” as the overarching metaphor to model and augment CIS activities (Golovchinsky et al., 2008; Morris & Horvitz, 2007). Though CIS within the context of ‘web search’ and ‘organizational work’ have some similarities, there are also substantial differences. There are differences in the way information is *fragmented* within

organizations across multiple actors, artifacts and routines (Reddy & Jansen, 2008). There are differences in norms and incentive structures. There are also differences in the ways the “social context” could be understood and captured (Gorman, et al., 2000; Sonnenwald & Pierce, 2000). Thereby, I question whether the “web search” metaphor is an appropriate one to model CIS activities within organizations. Second, many CIS tools were built based on user studies in controlled settings and not based on in-situ studies. As a result, these tools do not incorporate information concerning how people (or groups of people) within organizational settings work together to search for needed information.

## **Conclusion**

Through this study, I identified a set of barriers to CIS that converged into four overarching categories. Two central issues, concerning temporality and expertise seeking, were derived from the study. In regard to addressing these issues, CSCW research on “expertise recommendation” (McDonald & Ackerman, 1998) and “organizational memory” (Ackerman & McDonald, 1996) could be helpful. CIS tools and systems could incorporate functionalities that could recommend experts based on a summation of the user’s immediate information need and the user’s network of preferences. Similarly, tying intra-organizational social networks into the system could facilitate better CIS. Finally, having formalized processes that could address questions concerning what to do when a particular expert is not available (or, does not answer), could facilitate better collaboration during moments of information seeking.

To probe more into these issues, I designed and executed another study that aimed at gaining a more nuanced understanding about the barriers to expertise seeking within organizations. I elaborate upon the findings and implications of that study in the next chapter.

## CHAPTER 5

### Study 2 – Barriers to Expertise Seeking

Study 2 was designed to gain a more in-depth understanding about one of the major findings from study 1 concerning the barriers to expertise seeking. Findings from the previous study suggested that expertise seeking is a crucial aspect of CIS. In fact, collaboration during information seeking activities often happens between experts and non-experts. However, extant CIS research has largely overlooked these aspects. Hence, we don't have a good understanding of how expertise seeking activities unfold within the larger context of CIS, including what hinders expertise seeking during CIS. By understanding these dynamics, one could devise mechanisms and infrastructures that could augment and facilitate expertise seeking.

Through this study, I first describe the triggers for expertise seeking. Then, I explicate upon the mediums and practices that underlie it. Through this process, I identify four major activities, namely *action generation, identifying expertise, locating and selecting expertise and establishing contact*, that constitute expertise seeking. By construing connections across these activities, I develop a framework of expertise seeking within organizations. Later, I identify a set of barriers to expertise seeking that converged into four overarching categories, namely *structural barriers, temporal barriers, cultural barriers, and technological barriers*. Finally, I discuss about the implications of these findings for designing better expertise seeking tools and processes.

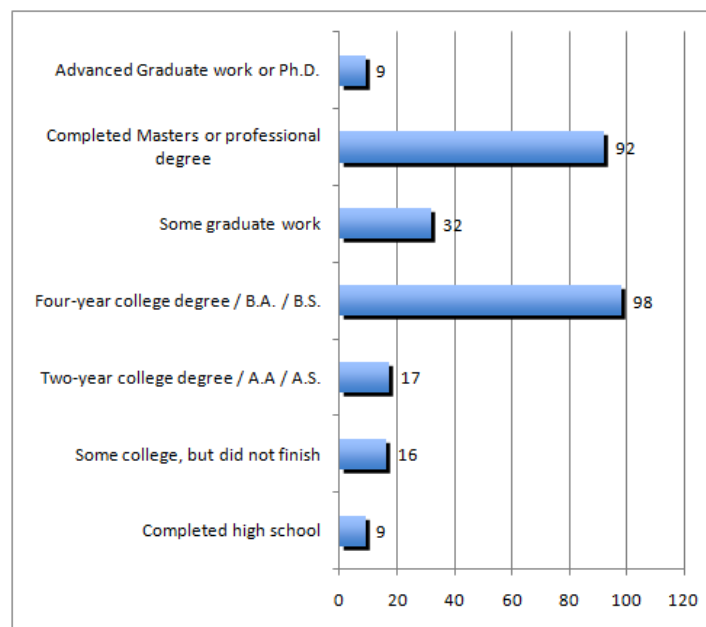
Although McDonald and Ackerman (1998) distinguish between the terms 'expertise' and 'expert', I use the terms interchangeably. According to them, the term *expertise* refers to the embodiment of "knowledge and skills within individuals" (p.315) that falls within a *range* spanning from low to high. Expertise could be topical (know-what) as well as procedural (know-

how). *Expert*, on the other hand, refers to the individual who has varying levels of expertise on different topics and procedures. I take the position that expertise is inseparable from experts. Hence, I use the terms interchangeably throughout the thesis.

### Participant Information

A total of 302 participants responded to the survey. Among them, 18 responses were rejected for being incomplete. Later, 11 more responses were removed because they were incoherent. The resulting data set included 273 participant responses, totaling a rejection rate of 9.6%. All the 273 participants had at least 24-months of full-time organizational experience.

Among the 273 participant, 68.5% (187 participants) were male and 31.5% (86 participants) were female. Average age of the participants was 31.04 years, with a median age of 29 years, and a standard deviation of 8.4. 35.8% (98 participants) had a four-year college degree and 33.6% (92 participants) had completed a Masters degree (See Figure 4).

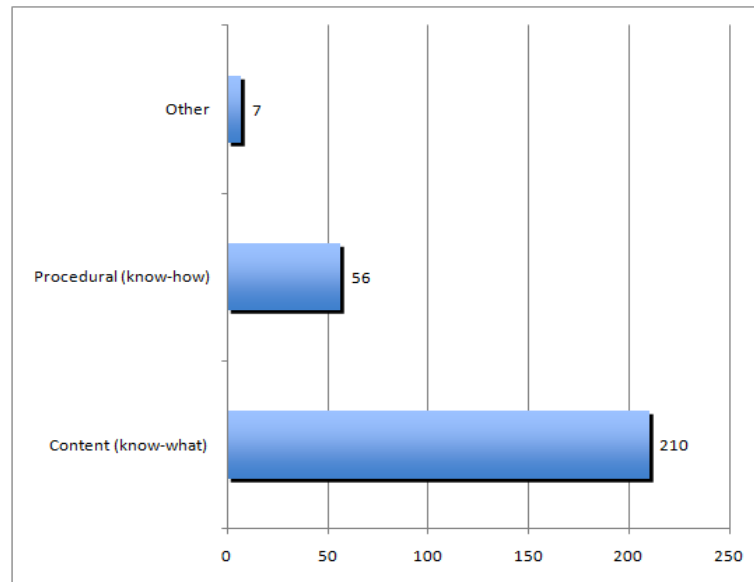


**Figure 4.** Participants' highest level of education

Participants worked in a variety of professions and occupations, ranging from designers, call centre executives, software engineers, project, sales and production managers to secretaries, scientists, technicians, teachers, and professors. Organizations they represented belonged to various sectors ranging from education, construction and manufacturing to information technology, healthcare, finance and non-profit.

### **Type of Information**

When participants intend to seek the help of experts, majority of them looked for topical or content-related information as opposed to procedural information. 77% (210 participants) said that they look for content-related information. These include facts, specificities and know-what's (cf. Garud, 1997), such as the name of a particular API (Application Programming Interface) for connecting with the shopping cart, phone number of a specific vendor or the total portfolio value of a client. Only 20.5% (56 participants) looked for procedural information. These encompass skills and know-how's needed for completing a particular task. Examples in this category include finding a systematic method for interpreting a log file, troubleshooting a problem in a drilling machine, or the process of refunding money to the remitter of a money order. The rest 2.5% (7 participants) were either not sure about the nature of information they were seeking for or were looking for a mixture of both content as well as procedural information (See Figure 5).



**Figure 5.** What kind of information were the participants looking for?

These findings were indeed counterintuitive. Typically, one would expect people to seek the help of experts for procedure-related information, since such information involves the nuances of performing a task and the subtleties of solving a problem (Orr, 1986; Orr, 1996). However, these finding makes sense when we place it within a larger context of the widespread shifts in organizing logics that happened across the globe. As chronicled by many other scholars, the latter half of 20<sup>th</sup> century saw a shift from a vertical, bureaucratic logic of organizing to a horizontal, occupational logic of organizing (Barley, 1996; Barley & Kunda, 2001, 2004; Barley & Orr, 1997; Bechky, 2003, 2006). Firms became the “loci for a set of projects and occupations becomes the nexus for accumulating, developing and disseminating knowledge” (Barley & Kunda, 2004, p.310). Consequently, skills and procedural know-how’s that are intrinsic to particular professions and occupations are accumulated within the horizontal lines, and are shared and disseminated through informal communities of practice (Brown & Duguid, 1991; Lave & Wenger, 1990). Julian Orr’s (1996) ethnographic study of photocopier technicians and

Lucy Suchman's (1983, 1987) pioneering study on clerical and accounting work illustrates such informal seeking and sharing of expertise that happens as a part and parcel of everyday work.

However, unlike skills and procedures, it is the facts, know-what's and content-related information that are fragmented across the functional boundaries of the organization. In addition, there aren't any informal mechanisms to share that knowledge. In other words, since firms are organized horizontally, people belonging to the same professional and occupational groups have more chances to socialize with each other, and in the process, share the procedural information – the tips and tricks of the trade – that is needed for the successful completion of tasks (Brown & Duguid, 1991; Lave & Wenger, 1990; Orr, 1996). But, information related to content and know-what's are often spread *across* different professional, functional and occupational boundaries of the organization. As reflected by the below participants, these information typically reside outside one's own professional and functional jurisdiction, which in turn invoked the process of expertise seeking.

“I am responsible for the operations of the financial planning department in my organization. One area that I am not familiar with is insurance. While helping a high-profile client with their long-term investments, they expressed interest in purchasing a life insurance policy with our company. At that moment, I needed information about life insurance as quickly as possible.” (participant #191)

“I needed some history on a given legal issue that had come up, particular to the agency. The "expert" on that issue was a lawyer who has been at the agency for 40 years, and knew the ins and outs and history, updated regulations, and all relevant statutes pertaining to the issue.” (participant #67)

As a consequence, a large number of participants sought expertise related to content-related information opposed to procedure-related information.



## Triggers for Expertise Seeking

Probing more into the data, I found that expertise seeking is intrinsic to day-to-day work activities. That is, expertise seeking happens not as an activity that is separate from work, but instead happens in and through work (Reddy & Dourish, 2002; Star & Strauss, 1999; Strauss, 1985, 1988).

“Well, there was a time in particular where one of our most beloved customer wanted a grocery item right away. Nevertheless, that specific item wasn't on the shelf at that time, and it wasn't in my department as well, so I wasn't able to help out that client. Therefore, I needed aid to finding that item and I had to go to an expert. So one of the top managers had to be contacted in order to locate that product. In order to satisfy our client, we must go to certain length to keep business going.” (participant #36)

“I was in the process of replacing a blackberry for a user. The user had an extra blackberry in their office, the blackberry that they were currently using was no longer working. They provided me the extra one they had in their office and asked if i could set that up. At that time I did not have access to the blackberry enterprise server and had asked someone who had access if they could determine if the extra blackberry was still active on the server” (participant #104)

What triggers the process of expertise seeking within CIS? As reflected by the participants, most often, unusual experiences and unexpected contingencies that happen during the moment of work trigger the process of expertise seeking. As told by the participants, events, incidents and experiences that “do not fit squarely into known categories” (Garud, Dunbar, & Bartel, 2011) triggered them to seek the help of experts.

“I was looking for a way to manage a particular negotiation in our system that my client had made with the vendors. This was critical as this change will impact the way invoicing will be done. In my 2 years experience I hadn't come across such a negotiation clause.” (participant #6)

“I was cashiering in the children's department and someone was buying a large amount of items from both the children's department and the home section (pots, coffee makers, etc). They were visiting from a foreign country and wanted their items delivered to a freight fort. I am not familiar with this procedure as a cashier because I normally just ring people up and send them on their merry way. I needed to know if it could be done and how to do it.” (participant #108)

“We received a request to repurchase a loan that we originated and subsequently sold into the secondary market for an underwriting deficiency. I requested information from the underwriter who underwrote this loan to support our position and to have the repurchase request rescinded.” (participant #72)

At other times, when people were reflectively aware and cognizant about their “lacks” and “gaps” in a topic or procedure, they resort to seeking the help of an expert.

“I was looking for suggestion to integrate Ebay api into our software used for selling on markets. I had no idea how to start and the expert in market integration on our team was missing.” (participant #2)

“One of my projects dealt with Cloud 9 computing and as myself and my team members were not familiar with this new technology I had to consult an expert in this field.” (participant #211)

“I was okay with knowing that I needed to ask for help and I thought of a couple of people who I felt comfortable talking with. I asked around for the best people in the area and contacted a couple of them so that I made sure I got the best answer.” (participant #67)

Finally, people get triggered to seek the help of an expert when they need “highly-specific” information about certain contents or procedures. These could include information about an old and outmoded data format or about the most effective method for addressing a problem.

“Details as to the format of an obsolete, once-proprietary database “blob.” This database system had been designed when computing resources were at much more of a premium than they are today, and the designers had used some pretty aggressive techniques to maximize the performance of the database on the hardware on which it originally ran. Unfortunately, some of those techniques also made the format very difficult to understand, as they reflected assumptions about the target hardware more-so than any conventional sort of organizational structure.” (participant #24)

“I was confused with some documentation procedure. As the national standards we are following we need to keep all documents for a defined period of time and this period is different for every document and so there were some documents which I was not confirmed about the retention period.” (participant #216)

“When I was installing a 6inch lift kit on a 2002 chevy 1500 4 wheel drive truck and I needed to figure out the pinion angle due to the fact the truck already had a leveling kit installed. So I had to call the fabtech support line and the tech did not have the real world knowledge of what the angle needed to be taking into consideration that the extra 2inch lift cause a small degree of angle change that caused the u-joints in the customers drive shaft to wear much faster than normal.” (participant #10)

“I wanted to find out the best method for interpreting the log files on a web server. We recently had a threat to our website and as I pursued the reason for the attempted breach and how it effected our servers I needed some additional insight into the log or records of the transactions on the web server.” (participant #3)

How does the process of expertise seeking unfold? What mediums do people use during the process? What are the practices that underlie the process? I would like to discuss about these in the following section.

## **Mediums and Practices**

From the data analysis, I found that expertise seeking unfolded through a series of four activities, namely action generation, identifying expertise, selecting and locating expertise and establishing contact.

### ***Action Generation***

Once triggered to seek expertise, people generate some form of ad-hoc action which in turn set things to motion. In other words, it is *action*, and not just *planning*, that opens up possibilities and lead people towards the information sources needed for identifying experts. These actions happen in several ways, ranging from speaking to a team member who is sitting nearby to searching the company intranet.

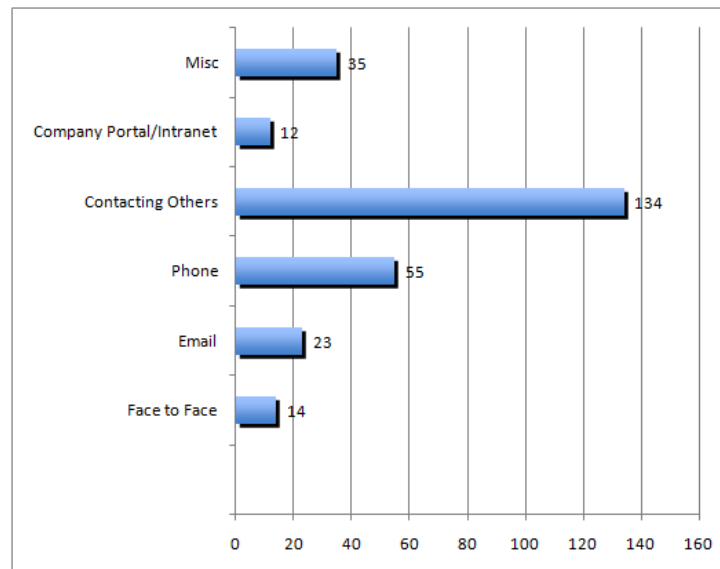
“In order to identify an expert for the problem domain initially I went through the organisation chart looking for people having higher qualification in mathematics and aerospace studies. I also went through the list of pilots with engineering background since they may not have their doctorates but they do have a lot of practical experience and domain knowledge. Once I had this list I showed it to my colleagues and based on their past association with them they suggested a few names with whom I could talk one on one and see if they had the expertise on our problem domain.” (participant #12)

“I tried to find out a solution myself. I couldn't. I spoke to my colleagues who were managing other accounts and sat besides me in the office. Some of them were clueless and others didn't bother much. I approached my immediate manager who also wasn't sure how it could be done.” (participant #45)

Most often, this initial activity involves navigating through multiple information sources. These include speaking to different set of people or looking up various company artifacts such as directory listings and organizational charts, and establishing connections across those sources.

“The instructions I had didn't cover the system updates, so I couldn't do it myself. I needed either instructions on how to access the server as an administrator or someone with the administrative rights to perform the work. I found the network admin list. One was out on vacation that day (Monday). One decided to come in late since he'd worked over the weekend. I had to call several people before one person was reached and then physically arrived to reboot the servers, since I didn't have the information to do it right.” (participant #3)

“I did a search of the production Job Control Language library looking to see where the recipient database was created. When I found the job I looked to see who was responsible for that job. Then I knew the person that had the most responsibility for that database. I emailed that person.” (participant #111)



**Figure 6.** Mediums used during Action Generation

During this initial activity, a large number of people tend to contact and talk to other people (138 participants, 49.08%), such as their immediate colleagues and supervisors, as opposed to emailing (23 participants, 8.42%) the experts directly or contacting them through face-to-face (14 participants, 5.12%) interactions (See Figure 6).

### ***Identifying Expertise***

From the multitude of information sources found in the previous step, people start to identify the ones that are appropriate to the problem they are trying to resolve. This process of identifying expertise happens in two ways (cf. Thomas, Clark & Gioia, 1993). The most common way is what I would term as the ‘rifle approach’, where people approach a *narrow* set of information sources in more or less a sequential fashion, and stop the process as soon as they identified an expert whom they ‘feel’ could resolve their information needs. Another less common way is what I would label as the ‘shotgun approach’, where people approach as *wide* an arena of information sources as possible, and then, compare and contrast the obtained results to decide upon a particular expert (or, a set of experts).

In the rifle approach, people first narrow down their “scope” of search. They employ trial-and-error techniques, and approach the identified set of information sources in a sequential manner. They move from one source to another till they narrow upon the expert (or, a set of experts) that they want to talk to.

“I looked online and emailed people who had titles that I thought might indicate someone who would be able to help. I emailed them 1 at a time and closed each email with something along the lines of "If you don't know how to help me with this, would you be so kind as to direct me to someone who might be able to?"” (participant #50)

“My approach was trial and error one. I had to ask 3 people the same question and compare their answers to reach to the most precise ,authentic and comprehensive answer. From then on i decided that the person with the most comprehensive answer on a particular matter would be my Help Window for that subject matter.” (participant #139)

“As I said, I had to speak to a series of people. I started with the project head who pointed me to project leads who worked on those projects and so on. I ended with a person who suggested the tech guy. That did the trick.” (participant #205)

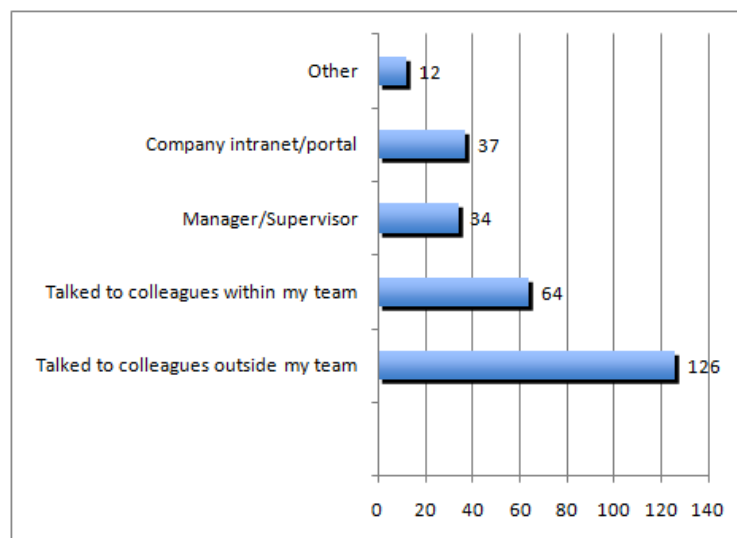
On contrast, in the shotgun approach, people first widen their “scope” of search to as broad a canvas as possible. First, they try to reach out to as many information sources as possible. Then, they compare and contrast upon the results obtained from those information sources, and

then, choose one or more experts whom they feel and perceive could best address their needs. As compared to the rifle approach, this approach is less common

“In the first place we contacted everyone in the organization through Email asking for references of people with the desired criteria. We received several responses and we short listed some people after discussing with those who sent us suggestions.” (participant #9)

“Given the lack of information available indirectly, I was forced to pursue a direct approach and cold call each of the individuals who appeared to be relevant.” (participant #106)

During this activity, a large number of people talked to colleagues who are outside their team (126 participants, 46.15%), as opposed to the colleagues who are within their team (64 participants, 23.44%) (See Figure 7). Lesser number of people approached their managers (34 participants, 12.45%) or used the company intranet/portal (37 participants, 13.55%) to identify experts.



**Figure 7.** Mediums used during Identifying Expertise

### ***Selecting and Locating Expertise***

After the identification process, people try to select and locate experts, before moving on to the final step of establishing contact with them. 143 participants (52.5%) said that they were able

to identify more than one expert, whereas the rest 130 participants (47.5%) said that they identified only a single expert.

In cases where people identified more than one expert, they adopted different rationales for selecting a particular expert from their list. Mostly, people selected experts based on the availability of the expert as well as based on the distance those experts were located from them.

“There were about 5 experts in this field. I did not know whom to contact first as all were equally good in the field. Then, I selected the one which was closest to me but equal in expertise. Others were far off and i knew them less closely.” (participant #27)

“There were two to three names and I was not sure to whom should I contact. Also two of them were located on site which is out of my state. The construction site Locating "where" the expert(s) is/are one of them was located had no mobile network available. One of them was busy in billing related work with government offices and was unable to fix the visit. Some how I managed one expert who was in a near by city” (participant #4)

“He was the first person that I was able to make an appointment with, and I needed to software on my computer as soon as possible.” (participant #66)

“The expert I made contact with, who was chosen for the project, was the first available. He had already been noted on our maintained list as an expert we could contact within our organization if we needed his expert help.” (participant #144)

People also selected those experts whom they believed had the most experience with the subject-matter that they were seeking information on.

“The expert's level of experience, the type of work they have done with universities and technology transfer offices in the past, and their current job duties.” (participant #55)

“First and foremost, the work experience of that "expert" in that particular field. And of course the work profile and feedback of that person to determine whether he/she would be suitable for our need.” (participant #130)

“I contacted the manager of our Information Technology department. I didn't think that he would necessarily have the answer or knowledge that I needed but I believed that he would have access to a team member who might have the information that I needed.” (participant #114)

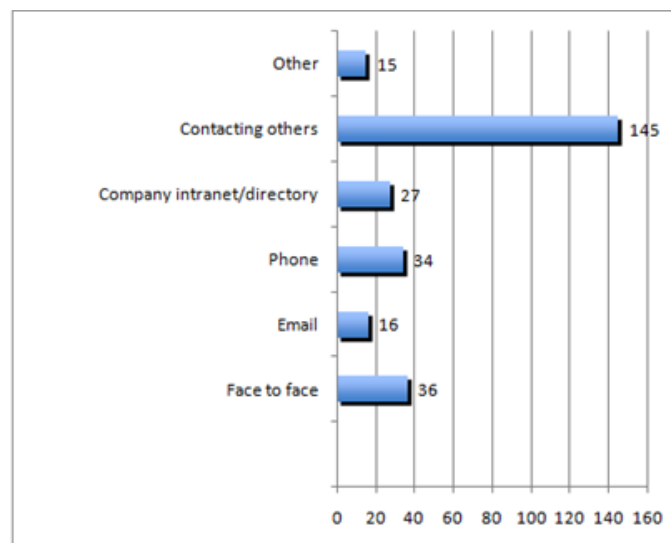
Finally, people selected experts based on their perceptions about whether the expert has an attitude that is compatible with them.

“I searched from my contacts based on my perception about my colleagues as to who would be the ideal person to seek this info from. Then called him to ask him my question.” (participant #271)

“I approached this person because he was the youngest of all and thus it would help me to relate more closely to him. He was a gold medalist in his masters and was looked up by few of my teammates as well. Thus he was an obvious preference compared to others.” (participant #249)

As we saw from the above quotes, location of the expert – in terms of how near or far the expert was from the information seeker – influenced the selection of that expert (cf. Allen, 1977; Olson & Olson, 2000). In most cases, locating experts happened as a part and parcel of the selection process. In addition, this process also involved talking to multiple people.

“I first got in touch with a pair of (much) more senior programmers, these being people who had worked to some extent with this database format in the past, although they were not the creators of it. When their expertise did not suffice, I attempted to contact the actual creators of the database format, a couple of guys who had been retired for quite a long time, but had somewhat kept up communication with people within the company. Unfortunately, one of these men had since passed away, and the other was no longer in any kind of condition to answer the sort of questions I had.” (participant #24)



**Figure 8.** Mediums used during Selecting and Locating Expertise

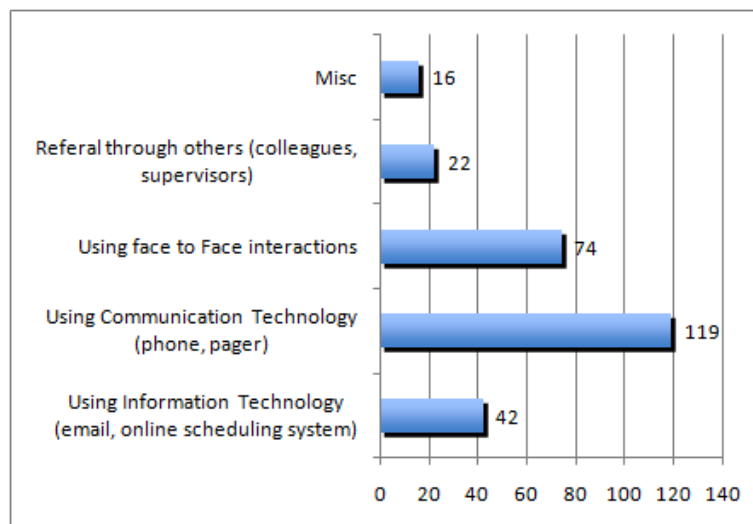
During this activity too, a large number of people (145 participants, 53.11%) talked to others, such as their colleagues and supervisors, as opposed to using the company intranet (27



participants, 9.89%) or emailing (16 participants, 5.86%) experts directly or contacting them through face-to-face (36 participants, 13.18%) interactions (See Figure 8).

### ***Establishing Contact***

Final activity in the process is that of establishing contact and scheduling a time to meet the expert. There weren't any clear cut patterns that emerged from data concerning the strategies people used to establish contact with experts. However, one theme came out very clearly: people employed communication technologies (CT), such as phone and pager, much more frequently than information technologies (IT), such as email and meeting scheduling tools, to establish contact with experts (See Figure 9). In fact, they even preferred to go and directly approach the expert face-to-face than relying upon IT to establish contact with them. Participants attributed a lack of functionalities in existing IT tools as reasons for their reliance upon CT tools.



**Figure 9.** Mediums used during establishing contact with experts

What is more interesting from the above finding is that only a very small number of participants approached experts via direct referrals through their colleagues and supervisors (22 participants, 8.05%). This finding is indeed surprising. Often, one would expect people to seek the help of their supervisors to establish contact with an expert who is either in a different team

or in a different functional unit. I speculate that since the logic of organizing has increasingly shifted from a vertical, bureaucratic mode to a horizontal, occupational mode (Barley, 1996; Barley & Kunda, 2004), traditional chain of command seems to not work very well in these contexts (Kellogg, Orlikowski, & Yates, 2006). As a consequence, people are left to themselves to establish contact with the experts they want to talk to.

### **Unfolding of activities**

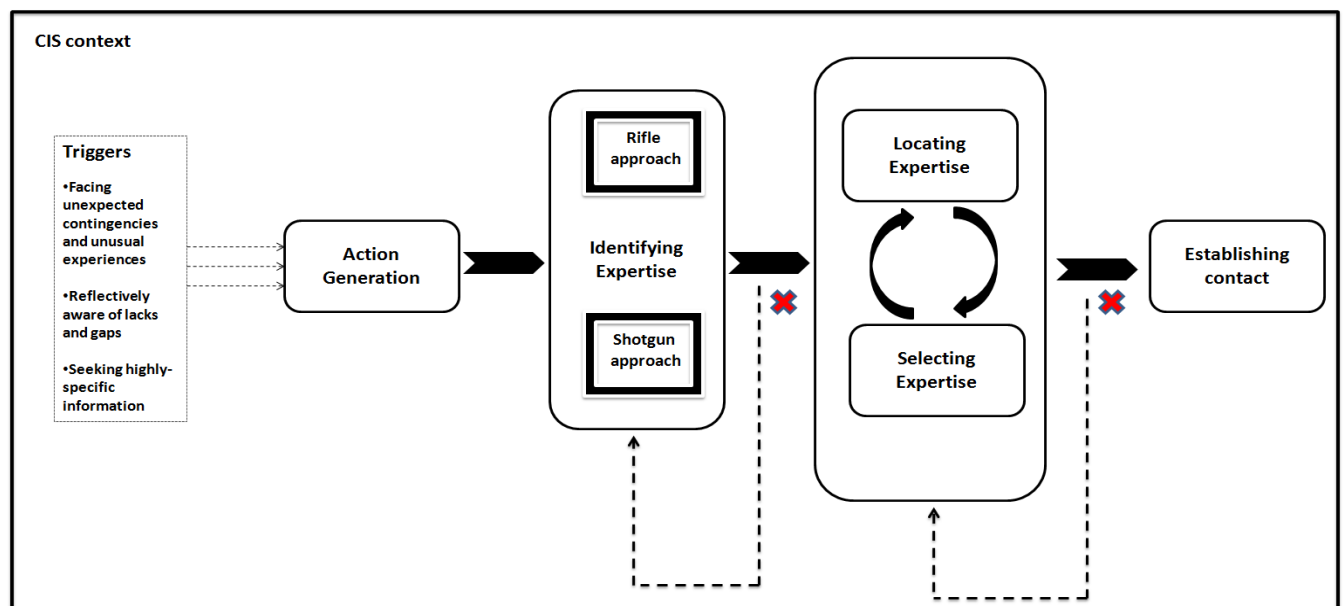
These four activities are indeed analytical distinctions made by comparing and contrasting the themes that emerged from data. As expertise seeking happens as a part and parcel of work, these activities often are intertwined with each other. Thereby, one should not construe these activities as discrete ‘stages’ that unfold in a sequential fashion. Indeed, from the data, I found several instances where these four activities unfolded not in a sequential, but in an interlaced fashion. Often times, one activity did not automatically lead to the next, but instead, led to the circumvention of intermediate activities.

“My approach with my staff experts is generally informal. I will either go to their office, first, to see if they happen to be there. If not, I’ll generally check the parking lot to see if their car is there. If it is, I may wander our campus to see if I can locate them, or I will tell our office manager, who is located near the main door, to give me a ring as soon as she sees that person.” (participant #156)

“We received a request to repurchase a loan that we originated and subsequently sold into the secondary market for an underwriting deficiency. I requested information from the underwriter who underwrote this loan to support our position and to have the repurchase request rescinded. Although I received information from our underwriter in a relatively short time, it did not clearly support our position. I needed someone who could find our specific situation within the guidelines of Fannie Mae, Freddie Mac, or FHA. Once I determined that the underwriter was not going to resolve my problem, I looked for her superiors in the company directory. It was my choice to go straight to the top and bypass several layers along the way. As the Senior VP of Business Development I felt it was my right to do so. I moved up the ladder from the person who was most closely involved with the underwriting of the file (the Underwriter) and went straight to the top. I admit that I did bypass several people along the way. I could have, for instance, requested the assistance of the underwriters immediate supervisor, or her superior, the head of

underwriting...but, I wanted a speedy resolution. So, I bypassed them and went straight to the VP of Risk Management who is responsible for all risk, and to whom these staff members ultimately report.” (participant #72)

As we see from the above quotes, identifying, selecting, locating and establishing contact with experts often happen in an interlaced fashion. Also, the dynamics that happen within a particular activity enables and constrains the transition to the next activity. For instance, if participant #156 was able to accidentally chance upon the expert during the process of loafing and wandering around the campus (‘action generation’), then it does indeed bypass the intermediate activities of identifying, selecting and locating that expert.



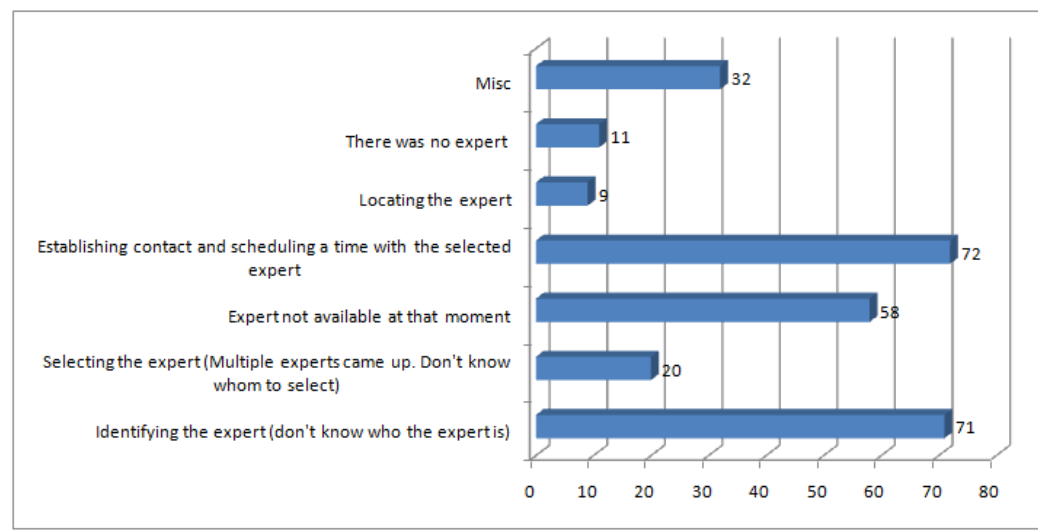
**Figure 10.** A Framework for understanding expertise seeking activities

Thus, it is important to consider these activities, not as discrete ‘stages’, but as interlaced steps that unfold within the overall arc of work. What these set of activities offer is a grounded analytical framework (See Figure 10) that could be used to conceptualize the dynamics that happen during the process of expertise seeking.

## Barriers to Expertise Seeking

So far, I have described the mediums and practices that underlie expertise seeking. In doing so, I have also developed a framework for understanding the activities that constitute expertise seeking within CIS. Building upon these, I would now like to present the findings concerning the barriers to expertise seeking.

Through analyzing the open-ended responses, I found that more people got stuck in activities that involved identifying the expert (71 participants, 26%) as well as in establish contact with the expert (72 participants, 26.37%). A significant number of people (58 participants, 21.24%) explicitly said that they were not able to establish contact with the expert because of the inaccessibility and unavailability of the expert (See Figure 11). Only few participants faced difficulties in locating (9 participants, 3.2%) and selecting experts (20 participants, 7.3%)



**Figure 11.** What activities hindered expertise seeking the most?

In the remaining portions of this section, I would discuss about the four major categories of barriers to expertise seeking, namely *structural barriers*, *temporal barriers*, *cultural barriers* and *technological barriers*. Please refer to Table 11 for illustrative quotes concerning these barriers.

Categories of expertise seeking barriers	Illustrative quotes
<b>Structural</b>	<p>The company's organization is very wide. People over here have very specific missions, sometimes related to a single task. It is so wide that each person isn't listed on the organization's chart. So it is very difficult to identify a specific person. I got stuck in a very stressful manner: I felt as if I was walking in a maze without finding the exit. (participant #33)</p> <p>Given the number of departments involved in the payment process, it was so difficult to know which department to go to, and who within the department to go to. Different departments claimed authority over others, so information was conflicting. (participant #262)</p>
<b>Temporal</b>	<p>I knew who the experts were, but I couldn't get a hold of any of them. It was a matter of leaving voicemails for someone to get back to me to get them to either explain the process on the new software or do the work. Then they decided just do the work themselves instead of telling me how, creating new delays. (participant #5)</p> <p>The particular code I was working with had passed through multiple developers and had not been sufficiently annotated. Finding the person(s) responsible was difficult as was Scheduling a time with the selected expert time for them to explain and assist. (participant #56)</p> <p>Well the expert was a very busy person. It was very difficult to get an appointment to see him because he was in charge the same department at four of our company's units in my state. So he keeps on moving from one place to another frequently. (participant #96)</p>
<b>Cultural</b>	<p>Because in day to day transactions everyone seemed good at their fundamental knowledge in executing their assigned task in office. But the depth of domain knowledge of an individual has never been judged through any parameter or examination by the company. (participant #73)</p> <p>I have noticed on more than one occasion that certain employees at my organization will go to great lengths to not reveal certain information until they are forced to by an e-mail from an executive upstairs. Their motivations for this are unclear to me at this time. (participant #18)</p>
<b>Technological</b>	<p>I began to look for files that would have contained the required data in order to avoid having to seek for external help. When I realized such files weren't available, I turned to my colleagues to get the name of the relevant expert. They didn't know that person, so I decided to have look for him or her on the company's Company intranet which isn't very well updated. (participant #24)</p> <p>I found this step particularly difficult because there is no available contact list for experts and there is no reference system within my organization that could have supplied me with the information I needed. The local administrators are not well informed or briefed on this information. (participant #82)</p> <p>We have some online profiles and expert "answer services", but they are a bit cumbersome to use. People get nervous to reply on this service since the answers are public. We are perfectionists and don't want to mis-speak. This desire to give the perfect, complete answer makes us slow to respond sometimes. (participant #3)</p>

**Table 7.** Categories of barriers to expertise seeking

### ***Structural barriers***

Barriers that arise due to the structural characteristics of the organization are referred to as 'structural barriers'. Most often, these barriers arise due to ways in which professional, functional and occupational boundaries are defined, specified and formalized within the organization. For instance, an organization that is very wide and diversified would have numerous departments and business units, each allocated to a specific purpose. As a consequence, organizational chart becomes very complicated, making people feel as if they are "walking in a maze without finding the exit" (participant #33). These, in turn, act as barriers to seek the appropriate expert.

"Identifying a subject matter expert is perhaps the most important point. People are generally more than willing to help, but to identify the people with a specific domain knowledge is a challenge. For my work I had to talk to a lot of people- a few pilots and other Phd's in my organisation. It took almost a couple of days before I was able to identify the correct person for assisting me on the job. Thus identifying the person whom to approach to is a critical and perhaps the biggest impediment than has a proportional impact on the quality of deliverable's in a project." (participant #12)

Similarly, rules and procedures that are formalized and embedded into the organizational structure hinder people from expertise seeking. For example, procedures such as seeking approval of multiple people to contact an expert or going through multiple organizational or departmental layers to locate an expert constrain expertise seeking.

"I contacted first our IT support dedicated to our project. I then was directed to contact another person in a different facility to have authorization granted in order to request a new function. Then, I had to contact our Microsoft team contact for direction on how to set it up." (participant #19)

"My organization has many layers and many rules and procedures. In order to use funding to pay someone legitimately, our proposal must go through six departments, and sometimes the rules for these departments conflict with one another and, consequently, the process can be quite lengthy. Moreover, there is no set of published rules that are universally available to everyone. For the most part, I have been at my organization long enough to understand how to get my proposals pushed through. However, I needed to pay one group of people using gift cards, rather than checks, which differs from the norm and

thus, the procedure differs. I needed to find out how to make this happen.” (participant #15)

In sum, a large number of participants felt that the structural features of the organization – specifically how the functional and occupational boundaries are defined, specified and shared, imposed a constrain on expertise seeking.

### ***Temporal Barriers***

Constraints that emerged due to a lack of availability of the expert’s time or due to a clash of work time between the expert and information seeker brought forth temporal barriers. These barriers mainly often arose during the final steps of expertise seeking – especially during the activities that involve scheduling a time with the expert.

“Establishing contact with the selected expert was the biggest difficulty. The expert was always engaged either in training the new recruits or he had his own works to complete. Apart from that he was available for only 3-4 days a week at my office. So I had to work really hard to adjust my work and time with the experts' to find an appropriate time for a meeting.” (participant #49)

Often, the information seekers adjust their work tasks to make room for meeting the expert. However, even before reaching to that step, an inordinate amount of delay in getting a response from an expert - telling what time works the best for him/her - causes significant frustration amongst the information seekers.

“Supervising the underwriting function is only one of the roles that risk management performs within our organization. They are responsible for managing all types of risk. Examples are pricing risk, fallout risk, fraud risk, hedging risk, etc... Repurchase risk (Underwriting) is only one of the areas of their responsibility. Getting face time with the VP in charge of risk management took longer than I expected it to take, and at first, I was relegated to an underling...which I did not appreciate at all.” (participant #72)

Finally, when experts, due to a lack of time, “complete the tasks” that the information seeker is asking for by themselves instead of explaining to them “how to do that task”, creates new barriers. Now, the information seeker wouldn’t have acquired the knowledge needed to

complete the task, despite the fact that the task is complete. At the same time, he would be reluctant and reticent to contact the expert again when the same problem arises in the future.

### ***Cultural Barriers***

Barriers that emerge due to the cultural characteristics - such as values, beliefs, norms, and rewards - of the organization are referred to as cultural barriers. These barriers arise mainly due to two different reasons. One, due to lack of norms and reward structures for fostering expertise sharing. Two, due to a lack of checks and balances that could prevent people from taking advantage of the reward structures. In the case of the former, people tend to hold their information 'close to their chest', which, in turn, adversely affect the overall expertise sharing climate of the organization (Hinds & Pfeffer, 2003; Orlikowski, 1992).

“Many so called "experts" were not up to the mark of the project requirements. So finding a real person with ample knowledge on that field was quite troublesome. And when after long searching someone was found, the Scheduling a time with the selected expert problem was a big issue. The concerned department was not willing to assign him to our project as that would hamper their work. Many communications and letters went by with the higher authorities. At last we had to postpone our project until that resource become free to join our team.” (participant #253)

“I have noticed on more than one occasion that certain employees at my organization will go to great lengths to not reveal certain information until they are forced to by an e-mail from an executive upstairs. Their motivations for this are unclear to me at this time.” (participant #167)

In the case of the latter, people either inflate their knowledge and skills than what they actually have or lie about their expertise and enter improper information in the expert-lookup systems to make their “profile look better”. That is, reward structures, without adequate checks and balances, initiate a “vicious cycle” (Garud & Kumaraswamy, 2005) that dampens the expertise sharing climate of the organization.

“Several people were indicated to have virtual server experience, but the first couple of people that I talked to actually had 5 minutes of experience and were just making their



profile look better. After thinning the search results down to a more coherent list, I was able to quickly find my expert.” (participant #113)

“As a result people who call themselves leaders are themselves not sure of their domain knowledge as because specific domain knowledge in depth training has not been rendered by the company ever to create an Expert HELP WINDOWs for subordinates or colleagues. Most cases small companies rely upon practical onsite OJT to enrich an employee's domain knowledge. These are not systematic knowledge impartment, but some collection of experiences that create bits and pieces of domain knowledge at random.” (participant #253)

### ***Technological Barriers***

Barriers that arose due to issues with tools and technologies – either due to a lack of a particular technology, or due to some missing functionality within a current technology - are referred to as technological barriers.

As we saw in the previous section, a majority of the participants employed communication technologies much more frequently than information technologies to establish contact with experts. Within communication technologies, people used telephones more frequently as opposed to pagers.

“It would be a lot easier if I could pick up the phone and call a specific manager directly instead of having to page them. By paging them, a lot of times I get ignored because they may not hear me calling for them.” (participant #24)

176 (64.5%) participants said that there was a lack of technology within their organization that could facilitate expertise seeking. Among the rest 97 participants (35.5%) who felt that there is some form of technology that could facilitate expertise seeking, a large number of them (52 participants, 53.60%) felt the lack of a centralized repository of experts as a major barrier for expertise seeking. Few other participants (35 participants, 36.08%) reflected that the inadequacy of search features within company portals and intranet hindered their efforts in seeking appropriate experts. Rest of them (10 participants, 10.30%) either felt the need to improve

existent expertise evaluation systems, or felt that any implementations of technology would be of little use to the organizational contexts that they are situated within.

“No idea about Technologies, but small in-house evaluations of domain knowledge, regular parameter monitoring of Least Errors Made during Execution of assigned task can help identify the person doing neat consistent and error free job completion. These people are the ones who are experts in their Domain.” (participant #128)

“In this case, no new technologies would have helped as a patient inside the ICU cannot be contacted so easily. So I do not think any new technologies can help in a situation like this.” (participant #89)

## **Discussion and Implications**

Past research by McDonald & Ackerman (1998) on expertise location had offered us a conceptual framework to understand how people identify and select expertise. According to their framework, expertise seeking is comprised of a set of iterative steps, namely identification, selection and escalation. During the identification phase, people determine who has the appropriate expertise, and during the selection phase, people narrow down their list from a pool of candidates based on several psychological and workload considerations. In the escalation phase, people try to fix the failures and breakdowns that happened in earlier phases.

Through the above field study, McDonald and Ackerman (1998) demonstrated that seeking expertise is fundamentally a collaborative activity. The grounded framework that I construed too found convergent evidence with McDonald and Ackerman's (1998) findings. However, I would like to stress upon three aspects upon which my framework diverged from McDonald and Ackerman's (1998) framework.

### ***Scheduling and Awareness functionalities***

First, is the relative importance of activities centered on establishing contact and scheduling time with expert that McDonald and Ackerman's (1998) framework tend to overlook.

As I described in the findings, a large number of participants expressed frustration with the process of either establish contact or scheduling a time with experts.

“One of my responsibilities is to create a weekly worship folder, with information on the order of the service as well as on upcoming events at our large and active church. I must receive information from many sources for this to be a complete guide, and I often find myself "chasing down" individuals who have some nugget of information that I need--the time of a lecture, for example, or whether tickets are required for a concert. By far the hardest information to find, however, is info on the order of the service, which changes from week to week. This info must come from the pastors (there are three of them). They are, frequently, out visiting people or attending to church business elsewhere. But the real challenge is that two of the three answer their email infrequently and do not return phone calls. This means I must watch for them and scramble to get their attention on those rare experiences when they are actually in the office. This, in fact, is generally a daily occurrence.” (participant #21)

Hence, expertise recommender (ER) systems that aim to augment expertise seeking should have scheduling functionalities that let people negotiate a time with experts. Current ER systems (McDonald & Ackerman, 2000; Reichling, Veith, & Wulf, 2007; Yimam-Seid & Kobsa, 2003) lack this functionality.

In addition, ‘awareness technologies’ could be incorporated into the expertise seeking tools to display information about the work status of experts (Dourish & Bellotti, 1992). Requests for expertise seeking should have labels and flags associated with it that could show the ‘importance’ of the request (such as, high/medium/low), as perceived by the information seeker. This would mainly help the experts to understand the nature of the submitted requests, which in turn would help them to prioritize accordingly.

“I believe that I got stuck at the point I did because I had sent an email and I'm guessing that in the eyes of the recipient it didn't warrant the importance that I felt it did. I think that because I didn't have a personal relationship (in this case I hadn't even met the person) with the person I was trying to contact and so because there was 'no face' to my request the recipient could more easily ignore it.” (participant #6)

Also, roles and responsibilities of both the information seeker and the expert need to be explicitly specified (Spence & Reddy, 2011) and incorporated as a part of those awareness functionalities. These features would help both the parties to be mutually cognizant about where they each come from, and what their backgrounds are (Hinds & Kiesler, 1995). This could reduce potential misunderstandings amongst them.

“What I found to be most interesting from the process of communicating with each of the individuals was how uncertain they seemed of one another's role - each could speak to their own expertise, but not to the expertise of others within the organization. Instead, I was forced to speak with different individuals to properly discern who held expertise in which area.” (participant #163)

### ***Beyond breakdowns***

Second, though McDonald and Ackerman (1998) talk about episodes of failure that happen during the expertise identification and selection phases, they conceptualize them as ‘breakdowns’. But, I feel that the term ‘breakdown’ is misplaced, since it connotes that occurrence of failures as anomalies. On the contrary, as described by the participants, episodes of failures are way too common within expertise seeking. Hence, these failures could not be considered as mere breakdowns. Instead, they should be conceived as an intrinsic part of expertise seeking (Star & Strauss, 1999; Strauss, 1985, 1988).

“I first got in touch with a pair of (much) more senior programmers, these being people who had worked to some extent with this database format in the past, although they were not the creators of it. When their expertise did not suffice, I attempted to contact the actual creators of the database format, a couple of guys who had been retired for quite a long time, but had somewhat kept up communication with people within the company. Unfortunately, one of these men had since passed away, and the other was no longer in any kind of condition to answer the sort of questions I had.” (participant #24)

Consequently, functionalities within ER systems that aim to provide means to revisit initial set of identified candidates or to reselect from a pool of candidates should not be conceptualized as just “escalations” that pushes the problem either vertically (along the hierarchical lines) or

horizontally (along the functional lines). Instead, they should be conceptualized as mechanisms that would let the information seekers' to reconfigure their entire expertise seeking process itself.

### ***Annotating Intermediate Information during Expertise Identification***

Third difference lies in the elaboration of how expertise identification happens. According to my conceptualization, expertise identification involves 'weaving' together fragments of information obtained from multiple information sources that are both human as well as non-human. This process unfolds both in a narrow, sequential manner (rifle approach) as well as in a broad, parallel manner (shotgun approach).

McDonald and Ackerman (1998) have also overlooked how the person who is identifying expertise would annotate and keep track of these intermediate fragments of information.

"Given the nature of the organization, it was difficult to determine who would be the best person with whom to liaison to 'get the ball rolling,' as there were a number of individuals whose titles and job descriptions would appear to be relevant to my situation." (participant #70)

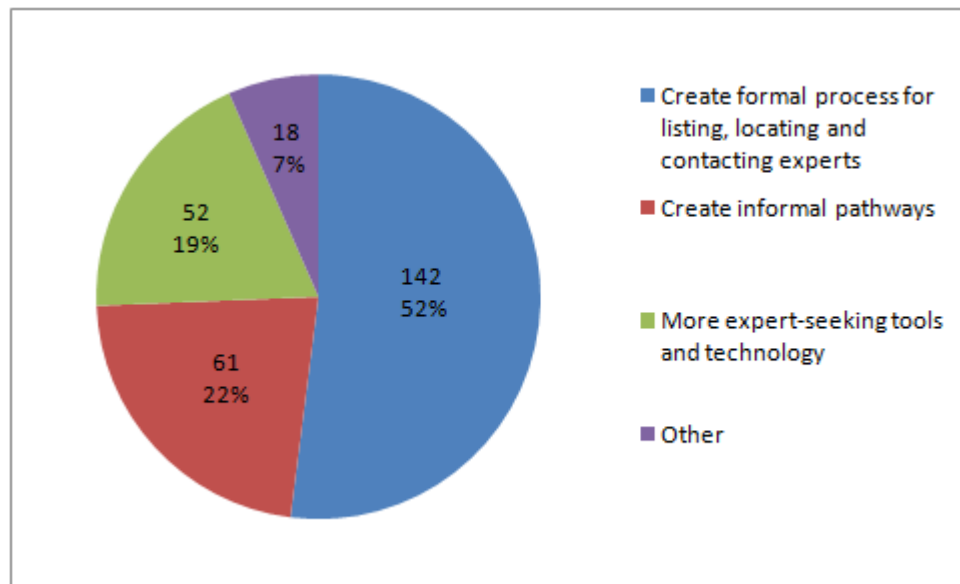
One way to support this is to build annotation functionalities into ER systems that would let people to continually record the intermediate information they have found, and reformulate their search queries based on the found information.

"The series of projects that our department is working on has experienced substantial changes in system, process, information storage & data processing. So, I was unable to locate the details for the earliest project in the series. The information cannot be pulled using the current SQL database as we migrated it an year ago. The details are sensitive in nature and extremely critical for my research. I approached the head of the projects, however they did not have the complete information. I had to search in our people portal and speak to at least 5 different people to figure out a person from out tech team can help. With the help of this technical expert, I was able to extract the information from the old database." (participant #19)

### ***Participants' Responses***

I asked the participants themselves about the changes they would like to introduce within the organization that would make their expertise seeking easier. A majority of them (142

participants, 52%) said that creating formal processes for listing, locating and contacting experts would be beneficial. Others (61 participants, 22%) said that creating informal pathways, such as gatherings in common spaces, monthly meetings, and knowledge sharing sessions, would be helpful. Few others (52 participants, 19%) said that developing better tools and technologies would enable their expertise seeking faster and easier.



**Figure 12.** What changes would participants' like to introduce within their organization?

Illustrative quotes on what people said about the changes they would like to make are presented below in Table 8.

**Table 8.** Illustrative quotes on the envisioned changes

Categories of expertise seeking barriers	Illustrative quotes
<b>Formal processes</b>	<p>A neat policy would be for experts to have a class periodically and pass on some of their knowledge to employees. This way more people would know who was a subject matter expert and would also increase the knowledgebase of the workforce. (participant #178)</p> <p>I would like to have one person designated to help make contacts when emergencies arise like the one we had. Also, it would nice if we develop a system whereby each expert could check in to let us know when they become available. In other words, we would all keep a running log of our projects' beginning and ending times. (participant #20)</p> <p>I would include protocol within our company manual that spells out how to "troubleshoot" a variety of issues that can come up in every department. Included in the manual would be a directory of who to contact for every problem described. (participant #12)</p> <p>Each expert should have buffer time allotted to meet other folks seeking help. (participant #61)</p>
<b>Informal practices</b>	<p>The first thing i would do is to arrange a monthly meeting exclusively for developing interaction between employees from all levels ie. from top management to junior levels. I believe Lack of interaction is the main cause of getting confused in situations were you need an expert opinion. (participant #79)</p> <p>Expert should be free to be approached by anybody who has problem and there should be meetings to inform a person who is expertise in which field. (participant #104)</p> <p>Arranging small weekly meetings for employees in the same discipline. Providing full information to all on experts in their respective departments/disciplines. (participant #50)</p> <p>The organisation climate should facilitate interaction with other teams and members rather than restricting it and thus preventing findings of bottlenecks in the initial rather than integration phase. (participant #223)</p>
<b>Tools and Technologies</b>	<p>An organization-wide log for all employees to let each other know when we have completed a project and when we may be available to help with any emergent projects. This log could be published on the company website in a particular discretionary section so that only employees could have access to it. (participant #112)</p> <p>There has to be a common sharepoint, which should contain the names and contact details of the experts. (participant #140)</p> <p>One change I would love is to be able to easily change or remove inaccurate listings. Some of the people on the list have not been with the company for over a year. This is confusing and causes inefficiency. Only those in the computer department can remove listings, and they are overwhelmed with other projects. (participant #245)</p> <p>Search words may need to be optimized to improve efficiency. It is also important to allow for feedback to be readily offered. Incentives to encourage that feedback is of value. (participant #8)</p> <p>The organisation should have a blog where people can be approached for a given domain. Central employee database should display some academic and project background for individuals which would make expert identification easier. It should allow to search employees with masters, phd's in a given domain rather than going through long records to identify a probable expert. (participant #12)</p>

## Conclusion

Through this study, I first identified the triggers that lead to expertise seeking. Later, I described the mediums and practices that underlie expertise seeking. Then, I identified four major activities, namely *action generation*, *identifying expertise*, *locating and selecting expertise* and *establishing contact*, which constitutes expertise seeking. I established connections across these activities, and in doing so, developed a framework for expertise seeking within organizations. Later, I identified a set of barriers to expertise seeking that converged into four overarching categories, namely *structural barriers*, *temporal barriers*, *cultural barriers*, and *technological barriers*. I then discussed how these findings diverged from extant research (Ackerman, Pipek, & Wulf, 2003; McDonald & Ackerman, 1998, 2000), and in doing so, derived implications for theory and design.

Expertise seeking is an important aspect of CIS. By identifying and understanding the barriers that constrain expertise seeking, one could devise mechanisms and infrastructures – in the form of an ensemble of tools, technologies and processes – that could let people overcome those barriers.



## CHAPTER 6

### Discussion

Traditionally, information behavior has been considered as an individual activity, due to the dominant idea we have of a single user interacting with tools and technology. Also, organizational work was by and large viewed as a series of individual activities; lesser emphasis was placed on collaborative work. Due to this, we see an array of simplistic organizational policies and information systems that could only support individual work activities, but unable to handle the complex and intricate nature of collaborative work activities. As a result, most of the initiatives to support collaborative work fail.

Research in CIS offers us possibilities towards addressing these issues. It ventures into exploring phenomena that lies at the nexus between two central aspects of modern day organizations, namely collaboration and information. However, as we begin to build tools to support CIS activities, it becomes critical to understand what is it that we are trying to augment. Due to the lack of conceptual understanding about the barriers that hinders CIS, researchers were unsure and ungrounded about *what* activities they should augment. Through the two empirical studies, I contributed to the grounded understanding of the barriers to CIS.

Together, two central findings, concerning *temporal asymmetries* and *horizontal coordination*, were derived from these studies. I now discuss about these in the rest of this chapter.

#### **Temporal asymmetries**

Temporality played a key role in hindering CIS. This was evident across both the studies. Temporality yields to asymmetries on three different levels. At the first level, it imposed constraints upon the information seeker in establishing connection with the sources of

information. That is, it led to an asymmetry between the *information seeker* and the *information source*. These information sources could be either a person or an artifact that could have potentially resolved the information need.

“As I mentioned above, the pastors are not often available in our office building, since they are out on church business. And secondly, they are sporadic in responding to voicemails or emails. I sometimes have to put aside the document I'm working on (which is time sensitive, since we do one every week and it MUST be ready for Sunday morning services) for a day or so, until I can track one of them down and pin down the info that I need. Even when they are available, they might feel the need to consult with another pastor (who is inevitably not around just then) or take additional time to collect the info that I need.” (#participant 21, study 2)

“I would require employees to keep that skills directory up to date. When someone leaves a position for another one, they need to remove themselves as the "go to" person. When someone retires or quits, a new contact for that subject area needs to be selected.” (#participant 133, study 2)

“I work in a 10,000 person organization. The organization chart and points of contact are constantly changing... I have no clue who could help me. We have so many employees, I don't know who does what, what department works on what or who even to begin asking to get pointed in the right direction.” (participant #118, study 1)

At the second level, it hindered the information seeker from collaborating with the person who has partial information that the information seeker was looking for. Together, their collaboration would have resolved the information needs, but that process was hampered due to temporal issues. Thus, at this level, an asymmetry was established between the *information seeker* and the *collaborator*

“I have experienced people that will use excuses that they have no time to do what is in affect their job. Also, there are some who cause such an uproar if you ask for help, that you would rather struggle with the problem and seek almost any source of information but them.” (participant #14, study 1)

“Sometimes questions comes up when I'm not scheduled to work that have an immediate answer, and I'm stuck, or questions come up when I am on shift that need a quick response, which I cannot get via e-mail.” (participant #204, study 1)

“Well the expert was a very busy person. It was very difficult to get an appointment to see him because he was in charge the same department at four of our company's units in my

state. So he keeps on moving from one place to another frequently.” (participant #96, study 2)

At the third and the deepest level, asymmetries sprang up between the two different notions of time, namely *chronos* and *kairos*, which in turn hindered CIS. Chronos is calendar-based time that is determined by the rhythms and routines of the organization. Kairos is phenomenological-based time that affords people to leverage opportune moments when “the *time is right*” (Garud et al., 2011; Hassard, 1996; Orlikowski & Yates, 2002). Asymmetries between chronos and kairos prevented actors to sense and seize ‘opportune moments’ to collaborate and resolve the information needs ‘then and there’.

“Most of my colleagues were more than willing to help when available however, so it was usually a matter of timing in order to catch them at an opportune moment to be able to have our discussion. "Right now" wasn't always possible, but "later on" was usually anywhere between the space of a few minutes or even hours....” (participant #72, study 1)

In sum, temporality hindered actors a) to establish connection with the information sources (level 1), b) to collaborate with others and weave together fragments of information (level 2), and c) to sense and seize opportune moments for collaboration (level 3) and to resolve the information needs during the moment of work.

### **Horizontal coordination**

As the latter half of 20<sup>th</sup> century saw a widespread shift from a vertical, bureaucratic logic of organizing to a horizontal, occupational logic of organizing (Barley, 1996; Barley & Kunda, 2001, 2004; Barley & Orr, 1997; Bechky, 2003; Bechky, 2006), the nature of information and the nature of expertise sought by employees too changed. In post-bureaucratic firms, procedure-related information (know-how's) is located within various occupational and functional pockets of the organization. These skills and know-how's could indeed be acquired and internalized through learning-by-doing (Orr, 1996) and through informal interactions and through

communities of practice (Brown & Duguid, 1991; Lave & Wenger, 1990; Suchman, 1987). However, factual and content-related information (know-what's) is fragmented and distributed across the firm. And, there are no mechanisms in place to access this information. In other words, there are no formal or information processes to orchestrate *horizontal coordination* between these different occupational and functional groups that would enable people to collaboratively seek the needed information.

In short, I posit that better horizontal coordination would lead to better CIS. And, devising mechanisms and infrastructures to augment coordination along and across the horizontal lines of the organization would be one of the grand challenges for CIS researchers.

“One organizational barrier is authentication and permission rights. There are many aspects of my organization's network that are prohibited to some departments, and allowed to others. This creates a serious barrier for information flow, mainly because any inter-department assistance would require both individuals relocating to a computer that is linked to both networks.” (participant #104, study 1)

How one could support and facilitate horizontal coordination? One way to doing this - as suggested by a participant - is via documenting the cross-functional interactions that happen within the organization, and maintaining a log book with contact details about the various information sources.

“To keep electronic log book indicating the full details of cross functional interactions happening in day-to-day basis with special remarks for indicating the severity of the transactional requirement.” (participant #112, study 2)

However, this might not work all that effectively, considering the numerous contingencies and interactions that take place within organizations. An alternate way to do this is via establishing “expertise concierges” (McDonald & Ackerman, 1998) who would span functional and occupational boundaries (Carlile, 2002; Levina & Vaast, 2005; Lutters & Ackerman, 2007), and make connections across the horizontal lines of the organization. As one of the participants

reflected, having such boundary spanners and expertise concierges would be especially critical during emergency situations.

“I would like to have one person designated to help make contacts when emergencies arise like the one we had. Also, it would nice if we develop a system whereby each expert could check in to let us know when they become available. In other words, we would all keep a running log of our projects' beginning and ending times.” (participant #20, study 2)

A third way to do this is via recording, storing, categorizing and disseminating narratives. Narratives provide a mechanism for people to share contextual information with one another (Bartel & Garud, 2003, 2009; Garud et al., 2011; Weick, 1995) that could otherwise not be shared in the form of abstract propositions and formalized workflows. Since people who belong to different occupations and professions within an organization do not have a common vocabulary to facilitate easier communication and information sharing (Brown & Duguid, 1991), it becomes extremely difficult for information to be sought, understood, interpreted and disseminated across disparate epistemic boundaries (Dougherty, 1992; Dougherty & Heller, 1994). However, through the usage of plots, narratives offer a “point of view” of an actor towards handling a specific event or a situation (Bartel & Garud, 2003). This point of view goes beyond being mere descriptions of the situation to becoming active reenactments of the situation (Weick, 1995). That is, this plot help the seeker of information to see and visualize (in the present) how that event (of the past) unfolded in real-time, and how it could in turn be used to address information needs and demands (of the future). These enable information to be sought and shared across different functional boundaries, which, in turn, facilitate horizontal coordination.

Together, these mechanisms would enable us to start designing better tools and processes that could minimize the barriers to CIS.

## CHAPTER 7

### Summary and Conclusion

CIS is a relatively nascent research area. We are just starting to understand the nature and structure of CIS, including the various activities that constitute CIS. An important step in this is to identify and understand the practices that hinder CIS. Through this thesis, I focused on understanding the barriers to CIS within the context of work organizations. Specifically, I was interested in identifying what the barriers to CIS are, and what practices lead to those barriers. Consequently, I had the following overarching research question:

1. What hinders people from collaborating while looking for work-related information? [i.e. What are the barriers to CIS]
  - a. What mediums and practices people use when they are not able to fully find the information they are looking for?
  - b. What issues people face in the process, and why?;
  - c. What could one learn from these issues to design better tools and processes that could augment and facilitate CIS?

I answered these questions through two sequential research studies. In study 1, I focused on identifying the mediums and practices that gave rise to CIS barriers. In study 2, I obtained a fine-grained understanding about one of the findings from study 1 concerning the barriers to expertise seeking within organizations.

Through study 1, I identified a set of barriers to CIS that fell into four broad categories, namely *organizational barriers*, *technological barriers*, *individual-level barriers*, and *team-level barriers*, and the practices that gave rise to those barriers. Through study 2, I identified the triggers and activities that underlie expertise seeking within CIS. Through this process, I

construed a framework of expertise seeking within organizations. Later, I identified a set of barriers to expertise seeking that converged into four overarching categories, namely *structural barriers*, *temporal barriers*, *cultural barriers*, and *technological barriers*.

Together, two central findings, concerning *temporal asymmetries* and *horizontal coordination*, were derived from these two studies. These findings contributed to our grounded understanding of the barriers to CIS. Through understanding these barriers, we can start to design better tools and processes to augment and facilitate CIS.

However, as we begin to design process and tools to address these barriers, we must be careful about the context for which they are being developed. For instance, web search is one context for the use of CIS tools. At the same time, the techniques and approaches to overcome barriers for CIS in the domain of web search may not apply to CIS in organizational settings. Therefore, we need to develop approaches to overcome barriers based on particular contexts.

## **Conclusion**

If variety is considered to be a measure of complexity, then organizations in information-intensive environments are extremely complex systems with many visible and invisible interdependencies. Organizing in such complex environments need the “requisite variety” (Ashby, 1958; Weick, 1979) embedded in its processes, and requires much more than simplified business processes and database query based information retrieval systems (Reddy & Dourish, 2002). In order to effectively support collaborative work in such environments, we need to consider the complex ensemble of individuals, groups, artifacts, work practices, technologies, and its overall interaction effects. The research area of CIS offers rich possibilities to explore this ensemble further.

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