INFORMATION SEEKING BEHAVIOR AND CONTEXT: THEORETICAL FRAMEWORKS AND AN EMPIRICAL STUDY OF SOURCE USE

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This PhD journey has been a turning point in my life. It helped streamline my life in the direction it was meant for. When it comes to thanking, faces and names flash up in a moving cloud. Let me try and list the most prominent names in the cloud:

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SUMMARY

'Information seeking', 'context' and 'source use' – these three phrases constitute the core of this thesis. *Information seeking* may be understood as a conscious effort to acquire information in response to a need/gap in our knowledge. All those factors that surround and influence information seeking behavior may be loosely understood as *context*. An *information source* can be defined as a carrier of information (e.g. a person, a book, a search engine, etc.). The first phrase (information seeking) contributes an integrated theoretical framework (Study 1). The second term (context) forms the basis for two theoretical frameworks. The third phrase (source use), along with 'context', leads to an empirical study utilizing a questionnaire survey (Study 2).

Study 1 - Towards an Integrated Framework of Information Seeking and Information Retrieval. In the first theoretical study, we[1] present an integrated framework synthesizing a large number of models/frameworks from the person-centric field of information seeking (that looks at the information needs of the user, the process of seeking and the searcher context) and the system-centric field of information retrieval (concentrating on technology aspects such as search engines/interfaces/algorithms). This process of synthesis could also serve as a methodological move for convergence of research in any field, whereby the work of a particular theorist is taken and other theories and models mapped to it. Designed to serve as one of the most comprehensive frameworks in the field of information

[1] Even though a PhD thesis symbolizes the culmination of years of effort in the PhD journey, I am not comfortable using 'I', for that would mean negating the contribution of my PhD supervisors and numerous others who have helped make this possible. Thus, in all the places where you would expect to see 'I', I have used the more inclusive 'we'.

behavior, the framework will contribute to theory development and be useful to practitioners and designers of information systems for research. It would help in understanding past studies in the wider context of the field, as well as in the design of new empirical studies. Our second study provides one such design based on elements from this integrated framework.

Study 2 - A Context-based Investigation into Source Use by Information Seekers.

An important question in information seeking behavior is where do people go for information and how do people decide on which information source to use when faced with an information-seeking task or need for information. Some studies have reported that seekers use the information source that is most easily accessible. Other studies have found that people go for the source with the highest quality. The empirical survey study seeks to address these conflicting findings by incorporating variables from the 'context' surrounding information seeking that impact a person's use of one or more information sources. However, this required facing difficult questions on what 'context' really means and what its boundaries are. This difficulty was resolved by proposing theoretical frameworks 1) to define the boundaries of context and 2) to list the variables that make up context. This was followed by a survey study of 352 working professionals in Singapore to study the role of these contextual factors in determining a person's use of information source. The study found that upon incorporating contextual variables, quality (benefit) was certainly the important factor in the use of a source. Accessibility (cost) was perceived by the seeker to be unimportant but was actually found to be important as well.

Keywords. Information Seeking Behavior; Context; Contextual Identity Framework; Elements of Context; Source Use; Integrated Framework; Information Searching/Retrieval; Sense-making; Cost/Benefit; Least Effort

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CHAPTER 1 INTRODUCTION AND MOTIVATION

'What you don't know has power over you; knowing it brings it under your control, and makes it subject to your choice. Ignorance makes real choice impossible'.
- Abraham Maslow (1963, p.116)

As human beings, we have an unending thirst for information. Every day, whether in our work lives, at home, for leisure or to satisfy a curiosity, we are looking for information. Researchers in the field of information seeking behavior have been studying the information needs of a person and the way s/he goes about seeking information. Lately, more of these researchers (along with those who build search systems for information retrieval) have begun emphasizing understanding the context of search so that systems better tailored to a person's need at a specific point in time can be designed. With people getting information from persons to books to online sources, there is a great process of democratization going on. 'With a wide array of possible sources, understanding what leads to selection of one source over another

must be considered in designing tools and technologies for managing, disseminating, and sharing these resources' (Zimmer, Henry and Butler 2008, p.298). Thus, three key phrases – 'information seeking', 'context' and 'source use' – constitute the core of this thesis.

The first phrase 'information seeking' contributes an integrated theoretical framework encompassing a large number of frameworks and models by leading researchers in the fields of information seeking and information retrieval (Study 1).

The second term 'context' forms the basis for two theoretical frameworks – one to understand the boundary[2] of context, and the other to understand the elements that make up context. The third phrase 'source use', along with 'context', leads to an empirical survey study to determine the role of contextual factors in the use of information sources (Study 2).

Before we go deeper into the motivation for these studies, it is important to understand a few concepts and briefly review the fields of information seeking and information retrieval.

1.1 Related Concepts

A number of related concepts have emerged in the interdisciplinary fields of information seeking and information searching/retrieval.

[2] When we talk about the boundary of context, we mean defining where context ends and where it begins. What constitutes the 'core' (main factors that lead to information seeking behavior) and what constitutes the 'surrounding' circumstances (or context)? Where do we draw the line between this core and the context? Or does this context subsume the core?

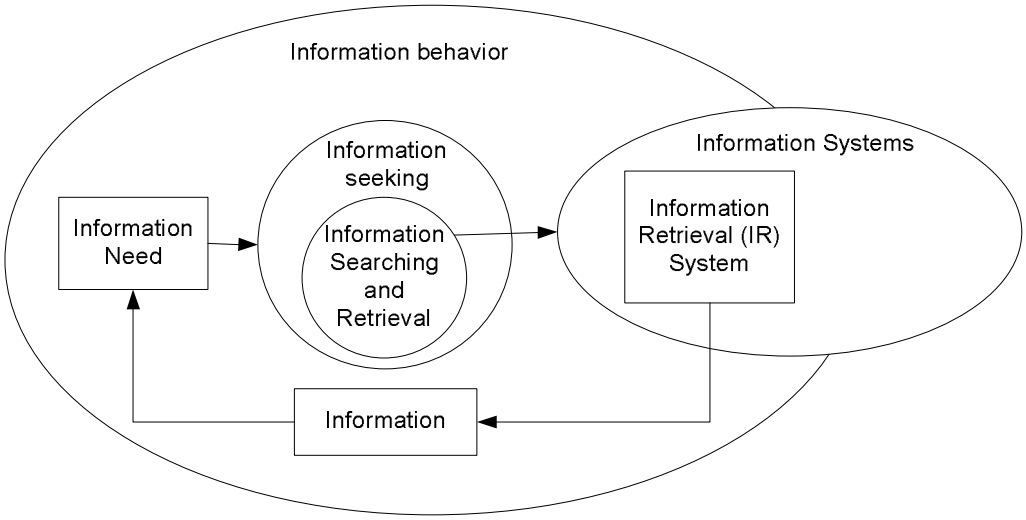


Figure 1 Related Research Areas

Figure 1 is an extension of a nested model originally proposed by Wilson (1999 p.263) that included information searching, information seeking and information behavior – one within the other. We have extended the model by including information, information need, information systems and an Information Retrieval (IR) system. The current model can be considered a high-level model relating information searching to an information system (implying search from a computer-based system) and showing 'searching' as a sub-part of 'seeking', where information may be sought from humans or books (not just computer-based systems). Let us briefly look at each component of this extension of Wilson's nested model:

- **Information.** 'Usually seen as the precondition of debate, [information] is better understood as its by-product. When we get into arguments that focus and engage our attention, we become avid seekers of relevant information. Otherwise we take in information passively – if we take it in at all.' (Lasch, 1995, p.162). A commonly held view with sundry minor variants is that data is raw numbers and facts, information is processed data or a construct on a continuum somewhere between data and knowledge (North *et al., 20*04), and

knowledge is authenticated information (Machlup, 1980; Dretske, 1981; Vance, 1997). Yet the presumption of hierarchy from data to information to knowledge with each varying along some dimension, such as context, usefulness, or interpretability, rarely survives scrupulous evaluation (Alavi and Leidner, 2001). According to North *et al.* (2004), information is determined or defined by its use and has value when it is relevant to the task at hand, is available in the right format at the right place, and is considered fairly accurate and recent. Effective information systems and information transfer requires development of theories and ways to ease transfer from generators of information (those who produce) to users of information (those who consume) (Ingwersen, 1992). As Ingwersen says, this involves methods and technologies that may improve the quality and performance of information. See Case (2007, pp. 39-67) for a detailed review of the concept of information.

- **Information Need** 'consists of the process of perceiving a difference between an ideal state of knowledge and the actual state of knowledge' (van de Wijngaert, 1999 p.463). Ingwersen and Jarvelin (2005, p.295) lay down two types of information need – *specific* (known item, known data element, known topical or contents, factual) or *exploratory* (muddled item, muddled data element, muddled topical or contents, muddled factual). Green (1990 p.65-67) concludes that 1) need is always *instrumental* i.e. it involves reaching a desired goal[3] 2) need is not necessarily a state of mind, and it is possible to be

[3] E.g. if a Ph.D. candidate 'needs to know' the work done by Andrew Green, it is typically because s/he desires to accomplish something with that information. That 'something' may be to answer a test question, to write about it in his/her thesis, or simply to satisfy his/her curiosity. Also, his/her need in these instances is based on some pre-existing need: to pass a class, to get a Ph.D., to be a knowledgeable person, etc. The key factor is that knowing will put him/her at (or closer to) an end state he wants to achieve (understood from Case 2002).

unaware of one's *true* needs[4]. Brittain (1970) distinguishes need from *demand*, the requests made to an information system e.g. a database. Taylor (1968) describes 4 stages[5] or levels of information need. Atkin (1973) says that people constantly seek information whenever they sense uncertainty, in order to reduce it. Belkin *et al.* (1982)'s concept is that of an 'anomalous state of knowledge' (ASK)[6]. Dervin's (1983b) view of sense-making[7] sees information need as a gap that can be filled by something that the needing person calls 'information'. 'The versatility of information-seeking behavior is a reflection of the multiplicity of different information needs arising from different problem situations' (Xu *et al.* 2006 p.1670). Morrison (1993) classifies information need[8] in organizational settings based on the technical or relational orientation of the information required. It is important to understand that information seeking may or may not include the identification or discovery of a need (Courtright 2007). If a need is identified, it might not always originate in the seeker but rather may be imposed on the seeker by a

[4] Case (2002) cites an example where somebody may *think* he needs to scan every psychology journal in the library to find information about recovered memory syndrome. But an experienced person might judge that what he *really* needs to do is to search *Psychology Abstracts* on the Internet.

[5] The first stage is a conscious or unconscious need for information, 'a vague sort of dissatisfaction…probably inexpressible' (p.182) (*visceral* need), followed by a *conscious* mental description, an 'ambiguous and rambling statement' which the searcher may sometimes discuss with somebody. He may then be able to construct a *formalized* (qualified and rational) statement of the need. He is not aware whether the need could be answered in that form by an information system. The final stage is of *compromised* need where the question is recast in a manner that can be understood by the information retrieval system. At this point, the question also reflects the kinds and forms of data that may be available (e.g. images, tabular data) and the ways in which they are organized or indexed (Case 2002).

[6] An ASK exists when a person recognizes that there is an anomaly (gap or uncertainty) in their state of knowledge regarding a situation or topic. He may then try to address the anomaly by requesting for information. He will then judge if the anomaly has been resolved. If it is not resolved, another ASK may be generated, or the motivation to address it may be exhausted. This is in line with Spink (1997)'s model of the search process (see Figure 14 in 2.3). Case (2002) interestingly points out that the searcher always 'gives up' eventually, because there is always more that could be known regarding a topic. The question of 'when' is determined by available resources and the searcher's level of motivation.

[7] 'The individual, in her time and place, needs to make sense….She needs to inform herself constantly. Her head is filled with questions. These questions can be seen as her 'information needs.' (Dervin 1983b, p.170)

[8] Morrison (1993) classifies information need into a) task mastery information need b) role clarification information need c) acculturation information need (e.g. knowledge of norms) and d) social integration information need.

third party (Gross 1999, 2001; Courtright 2007). Harter (1992) argues that to talk about an individual's *information need* is virtually the same as describing his or her *current psychological state*[9], because needs shift stochastically as each relevant piece of information is encountered. Ingwersen and Jarvelin (2004) see need as complex context consisting of the perceived work task or interest as well as perceptions and interpretations of various factors[10]. As Green (1990) concluded, it is possible to unaware of one's true need. At such times, a searcher is often looking for the right questions or the right keyword to ask, rather than the answer to the need right away.

- **Information Seeking** is defined as a conscious effort to acquire information in response to a need or gap in our knowledge (Case, 2002). Allen (1996) defines information seeking as 'the behavior that is the directly observable evidence of information needs and the only basis upon which to judge both the nature of the need and its satisfaction' (p.56).

- **Information behavior**[11] may be seen as a more general field of investigation subsuming seeking and searching, as well as the totality of other unintentional

[9] One bit of knowledge may raise questions, lead to another fact, or a new conclusion, and so forth, which changes one's knowledge state and hence what one finds relevant and worth seeking (Case, 2002). As per Dervin's (1992) sense-making approach, new knowledge from query results (outcome) may raise questions, lead to another fact, or a new conclusion (situation in time/space) which changes one's knowledge state (state). Dervin's use of *time/space* underlines the ever-changing nature of information need. Spink's (1997) empirical model of search process reinforces the same. So does Belkin's (1980) notion of anomalous state of knowledge (ASK) when he describes how new ASKs are generated until the gap or uncertainty is resolved or the motivation is exhausted.

[10] Ingwersen and Jarvelin (2004) identified these factors to be 1) knowledge gap or ASK and relevance; 2) uncertainty and other emotional states; 3) the potential sources for the solution (if any) of the work task or interest; 4) the intentionality i.e. goals, purposes, motivation, etc.; 5) information preferences, strategies, pressures (costs, time); 6) self i.e. own capabilities, health, experiences; 7) systematic and interactive features and information objects

[11] Courtright (2007) says that the term 'information behavior' might in be considered a shorthand for the cumbersome 'information needs, seeking, and use' or INSU. Kari and Savolainen (2003) reject the term 'information behavior' has too closely bound with psychological behaviorism, in which external observation of human behavior is used to draw interferences about an actor's state of mind or intentions (Courtright 2007).

or passive behaviors that do not involve seeking, such as avoiding information (Wilson, 1999; Case, 2002).

- **Information searching**, on the other hand, is 'a subset of information seeking, particularly concerned with the interactions between information user…and computer-based information systems, of which information retrieval systems for textual data may be seen as one type' (Wilson, 1999, p.263).

- An **information retrieval (IR) system** has the goal of 'leading the user to those documents that will best enable him/her to satisfy his/her need for information' (Robertson, 1981, p.10) or for the user to obtain information from the knowledge resource which helps him/her in problem management (Belkin, 1984).

- **Context**. All those factors that surround and influence information seeking behavior may be loosely understood as context (Chapter 3 covers the idea behind 'context' in detail).

- An **information source** can be defined as a carrier of information e.g. a person, a book, a search engine, etc. (Chapter 3 Section 3.3.8 and Chapter 4 cover information sources in greater detail).

The concepts of context and information source form the core of Study 2 of the thesis. Having touched upon these, and having understood the concepts of information, information need, information behavior, information seeking and information searching/retrieval, let us now briefly review the fields of information seeking and information retrieval.

1.2 Review of the Information Seeking & Information Retrieval Fields

> *'Several thousand studies have appeared and, clearly, it is impossible to review all this literature...the movement away from system-centric studies to person-centered studies did not begin until the 1980s...'*
>
> *- Tom Wilson (1994, p.15,30)*

Models typically focus on more limited problems than do theories, and sometimes may precede the development of formal theory (Case, 2002). Many models of information seeking and retrieval have emerged. While searching and retrieval have had a system focus, information seeking has been concerned about user needs and the process of seeking, without the IT artifact. Wilson (1999) and Case (2002) have been the major sources for this review.

In the first three decades of the 20th century, studies were carried out on information *channels* and *systems* – chiefly libraries and the mass media. The first reviews of the literature were published in the 1940s. By the 1960s, such investigations (e.g. the needs and uses of scientists and engineers) were appearing regularly in a variety of journals and reports. But what was mostly carried out was 'system-oriented' research (Vakkari, 1999), where information sources and how they were used were studied, rather than the individual users, their needs (as they saw them), where they went for information and what kind of results they expected. In the 1970s, the emphasis shifted away from the structured information system and towards the person as a searcher, creator, and user of information – making way for terms such as 'information seeking' and 'sense making' (Case, 2002). 'Studies have moved from an orientation that is

primarily system-centered…to an orientation that is also user-centered' (Choo and Auster, 1993, p.39)

The *system-oriented* approach has motivated thousands of studies – typically institutionally sponsored evaluations of library use, selective dissemination of information (SDI) programs, information retrieval systems, interface designs, information campaigns, advertising effectiveness, etc. (Case, 2002). The classic information retrieval research tradition commenced with the Cranfield tests in the 1950s and 1960s (Cleverdon, 1967) and continued with the MEDLARS evaluation (Lancaster, 1968), the work of Vickery (1961), Cuadra and Katter (1967), Saracevic's (1975) work on relevance judgment and Salton's (1971) research on automated systems. These were fundamental influences for the theoretical work of van Rijsbergen (1979) and Robertson (1977). They also influenced the empirical work of Robertson and Sparck Jones (1976) on relevance feedback and Willett (1988) on comparisons of Boolean and best match searching. The cognitive approach in information retrieval is represented in the work of Brookes (1977), Belkin (1990), Ingwersen (1992), and Vickery, Brooks and Robinson (1987). Croft (1987) and Smeaton (1992) combine research aspects from both the statistical and cognitive approaches (Ellis, Allen and Wilson, 1999). Several models of the system-oriented approach exist, such as Belkin (1984)'s Monstrat Model, Ingwersen (1992)'s Mediator Model and other subsequent models (e.g. Ingwersen, 1996; Saracevic, 1996; Spink, 1997; Jarvelin and Ingwersen, 2004).

On the other hand, *person-centered* research offers understanding of information seeking and use within the various contexts of people's lives. In the person-centered approach, many models of information seeking exist as well. These range from

Donohew and Tipton (1973)'s model (one of the earliest; depicts sequence of events) to the models of search processes by Ellis (Ellis 1989; Ellis *et al.*1993) and Kuhlthau (1991). These models show a series of cognitive, and affective (Kuhlthau, 1991) stages through which people are thought to move as they are looking for information[12]. General models of information seeking, applicable in multiple contexts, occupations, roles and knowledge solutions are those of Wilson (Wilson, 1981; Wilson and Walsh, 1996)[13], Krikelas (1983)[14], Leckie *et al.* (1996) and Johnson (1997)[15]. New ways of looking at information seeking have emerged, such as Savolainen's (1995) work on Everyday Life Information Seeking.

Models of both Ellis and Kuhlthau relate to *active search* mode of information-seeking behavior (put forth by Wilson and Walsh, 1996). Krikelas' model shows its age in the way it privileges document/library usage, but is simple and widely recognized. Wilson (1981) is more general as it refers to systems, sources and people. It introduces concepts of results of seeking (success/failure) and degree of satisfaction of a need, but ignores questions of source characteristics and personal preferences. However, it is more useful than Krikelas' model for designing empirical studies on Information Seeking. Wilson and Walsh's (1996) model introduces factors that Wilson's first model ignored – personal variables, modes of seeking, relevant theories of motivations. Johnson's model is causal, simple and general, while Leckie's model is limited to professionals (Wilson, 1999). In addition, there have been important meta-theories, such as Dervin's sense-making (1983a)[16]. A number of theories from

[12] Ellis and Kuhlthau's stages are shown in Figure 8 in 2.3 .

[13] Shown in Figure 6 and Figure 9 in 2.3 .

[14] See 2.3 and the discussion on Figure 7.

[15] See the discussion surrounding Figure 10 in 2.3 .

[16] See Figure 5 in Section 2.3 .

various fields such as sociology (Durkheim's grand theory of the division of labor – Chatman (1990) and Roger's (1983) diffusion of innovation theory), mass communication (Katz and Foulekes' (1962) uses and gratifications theory), psychology or cognitive theories (e.g. Daniels, 1986) have also been applied to information seeking. Gattis (2002) seeks to explain how novice technical communicators learn to search for information. Recognizing that no single model can fully represent this complex process, Gattis combines two different cognitive models – information foraging theory and strategic planning theory. Other theories used are Chatman's (1996) 'theory of information poverty', Zipf's principle of least effort (Zipf, 1949), the cost-benefit paradigm (Hardy, 1982), Katz, Blumler and Gurevitch (1974)'s uses and gratifications paradigm, and the Social Action Model (Renckstorf and McQuail, 1996).

1.3 Motivation and Research Contribution of Study 1

As discussed in the section above, the models, frameworks and theories in the system-centric (information searching and retrieval) as well as the user or person-centric (information seeking/user studies) tradition of information seeking and retrieval have made a seminal contribution in advancing the field. However, transfer of concepts across user studies and information retrieval/information systems remains problematic and insufficient (Kuhlthau, 2005). In their study using citation analysis, Ellis *et al.* (1999) found that scholars do not cite across the overlapping areas of information systems, information retrieval and user studies/information seeking. The tradition of research into information seeking considers information seeking from a systems perspective and information users as passive, situation independent receivers of objective information (Dervin and Nilan, 1986). Yet it has been often accepted that

information needs and information seeking processes depend on user's tasks (Belkin *et al.*, 1982; Ingwersen, 1992; Mick *et al.*, 1980; Bystrom and Jarvelin, 1995). Thus, many studies have investigated the relationships of various types of tasks (e.g. in sciences, technology, social studies, administration) and information seeking behavior (Brittain, 1975; Dervin and Nilan, 1986; Tushman, 1978) (Bystrom and Jarvelin, 1995). Kuhlthau (2005) has called for collaboration between the insights of user studies and the innovations of information retrieval and information systems.

> *'These overlapping areas…conduct different streams of research. One stream concentrates on system design and system use mainly at the point of interface. The other stream concentrates on the context and experience of information seeking and use…Collaborative research of this type offers opportunities to apply the findings to designing systems and services that are tailored to specific needs of users.'*
>
> *- Carol Kuhlthau (2005)*

Ingwersen and Jarvelin (2005) and Jarvelin and Ingwersen (2004) have also concluded that Information Retrieval research needs extension toward more context and Information Seeking research needs extension towards task and technology.

Taking Kuhlthau's, Ingwersen's and Jarvelin's call, Study 1 endeavors to present a theoretical framework integrating both the fields of information seeking and information retrieval. The framework is based on several past models and frameworks of information seeking and information retrieval, and draws on the work of several leading researchers in the field. Before arriving at the framework, we review theoretical development in the fields of information seeking and information retrieval and establish why an integrated framework is needed. We also discuss how the integrated framework is derived from past models and frameworks in the field. A number of propositions/hypotheses derived from the framework are also proposed. The framework answers recent calls for collaboration between the two related fields.

It contributes to theory development in the fast merging field of information seeking and retrieval. The importance of this effort is highlighted by the fact that ACM SIGIR (Special Interest Group on Information Retrieval) incorporated a workshop on Information Retrieval in Context (IRiX) in 2004 and 2005. The Information Seeking in Context (ISIC) conference is being held every 2 years – the 7th conference was held in 2008. TREC, the Text REtrieval Conference, a yearly workshop hosted by the US government's National Institute of Standards and Technology has also incorporated a track called HARD (High Accuracy Retrieval from Documents) to achieve high accuracy retrieval from documents by leveraging additional information about the searcher and/or the search context captured using very targeted interaction with the searcher. From the practitioner's perspective, the experimental study will be useful for developers of information systems for search – knowledge providers (who build knowledge repositories for use within an organization), content providers as well as builders of web search engines. As the organizers of IRiX 2005 mention in the preface of their proceedings, 'The underlying hypothesis (and belief) is that by taking account of context, the next generation of retrieval engines dependent on models of context can be created, designed and developed delivering performance exceeding that of out-of-context engines.' (Ingwersen, Jarvelin and Belkin, 2005). We also take Dervin's sense-making theory as an example and illustrate how the process of synthesis by mapping among models could serve as a methodological move, whereby the work of a particular theorist is made dominant and other theories and models nested under it. This approach will help in synthesizing the works of different theorists and should help bring about synthesis and convergence in research in any field. We invite other researchers to join in this endeavor, by following the process illustrated in this study. The integrated framework arrived at can be tested empirically

through experiments and surveys. Designed to serve as one of the most comprehensive frameworks in the field of information behavior, it would help in understanding past studies in the wider context of the field, as well as in the design of new empirical studies. Our second study provides one such design based on elements from this integrated framework.

1.4 Motivation and Research Contribution of Study 2

In this study, we are concerned with the 'person-oriented' aspects of information seeking – specifically, where people go for the information they need i.e. their use of one or more information sources. This question is important because 'source choice [or use] decisions directly impact the outcome of information seeking' (Xu *et al.* 2006 p.1666). Most past studies in the disciplines of Information Science and Organizational behavior have largely employed the cost-benefit framework to analyze how seekers decide on using an information source (Hardy 1982; O'Reilly 1982; Chakrabarti *et al.* 1983; Swanson 1987; Choo 1994; Vancouver and Morrison 1995; Fidel and Green 2004; Yitzhaki and Hammershlag 2004; Xu, Tan and Yang 2006).

However, conflicting findings have been found with regard to the importance of the cost (source accessibility) or the benefit components (source quality) in the seeker's use of information sources. Those advocating the least-effort principle include, e.g. Gerstberger and Allan (1968), Chakrabarti *et al.* (1983), Culnan (1983), Anderson *et al.* (2001) and Yitzhaki and Hammershlag (2004). Other studies have reported source quality as more important (Ashford 1986; Swanson 1987; Vancouver and Morrison 1995; Morrison and Vancouver 2000).

Also, while the cost-benefit studies have focused on the effect of source quality and accessibility on seeker's use of a source, they have paid little attention to the different contingent variables (which would make up the *context* of search) on the cost-benefit analysis. Incorporating these variables into our empirical research model could help to address the cost-benefit debate in the seeker's use of an information source. However, before we could move further in this direction, we had to tame a huge 'unruly beast' (Dervin 1997) and define what we mean by context.

In the last few years, the *context* of information seeking is receiving increased attention[17], along with equivalent notions like 'situation', 'setting', 'environment', etc. Cool (2001) attributes this increased attention to context to the thinking that 'in order to better understand information-seeking behavior (ISB) and information retrieval (IR) interaction, greater attention needs to be directed to the information spaces within which these activities are embedded' (p.5).

However, despite the seemingly widespread and growing attention, the concept remains ill-defined and inconsistently-applied (Cool 2001). Most literature on information needs, seeking and use fails to address the problem of context theoretically (Dervin 1997; Johnson 2003; Lueg 2002; Courtright 2007). There isn't any success in defining what context really means[18], what are the boundaries of context, what are the important variables that make up context that could be incorporated in a causal research model. This is especially more pronounced in the

[17] Ingwersen and Jarvelin (2005) and Jarvelin and Ingwersen (2004) have called for IR research to incorporate more context. ACM SIGIR incorporated a workshop on Information Retrieval in Context (IRiX) in 2004 and 2005. The Information Seeking in Context (ISIC) conference is being held every 2 years – the 7th conference was held in 2008. The HARD track of the TREC conference also seeks to achieve high accuracy information retrieval by capturing more information about the search context. 'The underlying hypothesis (and belief) is that by taking account of context, the next generation of retrieval engines dependent on models of context can be created, designed and developed delivering performance exceeding that of out-of-context engines' (Ingwersen, Jarvelin and Belkin, 2005).

[18] Courtright 2007, in her review, highlights the contending definitions

studies of source usage of the information seeker. A theoretical contribution of this study will be to propose 1) a theoretical framework that helps towards delineating the boundaries of context and 2) another theoretical framework that incorporates the contextual variables that will impact a seeker's cost-benefit analysis before using an information source. These variables, which are based on past studies, will enable the context in the use of one or more information sources to be empirically studied and will serve as useful moderators.

Of those variables identified in the framework, a few important ones will be incorporated into our research model, and studied empirically. Though an in-depth survey, the research question that we seek to answer is, "*Where people go for information and how people decide on an information source to use when faced with an information-seeking task or a need for information?*"

Thus, the contribution of this study is three-fold:

- A theoretical framework[19] laying out three views to help delineate the boundaries of context of information seeking behavior (what we call the 'Contextual Identity Framework' – see Chapter 3 Section 3.2) i.e. what are the different ways of looking at context and where do we set the boundaries?

- A theoretical framework to define the elements of context in a seeker's cost-benefit analysis before using an information source (see Chapter 3 Section 3.3

[19] The two theoretical frameworks of Study 2 focus exclusively on context (different ways of looking at context, its boundaries and the elements/variables that make up context), especially with respect to information seeking behavior in the choice of an information source. While the integrated framework of Study 1 incorporates a large number of variables in the process of information seeking behavior, the frameworks of Study 2 look at these variables with a focus on Context and source, as understood by different researchers over the years.

) i.e. what are the important variables that make up context, and in which view of context do these variables address?

- An empirical survey study that seeks to reconcile the conflicting findings of the relative importance of the cost (source access cost) and benefit (source quality) components before a seeker uses an information source, by incorporating contextual variables identified in the framework.

1.5 Organization of the Thesis

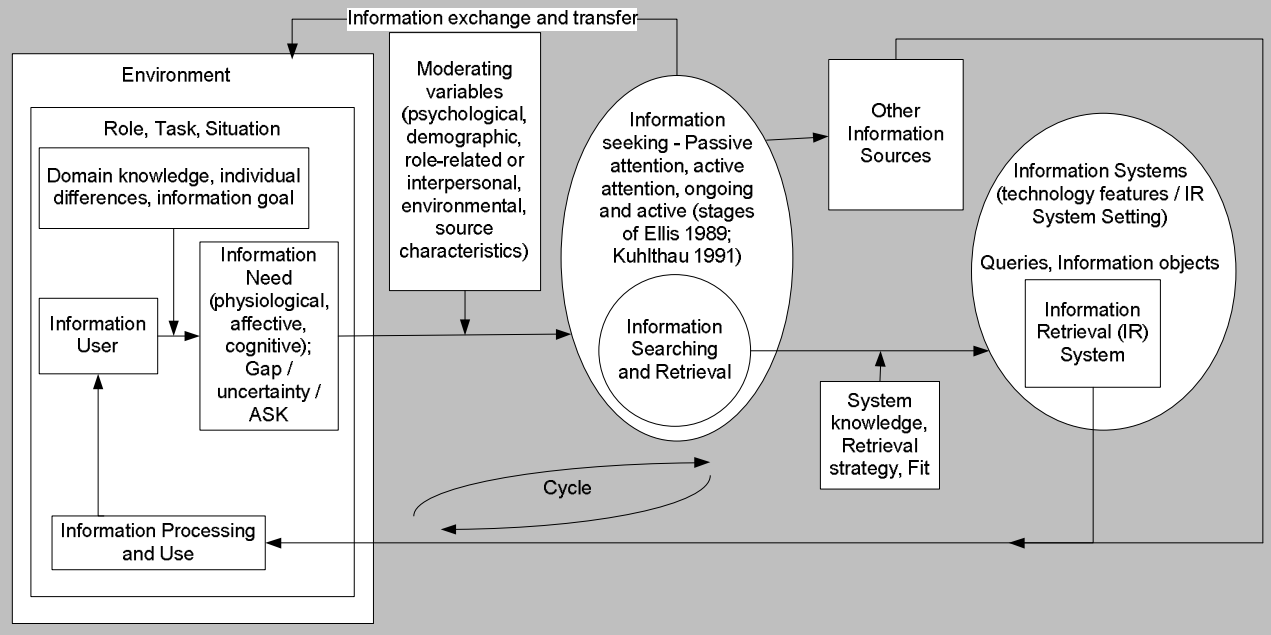
In this chapter, we've looked at a few important concepts in information behavior and reviewed the fields of information seeking and information retrieval. We also apprised ourselves with the motivation for the two research studies, and the research contribution they will make. The rest of the thesis is organized as follows:

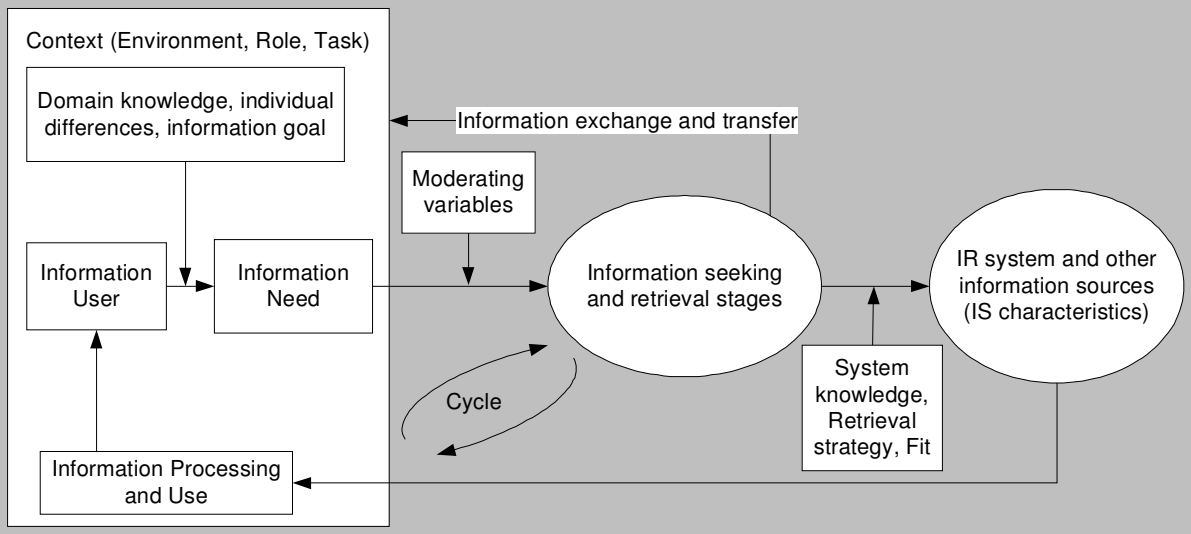
In Chapter 2, we move on to Study 1, where an integrated framework of information seeking and retrieval is presented. In this chapter, we also present existing models and how they map to the integrated framework. This is followed by a simplified integrated framework. Finally, we demonstrate using an example how our process of integration can be applied in any field keeping the work of a particular theorist as a base and mapping other models and theories to it. In Chapters 3 to 6, we look at Study 2. Chapter 3 is a long chapter which covers the following – the theoretical approach leading to the investigation into the factors affecting source use by information seekers; the Contextual Identity Framework to define the boundaries of context; and a framework for the elements of context. In Chapter 4, we present an empirical research model for the empirical survey study on source use, and arrive at testable hypotheses. The literature review for Study 2 is spread across a number of chapters. Chapters 1, 2,

3 and 4 all contribute to the literature review for Study 2. The research methodology, including data collection and analysis, is discussed in Chapter 5. Discussion and Implications from the survey study are covered in Chapter 6, which also includes a summary of the empirical survey study. We conclude the thesis in Chapter 7 and lay down briefly, the directions for future work. Let us now look at Study 1 where we propose a theoretical framework integrating the fast merging fields of Information Seeking and Information Retrieval.

STUDY 1 – TOWARDS AN INTEGRATED FRAMEWORK OF INFORMATION SEEKING AND INFORMATION RETRIEVAL

THEORETICAL STUDY





CHAPTER 2 TOWARDS AN INTEGRATED FRAMEWORK OF INFORMATION SEEKING AND INFORMATION RETRIEVAL

Very few researchers work at the boundaries of information seeking and information retrieval. Notable among these include the work of Cuadra and Katter (1967), Bates (1990) and Saracevic (1975). Jarvelin and Ingwersen (2004) and Ingwersen's (1992) cognitive and Ellis' (1989) behavioral approaches could also be seen as representing contributions to both the areas (Ellis, Allen and Wilson, 1999).

In Chapter 2, we briefly mentioned a number of models – both in information seeking as well as searching and retrieval. We now attempt to integrate the two closely-related fields into a framework that combines the process and person-centered approach of information seeking, and the system-centered approach of information retrieval.

2.1 Review or theory?

A review paper is a review of existing models. A theory paper develops new theoretical frameworks and new propositions. This paper does both. It reviews extant models and develops an integrated framework combining all the models. In doing so, it combines processes as well as factors or variables. Thus, the framework can be seen as a process model representing different states in the process, while combining different factors or variables that interact with one another. New propositions are also derived from the framework. Let us now look at the integrated framework.

2.2 Towards an Integrated Framework

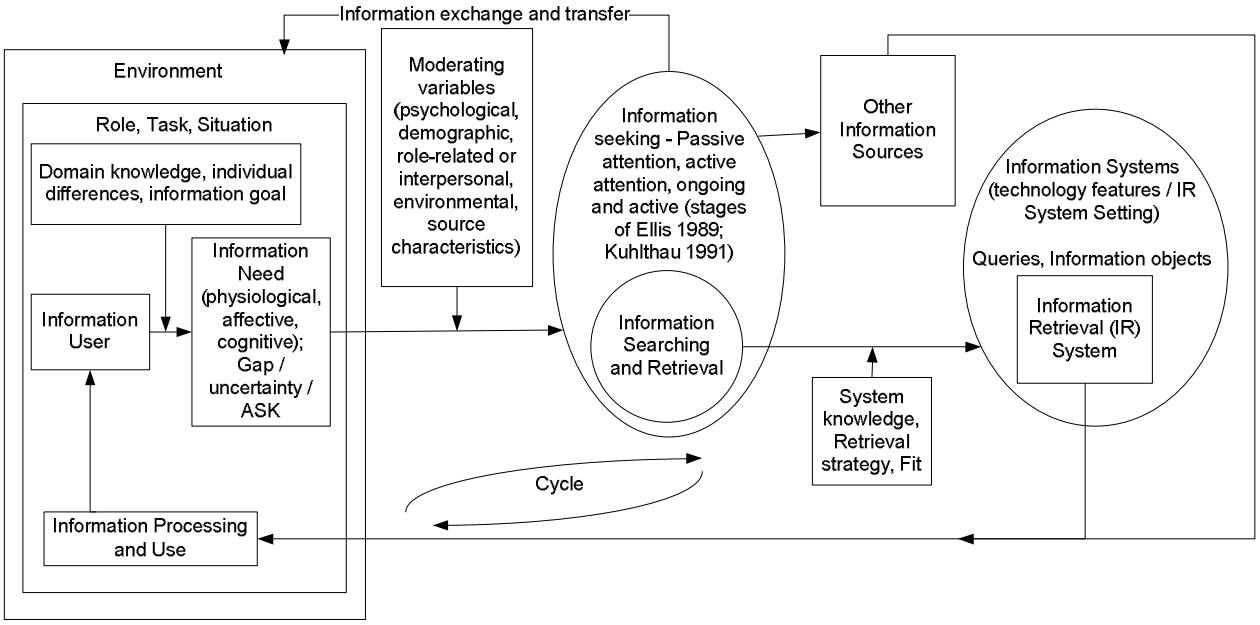


Figure 2 An integrated framework of Information Seeking and Retrieval

Figure 2 shows the integrated framework of Information seeking and retrieval. The framework expands the adapted nested model of Figure 1 (Chapter 1) to combine various models/frameworks of Information seeking and retrieval.

The framework shows that the information user is situated in the context of his work role, task or situation, which are part of the user's environment (work, socio-cultural, politico-economic or physical). Within this context, an information need arises, which may be due to a gap, uncertainty or anomalous state of knowledge (ASK – Belkin *et al.*, 1982). The level of uncertainty or gap in knowledge is moderated by the user's prior domain knowledge (Allen, 1991; Wildemuth, 2003; Miura, Fujihara and Yamashita, 2006), individual differences (such as cognitive ability, cognitive style and problem-solving style - Kim and Allen, 2002) and his information goal (Limberg, 1997; Todd, 1997; Kuhlthau, 2005). The path from information need to information seeking[20] is moderated by variables (barriers of Wilson, 1981) of six types: psychological dispositions (e.g. tending to be curious, or averse to risk), demographic background (e.g. age or education), factors relating to one's social role (e.g. acting as a manager or as a mother), environmental variables (e.g. the resources available) and characteristics of the sources (e.g. accessibility and credibility) (Case, 2002). The information seeking process might be passive (taking in information involuntarily or active and ongoing. During active information seeking, the user goes through Ellis' (1989) behavioral stages of starting, chaining, browsing, differentiating, monitoring, extracting, verifying and ending as well as the feelings and thoughts associated with each stage (Kuhlthau, 1991). Information may either be sought from people and other information sources (information seeking) or through an information system/IR system (information searching and retrieval). The knowledge of the search system (Dimitroff, 1992; Hoelscher and Strube, 1999), retrieval strategy (which could be either mental state or behavior) and the degree of fit between the search task and the

[20] Some may argue for 'information seeking' to be situated within the user's environment and role/task/situation. The user's domain knowledge and individual differences might affect the process of seeking as well.

technology features will moderate the path between information searching and the relevance of the search output. The IS characteristics consist of IR system setting such as search language/IR techniques, database structure and indexing rules/computational logic. Queries are sent via the search interface and information objects (text/knowledge representations, full text, pictures and semantic entities) retrieved. The information retrieved from the information system, as well as through other channels such as people is processed and used by the information user, who evaluates whether his need is satisfied or not based on the new information (a new situation in time/space as per Dervin's sense-making approach). This cycle of interactive feedback loops, search tactic or moves and user judgment (as per Spink, 1997) repeats until either the need is satisfied or the user loses motivation. Case (2002) interestingly points out that the searcher always 'gives up' eventually, because there is always more that could be known regarding a topic. The question of 'when' is determined by available resources and the searcher's level of motivation. The arrow from information seeking to the user's environment highlights information exchange and transfer to people/entities in the user's environment (Wilson, 1981).

Let us see how the integrated framework was derived from existing models and frameworks of information seeking and information retrieval.

2.3 Existing Models and their mappings to the Integrated framework

In each of the figures below, the model on the left represents the model from which the different portions of the integrated framework (at the right) are derived. The numbers correspond to areas of the models/framework that map to one another.

The two nested ellipses depicting information seeking and information searching/retrieval are derived from Wilson's nested model (1999 p.263). The model extends Figure 1 (in Chapter 1). See Figure 3 below.

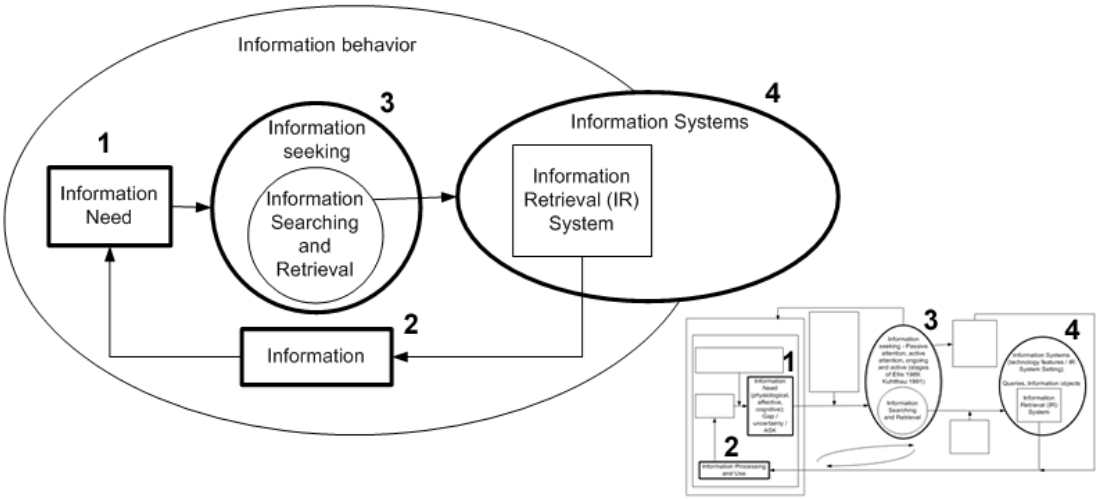


Figure 3 Extending Figure 1 (derived from Wilson (1999)'s nested model)

Wilson's (1981) model of Information behavior (Figure 4 below) elaborates research areas of Figure 1 and Figure 3, with the information searching and retrieval field relating to 'information seeking behavior' with 'demands on information systems'. It includes the concepts of information user, information use (which had received little attention till then), information exchange and the phenomenon of informal transfer of information between individuals. However, there is no arrow from failure to need (the seeking process typically repeats when a particular search fails to satisfy the need). Also, there is no suggestion of causative factors and it does not directly suggest hypotheses to be tested (Wilson, 1999).

In our integrated framework, we have drawn the information user and need from Wilson's (1981) model of Information behavior. See mappings of the numbers 1 and 2 in Figure 4 below.

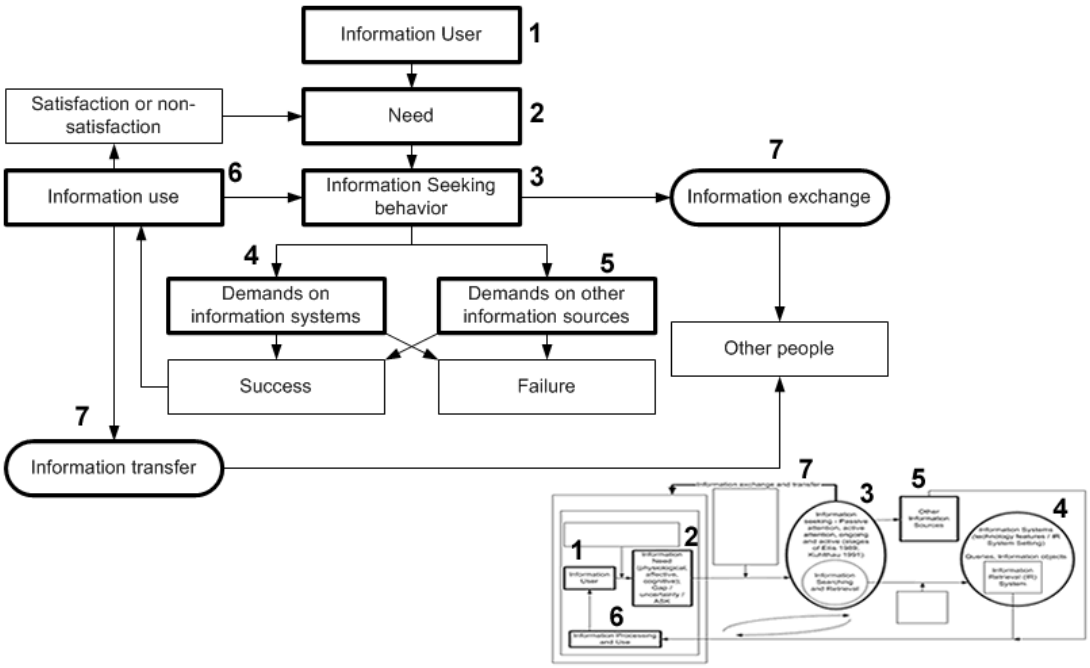


Figure 4 Mapping to Wilson's (1981) model of Information Behavior

Another well-known approach to information seeking is Brenda Dervin's (1992) sense-making paradigm[21]. The paradigm has theoretical groundings in the constructivist learning theories of John Dewey (1933, 1960) and Jerome Bruner (1973, 1990) and proposes that information is not 'something that exists apart from human behavioral activity.' Rather, it is 'created at a specific moment in time-space by one or more humans' (Dervin, 1992, p.63). Unlike other approaches to information seeking that see information as something 'out there' that is transmitted to people (as Dervin says, an information 'brick' that is put into a human 'bucket'), sense-making sees information as construed internally in order to address gaps or discontinuities (Case, 2002; Wilson, 1999).

[21] 'Some people call sense making a theory, others a set of methods, others a methodology, others a body of findings' (Dervin 1992, p.61) designed to cope with information perceived as, '…a human tool designed to making sense of a reality assumed to be both chaotic and orderly' (Dervin 2000).

Sense-making is implemented in terms of four constituent elements (Figure 5): a *situation* in time and space, which defines the context in which information problems arise; a *gap*, which identifies the difference between the contextual situation and the desired situation (e.g. uncertainty); an *outcome*, that is, the consequences of the sense-making approach, and a *bridge*, i.e. some means of closing the gap between situation and outcome (Wilson, 1999)

In the integrated framework, need reflected as 'gap' is drawn from Dervin (1992) (see the number 2 in Figure 5) and as 'Anomalous State of Knowledge (ASK)' from Belkin *et al.* (1982).

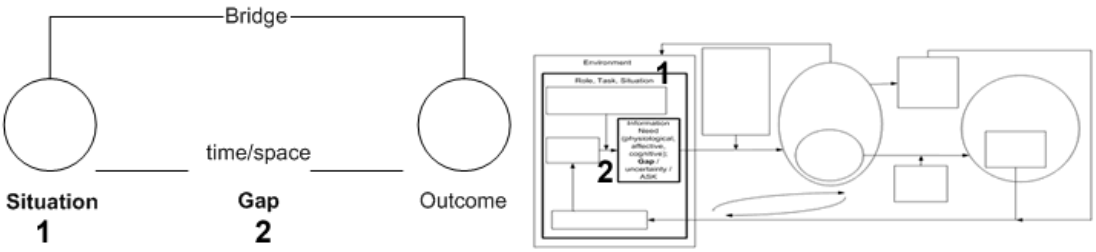


Figure 5 Mapping to Dervin's (1983a, 1992) Sense-making theory

Wilson's (1981) model of Information-Seeking behavior (Figure 6) expands the first two boxes of Figure 4 (numbers 1 and 2) – information user and need and leads to the third box (number 3), information-seeking behavior.

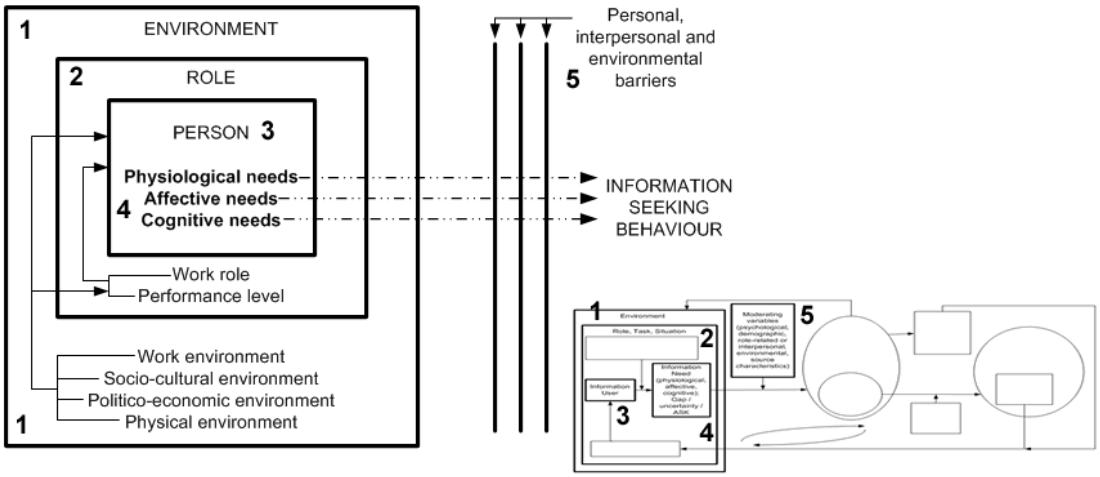


Figure 6 Mapping to Wilson's (1981) model of Information Seeking Behavior

The information user is depicted as a person in the context of his work role and surrounding environment. The needs are elaborated as physiological, affective and cognitive. Wilson also introduces the concepts of different types of barriers to information seeking. The strength of the model is that it suggests how information needs arise and what may prevent or aid the actual search of information (barriers). The model implicitly embodies testable hypotheses concerning information needs in different work roles or environments, different types of needs and barriers. The weakness lies in the fact that there is no indication of processes whereby context has effect upon the person, or of the factors that result in the perception of barriers. It is also not clear whether the various assumed barriers have similar or different effects upon the motivation of individuals to seek information (Wilson, 1999).

In the integrated framework, the contexts of role and environment surrounding the user are from Wilson's (1981) model of information seeking behavior (see numbers 1 and 2 in Figure 6 below), as well as the need-creating event/environment of Krikelas' (1983) model (see number 1 in Figure 7) and the situation in time/space of Dervin's (1992) sense-making theory (number 1 in Figure 5).

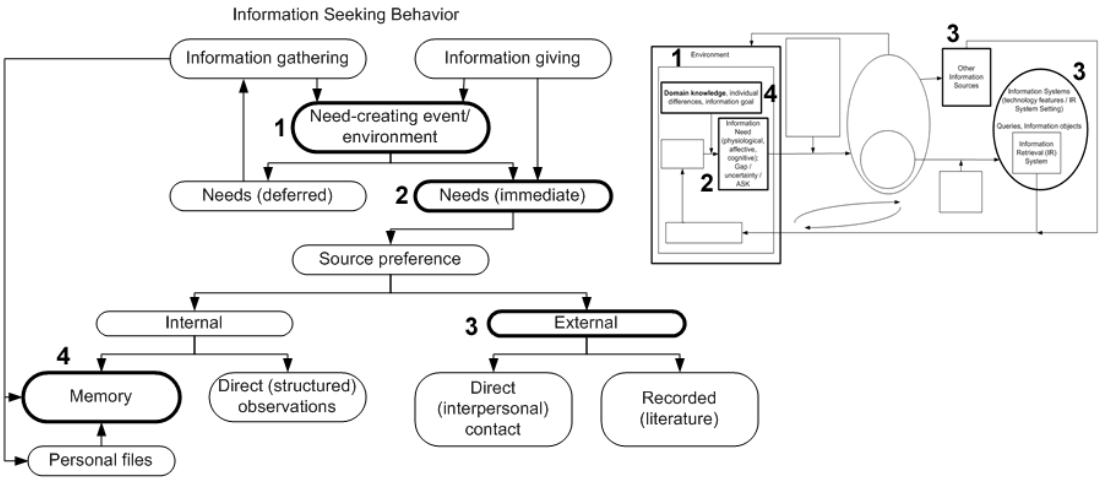


Figure 7 Mapping to Krikelas (1983)

Krikelas' (1983) model of information seeking behavior (Figure 7) is a simple, one dimensional flowchart. It expands the 'need' of Figure 4 into two kinds – immediate and deferred. It also identifies the role of memory as an internal information source. In addition, the model identifies *uncertainty* as a key concept – a situation in which a person becomes aware of a state of uncertainty about a problem and attempts to reduce it to an acceptable level. The weakness of the model lies in its lack of clarity around a number of issues – shouldn't need-creating environment be depicted as surrounding other factors, are 'information giving' and 'sources' different, can 'personal files' include 'recorded literature' or personal notes, etc. (Wilson, 1999). A number of empirical studies have utilized Krikelas' model. McKnight *et al.* (2002) conducted a study to understand the differing perceptions of information needs and communication patterns of healthcare professionals as they relate to medical errors. The survey questions were based on Krikelas' model. The study suggests that information needs and communication difficulties are common and can lead to medical errors or near misses, but the problems may be amenable to IT solutions. Other studies include the comparison of youngsters' use of CD-ROM and the Internet

as information resources (Shenton and Dixon, 2003) and a study on the information environment of veterinary researchers (Chikonzo and Aina, 2001).

In the integrated framework, the information user's domain knowledge reflects the 'memory' of Krikelas' model (see 4 in Figure 7).

Ellis' (1989) and Ellis, Cox and Hall's (1993) model of information search process outlines different behaviors in information seeking – starting, chaining, browsing, differentiating, monitoring, extracting, verifying and ending, which are intended to function at different levels of the overall process of information seeking. These stages are based on empirical work and tested in subsequent studies e.g. Ellis and Haugan (1997) tested the 'features' in the context of an engineering company. Wilson (1999) has shown how Ellis' stages can be incorporated within Wilson's (1981) model of Information Seeking Behavior (Figure 6).

While Ellis' suggests that the sequences of behavioral characteristics may vary, Kuhlthau's framework posits 6 successive stages in the information search process on the basis of behavior analysis. These stages are initiation, selection, exploration, formulation, collection and presentation. In each of these stages, Kuhlthau identifies the feelings (affective) and thoughts (cognitive) common to each stage, as well as the appropriate actions (physical) and tasks. The framework is sequential, with no iteration suggested. Kuhlthau's model is based on a series of studies investigating common experiences of users in information seeking situations. What Kuhlthau's model reveals is a process of the gradual refinement of the problem area, with information searching of one kind or another going on while that refinement takes place. Thus, a successive search process is implicit in Kuhlthau's analysis of the search activity (Wilson, 1999). Kuhlthau's model also forms the basis of Vakkari's

theory of task-based Information Retrieval Process (Vakkari, 2001). Wilson (1999) combines Ellis' and Kuhlthau's stages of the Information Search Process (see Figure 8).

The information seeking behavior of the integrated framework combines Ellis' (1989) and Kuhlthau's (1991) cognitive and affective stages (see Figure 8).

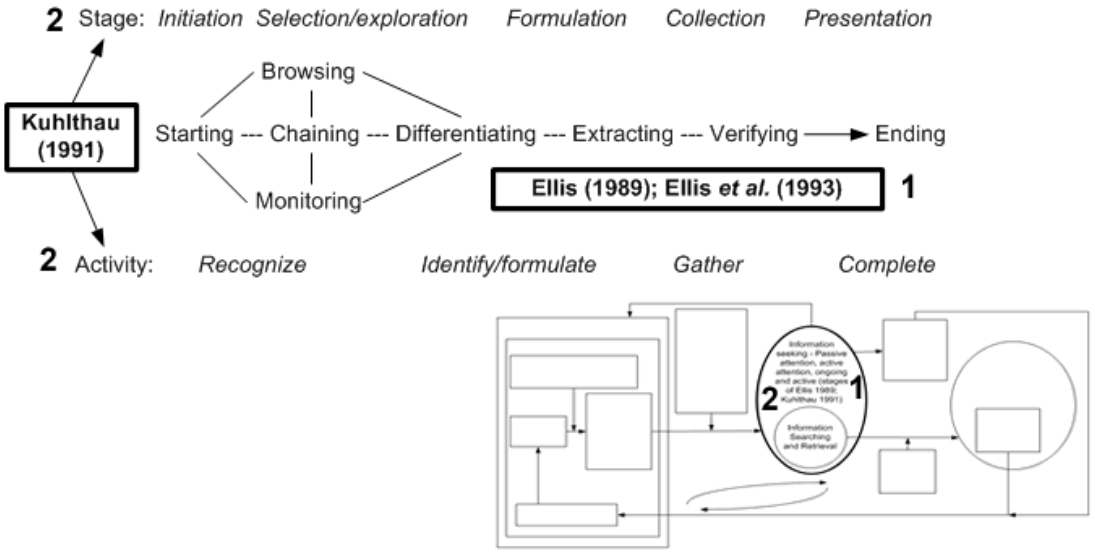


Figure 8 Mapping to Kuhlthau's and Ellis' stages of Information Search Process (combined by Wilson, 1999)

Wilson and Walsh's model of information seeking (1996) emphasizes the complex context of information seeking (Figure 9) and invokes explicit theories to explain the following aspects of information seeking:

- Why some needs prompt information seeking more so than others? (stress/coping theory, from psychology)
- Why some sources of information are used more than others? (risk/reward theory, from consumer research)

- Why people may, or may not, pursue a goal successfully, based on their perceptions of their own efficacy? (social learning theory, from psychology)

Wilson and Walsh's activating mechanisms are motivators (what motivates a person to search for information, and how and to what extent?), affected by 6 intervening variables. The model also recognizes that there are different types of search behaviors – passive attention, passive search, active search and ongoing search. 'Information processing and use' implies that information is evaluated as to its effect on need, and forms part of a feedback loop that may start the process of seeking all over again if the need is not satisfied. Wilson's expansion and inclusion of other theoretical behavioral models make it a richer source of hypotheses and further research compared to his 1981 model (see Figure 6) (Wilson, 1999; Case, 2002).

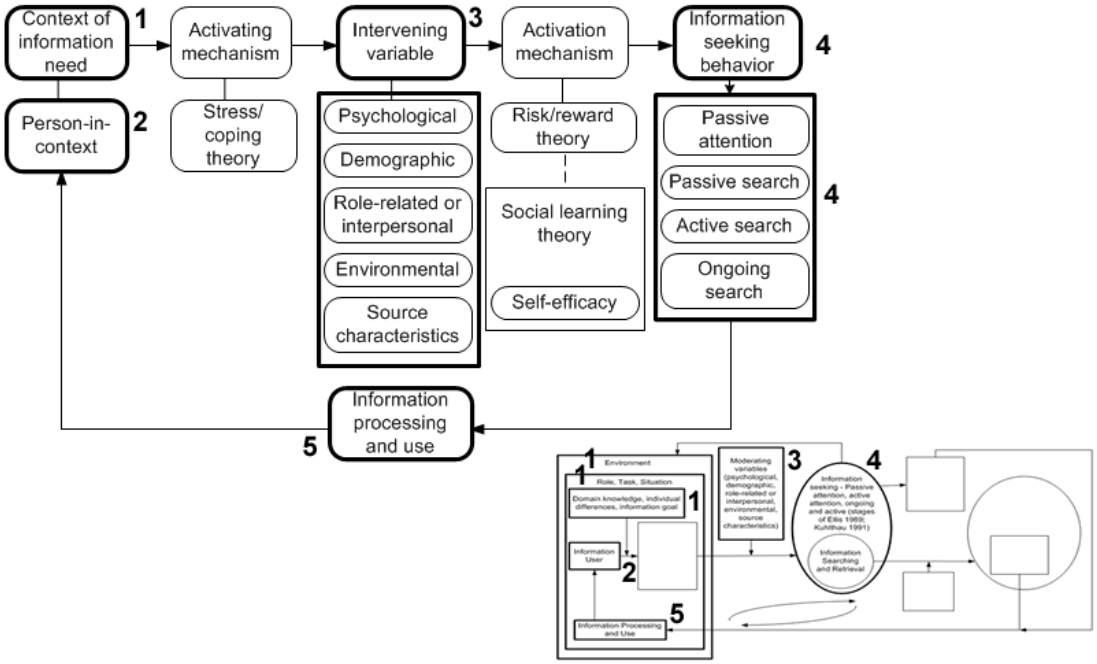


Figure 9 Mapping to Wilson and Walsh (1996)

In the integrated framework, the link between information need and information seeking in the integrated framework is moderated by the barriers of Wilson (1981)

(number 5 in Figure 6), which Wilson and Walsh (1996) expanded to form the intervening variables in their model (see number 3 in Figure 9 above). The concepts of passive attention, passive search, active search and ongoing search (number 4 in Figure 9), as well as information processing and use (number 5 in Figure 9) have been incorporated from Wilson and Walsh (1996).

Johnson's (1997) model (see Figure 10) depicts a causal process that flows from left to right. Antecedent background and personal relevance factors motivate a person to seek information. Information carrier factors are characteristics and utility of the information channels selected and used. What information seekers are concerned about is the content of the information, not the channel through which it arrives (a preoccupation criticized by Dervin (1989)). The model adopts a 'sense-making' perspective like Dervin, when saying that all information seeking takes place within a context, and begins only when a person perceives a gap in existing knowledge. The strength of Johnson's model is that it is empirically tested in health and decision making and is being used in a series of health care studies funded by the U.S. National Institutes of Health through the University of Kentucky.

In our integrated framework, Johnson's (1997) background and personal relevance factors are reflected in the characteristics and the context surrounding the information user (see number 1 in Figure 10 below).

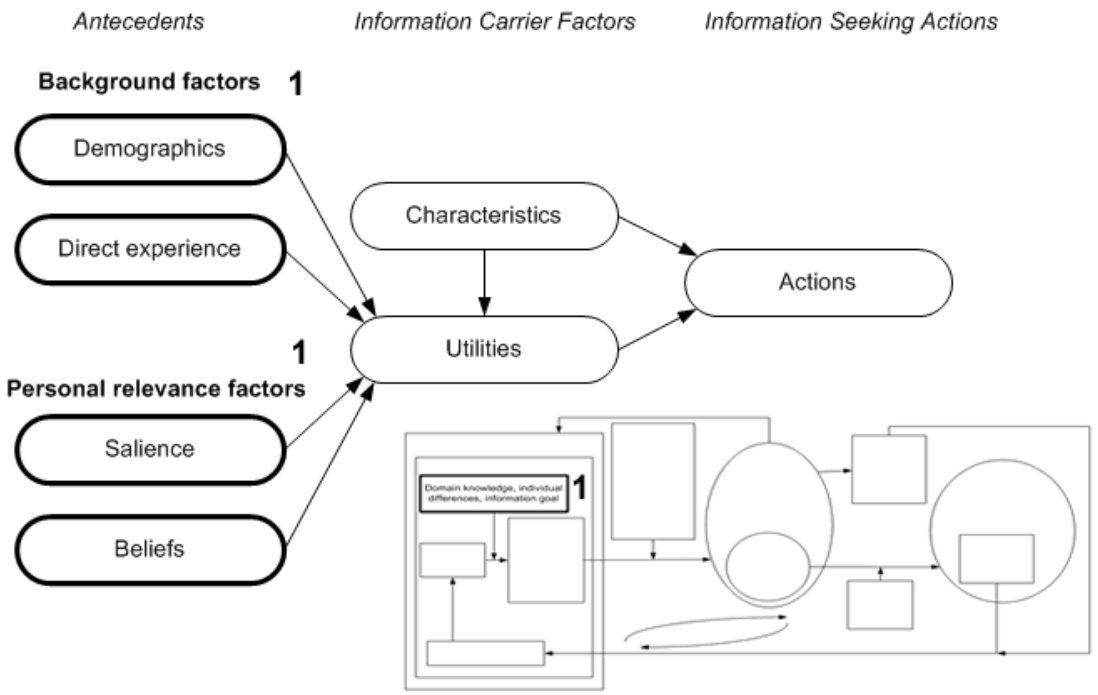


Figure 10 Mapping to Johnson (1997)

So far, we've seen how the integrated framework maps to, and has been incorporated from several well-known models in Information Seeking. The figures below reflect the portions of the framework relating to models from Information Searching or Retrieval.

Belkin's (1984) MONSTRAT model is based on the cognitive model of IR interaction. It models system characteristics, user characteristics and problem characteristics and has ten functions (dialogue mode, problem state, problem mode, user model, problem description, retrieval strategy, response generator, input catalyst, output generator and explanation) that correspond to system modules. The model assumes that it is possible to construe an intelligent mechanism, which is able to understand the information needs of users and perform like an intermediary.

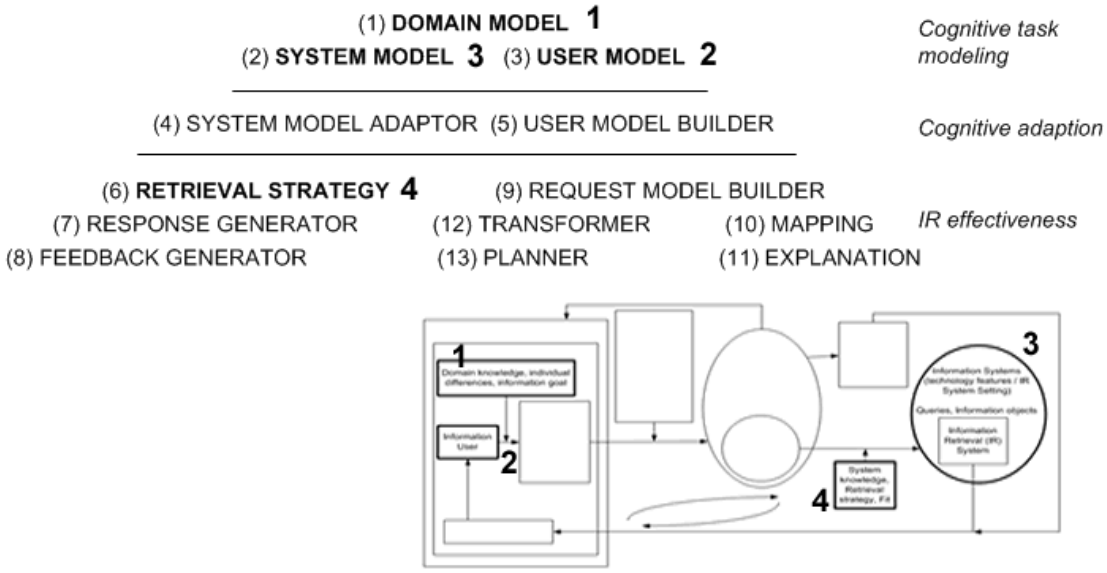


Figure 11 Mapping to Ingwersen's (1992) Mediator Model

Both Belkin (1984) and Ingwersen's (1992) Mediator Model (Figure 11) are constructed within a research tradition in which it is assumed that the study of individual users' psychological, mental or cognitive structure may uncover the principles of information retrieval. Ingwersen's (1992) mediator model is a consolidated framework of functional requirements for intermediary analysis and design. It considers all participating knowledge structures in the entire IR interaction process and isolates the fundamental knowledge elements internal to an intermediary. The model revolves around 13 integrated functions on 3 levels, and 54 sub-functions (building on Monstrat Model's 10 functions). It integrates the Monstrat Model's user orientation with generalized domain and task knowledge as well as IR system adaptation.

The system and user characteristics of our integrated framework are drawn from Belkin's (1984) MONSTRAT model, Ingwersen's (1992) Mediator Model (Figure 11) and Saracevic's (1996) stratified interaction model (Figure 12). Figure 11 shows the mapping to Ingwersen (1992).

Saracevic's (1996) 'stratified interaction model' (Figure 12) was developed within an overall framework of an 'acquisition-cognition-application' model of information use. The levels of strata are simplified to three: 1) *surface* level of interaction between the user and the system interface (query, text/images); 2) *cognition* level of interaction with the texts or their representation (output, utility assessment) and 3) *situation* context that provides the initial problem at hand (search results applied to situation). The model has a strong resemblance to Ingwersen (1996) (see Figure 13) (Wilson, 1999).

Figure 12 shows the mapping of the integrated framework to Saracevic (1996).

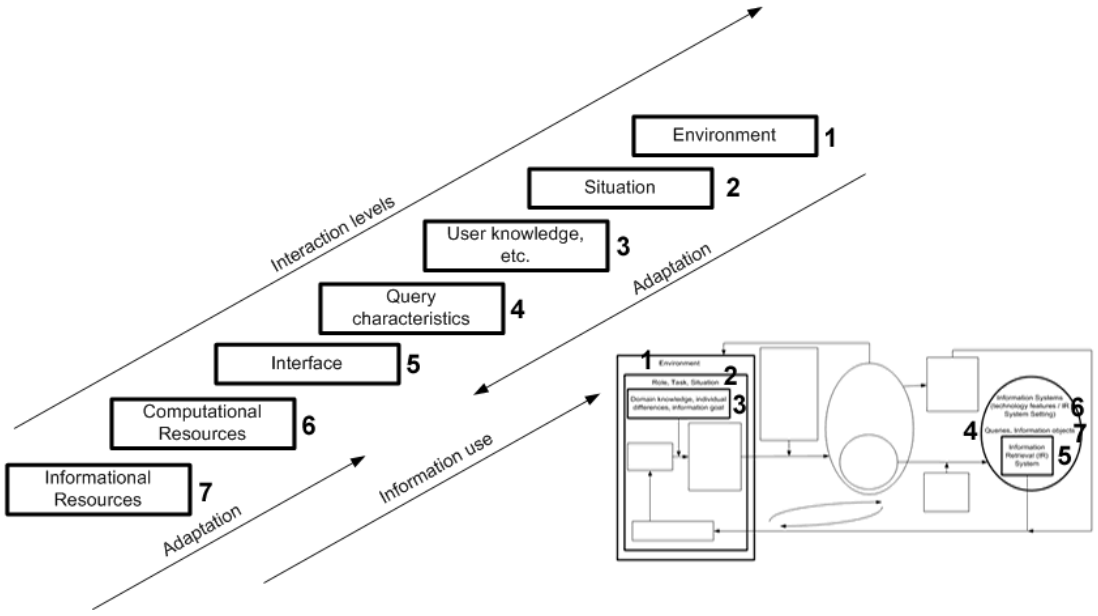


Figure 12 Mapping to Saracevic (1996)

In his later model (Figure 13), Ingwersen (1996) concentrates on identifying processes of cognition which may occur in all the information processing elements involved. The elements *user's cognitive space* and *social/organizational environment* resemble the 'person in context' and 'environmental factors' of Wilson's models. The *queries posed* can be related to Wilson and Walsh's (1996) 'active search' (see Figure 9). The

strength of the model is that it integrates ideas relating to information behavior and needs with issues of IR system design. The weakness is that it does not provide for testability or for evaluation of IR systems (although Borlund and Ingwersen (1997) have developed an evaluative strategy based on this model) (Wilson, 1999).

In the integrated framework, the concepts of information objects and the IR system setting are from Ingwersen (1996). See Figure 13.

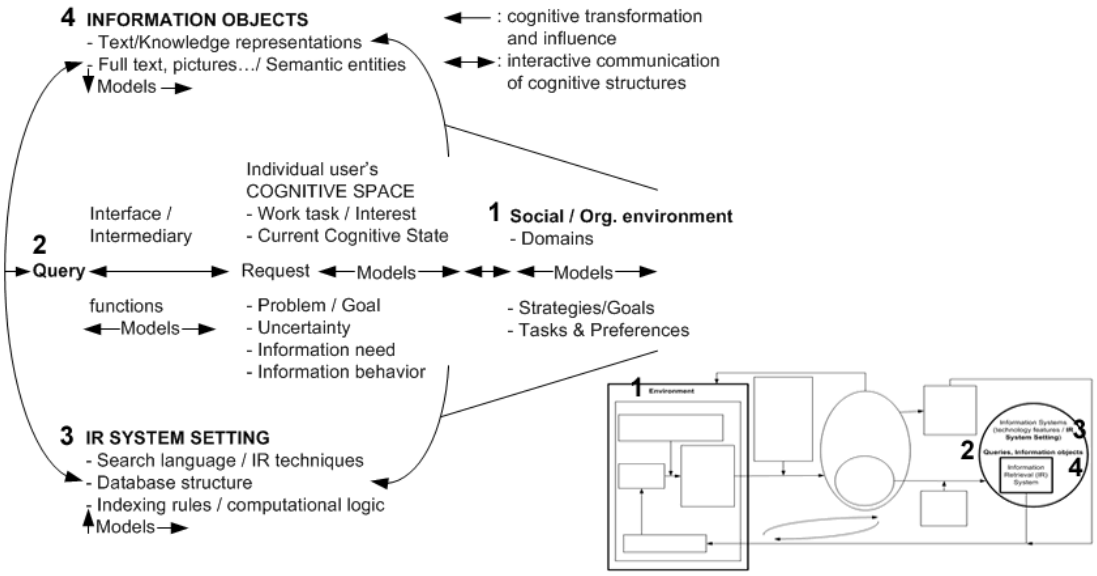


Figure 13 Mapping to Ingwersen (1996)

Spink's (1997) model of the search process (Figure 14), derived from empirical research, can be related to Dervin's (1992) sense-making approach of continuously making sense of a situation in time/space. As Spink describes, 'each search strategy may consist of one or more cycles [one or more search commands ending in the display of retrieved items]. Each cycle may consist of one or more interactive feedback occurrences (user input, IR system output, user interpretation and judgment, user input). An input may also represent a move within the search strategy…and may be regarded as a search tactic to further the search. Each move consists of a user input or query requesting a system's output' (Spink, 1997 p.392; Wilson, 1999).

In the integrated framework, the search cycles of Spink's (1997) model have also been incorporated (see Figure 14).

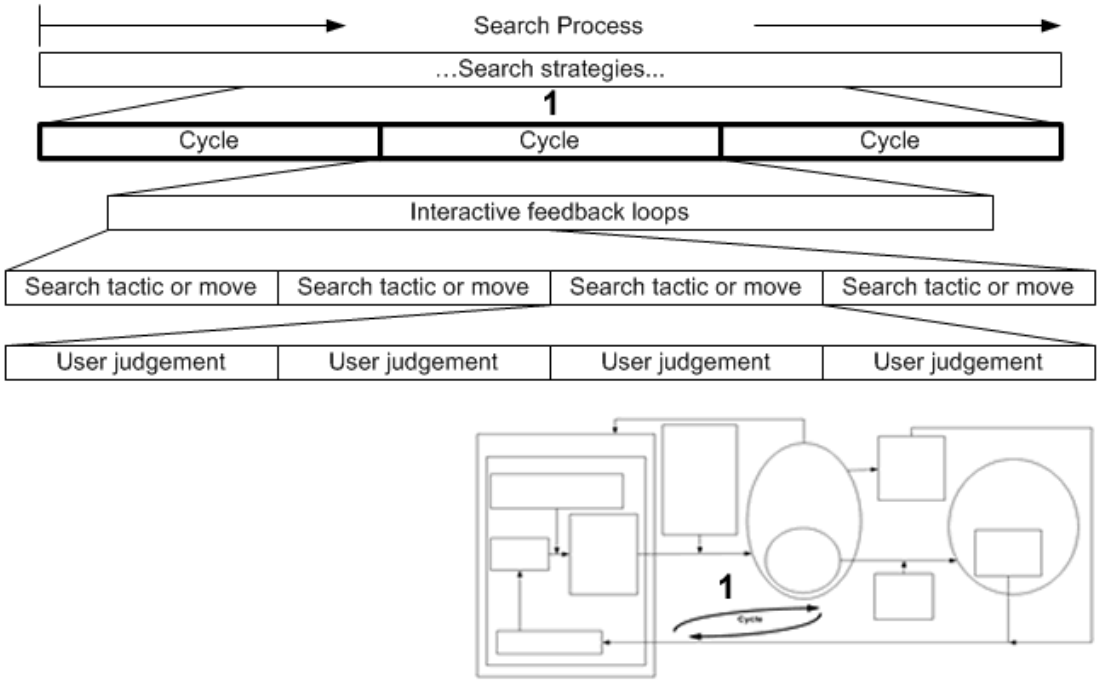


Figure 14 Mapping to Spink (1997)

2.4 Process of deriving the framework

The integrated framework was derived iteratively. In the first step, Wilson's nested model was used. This was mapped to another model from where artifacts that added to the richness of the model were included. This process was repeated as more and more models were mapped to it, and an integrated framework emerged. However, it is to be noted that the integrated framework need not be the sum total of all past models. The author has the leverage to make amendments or additions as necessary (if it contributes to theoretical discourse and empirical study design). E.g. Figure 2 shows moderating variables such as psychological and demographic factors. However, these factors were mapped as mediating/intervening variables by Wilson and Walsh (1996) (see Figure 9). This liberty can be taken because most frameworks in the field of

information seeking (from which the integrated framework was derived) are not causal frameworks, but rather process models of information behavior. Similarly, this iterative process of synthesis and simplification (and having a process model as a basis) led to environment factors being linked to information seeking factors in the simplified integrated framework (discussed in the next section). Thus, there is no one right way of bring about the synthesis of extant models. The researcher has the liberty to synthesize and then seek feedback from the researchers whose artifacts have been included in the synthesis.

A concern might be that our integrated framework appears complicated. In the next section, we present a simplified version of the integrated framework, while also looking at propositions/hypotheses that could be derived from the model.

2.5 Simplified Framework

In the words of Wilson (1981), "Our concern is with uncovering the facts of the everyday life of the people being investigated; by uncovering those facts we aim to understand the needs that exist which press the individual towards information-seeking behavior; by better understanding of those needs we are able better to understand what meaning information has in the everyday life of people; and by all of the foregoing we should have a better understanding of the use and be able to design more effective information systems."

The strength of the proposed integrated framework lies in the fact that it combines several important contributions made in the fields of information seeking and retrieval in a single model. This will allow researchers from information systems, information retrieval and information seeking to design research studies based on the model, and

carry out research relating to their common goal of effectively meeting the information needs of information users and knowledge workers.

A number of propositions/hypotheses can be derived from the model. Table 1 lists a few examples.

Table 1 Propositions/hypotheses derived from the model

Context and Need
The information need of a user depends on the user's task and environment.
A user in a simple task situation will have higher ability to specify his information need compared to a user faced with a complex or fuzzy task[22].
The user's prior domain knowledge moderates the level of uncertainty faced by a user in an information seeking task
User's cognitive style, problem-solving ability and information goal determine the nature or extent of his information need
User's need for information leads to the user's information seeking behaviour
Motivation for information Seeking
Searcher's psychological predisposition (e.g. curiosity level) moderates the relationship between information need and seeking
Searcher's demographic background (age or education) moderates the relationship between information need and seeking
Characteristics of sources (e.g. accessibility and credibility) influences information seeking and the choice of sources
Information Seeking and Searching/retrieval
During active search, an information seeker exhibits different behavioral and affective stages
Searcher's prior system knowledge moderates the relationship between information searching and relevance of search results
The degree of task-technology fit[23] moderates the relationship between information searching and relevance of search results.
Information searching takes place in successive stages until the need is satisfied or the user gives up.

[22] The user's ability to specify his/her information need to the system s/he is interacting with is a complex construct depending on a number of factors, including the complexity of the task at hand. See Agarwal and Poo (2007) for a detailed discussion on this construct.

[23] Task-technology fit as been indicated as 'Fit' in the integrated framework

A limitation of the model is the lack of parsimony. To improve parsimony, a simplified integrated framework is shown in Figure 15.

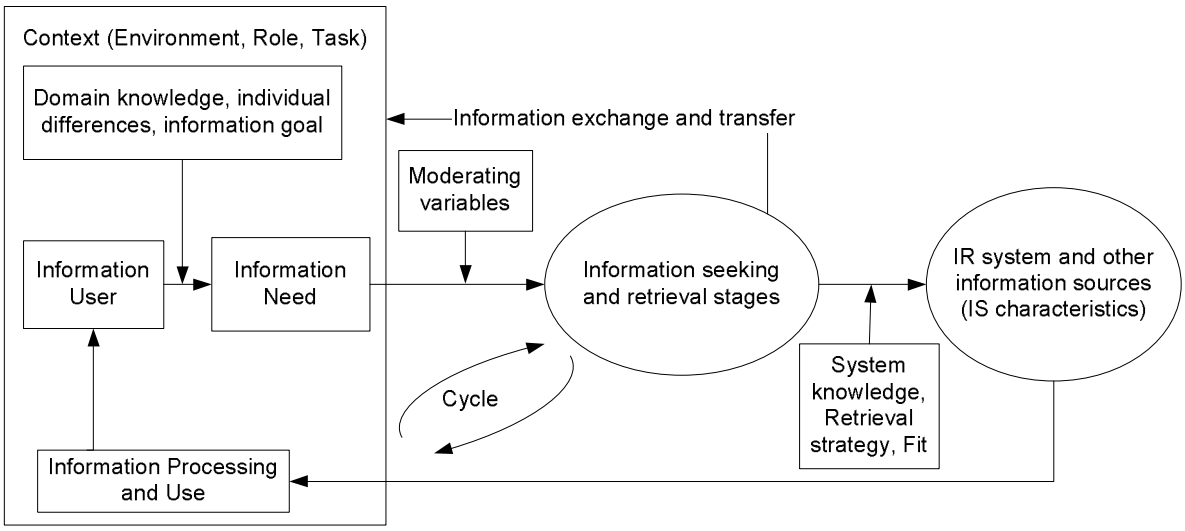


Figure 15 Simplified integrated framework

2.6 Framework or causal model?

Another major limitation of the integrated framework is that it is, as the name suggests, a framework and not a causal model. Most of the frameworks that contributed to the making of the integrated framework were 'frameworks' as well. The major distinction between a framework and a causal model is that the former need not have specific well-defined causal relationships. It is just meant to a guiding block to help design studies. On the other hand, a causal model has a very strong emphasis on causality i.e. A leading to B (or A causing B). To illustrate the limitation of a framework as presented here, it is very much possible that a researcher designing a study based on the framework might choose to include the moderator variables presented here as mediators (or vice versa). The framework just helps illustrate the presence of these variables, and not so much on the exact relationships between each of these variables (whether causal, mediator, moderator or cyclical). In Study 2, we

show a possible design of research study based on elements from this framework. However, the mapping from the research model of Study 2 (discussed in Figure 27 later) need not be one-on-one. For example, 'source characteristics' is a moderator in Study 1, but an independent variable in Study 2. To give another example of a variation, contextual variables in Study 1 moderates information user and need, and not source characteristics and use.

2.7 Other limitations?

Since the framework seeks to combine models from different researchers, different types of entities may have been combined together. E.g. the rectangles represent different types of entities – the environment, the agent (user), knowledge in the user's head (domain knowledge), information need state, information processing, various types of context factors, information sources, retrieval strategy and a computer system. The arrows represent different things in different parts of the framework. Different types of moderating variables are clubbed together – psychological, demographic, environmental factors, characteristics of information sources. This is unavoidable in an exercise such as this, and in a framework as comprehensive as the one proposed (seeking to combine a huge body of work in the fields of information seeking and retrieval). This may be seen as limitation, especially if one is looking for a causal model. Of course, different types of rectangles and ovals could have been used to represent different types of entities, and different types of arrows to represent associations versus sequences.

A framework may suggest hypotheses to study and how the study should be designed. It may also include factors to be included in an empirical research study. This

framework informs the design of the survey study (Study 2) by listing factors that make up context, as well as those that be included in the questionnaire survey. Some may argue that a list of factors derived from the literature, and grouped into categories, would have satisfied the needs of this study just as well. However, an integrated framework such as this one can inform multiple studies in different ways. Study 2 is just one example.

Also, some might argue that the system-centric and process/person-centric perspectives have not been combined well in the framework, and may want to see greater interaction between the system-oriented factors and person-oriented factors, instead of listing them in boxes (as the framework does). This framework attempts to put all these factors together in one framework so that the boundaries between system-orientation and person-orientation get blurred.

2.8 Framework or Methodology?

What has been presented in the preceding sections is an integrated framework of information seeking and information retrieval – one that integrates features from the different extant models of the fields. Let us now look at a slightly different scenario. What if we were to take the work of any of the theorists who have contributed to the different models presented here and those not presented, and look at all other models from the work of this particular theorist? That is, what would happen if we made a particular theorist such as Dervin or Wilson or Belkin dominant and nested everything else inside the chosen theorist's work?

To illustrate, let us look briefly at Dervin's work. Many people are using sense-making in many different ways – as metatheory, as practice and as method (Dervin

1999). It appeared in its emergent form since 1972 (Dervin 2005) and got its name in the 1980s. Since then, it has continued to advance and emerge, bringing with it work on concepts such as time and step-taking, journey-ing, and verbing and what Dervin points to as the struggle to stay in line (conforming) and struggle to fall out of line (charting a new path).

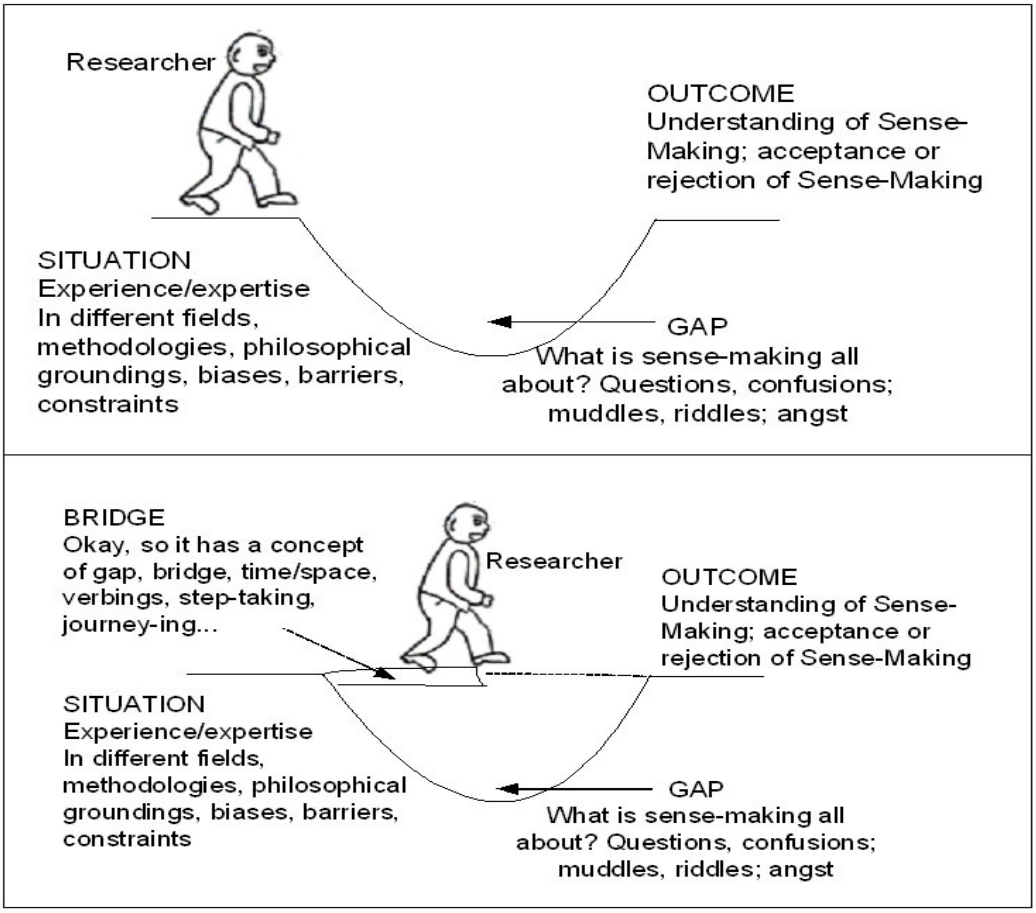


Figure 16 Making sense of 'Sense-Making': Encountering (top) and bridging (bottom) the gap (Adapted from Dervin and Frenette 2003; Savolainen 2006)

Dervin bases her work on three central assumptions (Dervin 2005) regarding communications practice – 1) that it is possible to design and implement communications systems and practices that are responsive to human needs; 2) that it is possible for humans to enlarge their communication repertoires to pursue this

vision; 3) that achieving these outcomes requires the development of communication-based methodological approaches.

Dervin and Frenette (2003) articulate sense-making through the illustration of a user in a particular situation encountering a gap or a problem which keeps him/her from achieving his/her desired outcome. Once the user makes sense of the gap/problem, s/he is able to construct a bridge to help cross the gap. Figure 16 takes the analogy further and sees it in the light of a methodological perspective – in particular, it portrays how researchers in the fields of information seeking, information retrieval and information systems come with their own experiences and expertise in different fields and methodologies. These researchers might encounter a gap when trying to understand Sense-Making. The process of bridging the gap then commences inside the researcher's head, and continues until he reaches a certain set of outcomes – which might be an increased understanding of sense-making, and its acceptance or rejection by the researcher. The figure is termed 'making sense of Sense-Making' as it attempts to illustrate the synthesizing of different methodologies and theoretical leanings in the fields of Information Seeking and Information Retrieval.

Let us briefly see how the central tenets of Dervin's work on sense-making (see Dervin, Foreman-Wernet and Lauterbach 2003 for an overview of Dervin's work) can be mapped to some of the other models that we have seen.

Sense-making's core assumption is that of discontinuity of 'gappiness'. There are gaps between entities, time and spaces. Each individual in an entity moves through time and space, dealing with other entities that include other people, artifacts, systems, etc. and uses sense-making to bridge the gaps encountered (Spurgin 2006). This gap conforms to Belkin *et al.* (1982)'s anomalous state of knowledge, Wilson

(1981)'s need, Krikelas (1983)s' deferred and immediate needs and Ingwersen (1996)'s 'problem/goal, uncertainty, information need'. In our Integrated framework, it maps to the box 'Information Need (physiological, affective, cognitive); Gap / uncertainty / ASK'.

Sense-making looks at information as a process (not as an object) and conceptualizes information as "that sense created at a specific moment in time-space by one or more humans". This is similar to the concept of 'knowledge' espoused by Knowledge Management researchers where they seek to differentiate information from knowledge. Here, knowledge is conceptualized as being formed when it is *processed* inside an individual's head. In other words, when the individual makes sense of the information, it becomes knowledge. In sense-making, Dervin does not differentiate between information and knowledge and sees both terms as that processed inside a person's head. Johnson (1997) also adopts a 'sense-making' perspective like Dervin, when saying that all information seeking takes place within a context, and begins only when a person perceives a gap in existing knowledge. In fact, the entire gamut of recent research on 'information seeking in context' (see Ingwersen, Ruthven and Belkin 2007; Ingwersen 2005; Ingwersen and Jarvelin 2005) can be mapped to Dervin's perspective in-so-far-as the seeing information seeking as taking place within a particular context or situation is concerned.

Sense-Making sees an individual at a certain moment in time and space when s/he encounters a gap or need for information. This situation can be likened to the environment, role and person in Wilson's (1981) model of information Seeking behavior; the need-creating event/environment, memory and direct (structured) observations of Krikelas (1983); context of information need of Wilson and Walsh

(1996); background factors and personal relevance factors of Johnson (1997); environment, situation, user knowledge, etc. of Saracevic (1996); and the social/organizational environment and individual user's cognitive space of Ingwersen (1996). Sense-Making studies have found that patterns of gap-bridging behavior are better predicted by the way individuals define the gaps in which they find themselves, than by attributes such as demographic categories or personality indicators (Spurgin 2006).

Similarly, mappings can be found to other aspects of Sense-Making, such as the focus on 'verbings' rather than on nouns. Sense-Making requires a focus on what people do, how they do it, and whey they do it that way, rather than on the objects that people do things with (Spurgin 2006).

The discussion above is an illustration of how we could take the work of any one theorist and ask ourselves what would happen if we were to make this work dominant and map the work of other theorists to this particular work. While it may not be possible to map all aspects of all extant models and theories to a particular work, there are certain aspects where it *is* possible. This is what makes it important.

This process of mapping and synthesizing helps bring about convergence of research and a true understanding of where a common direction unfolds, and areas where it doesn't. It allows researchers to engage more proactively in charting the forward movement of a field.

2.9 Summary of Study 1

An integrated framework of information seeking and retrieval has been presented, based on past models by leading researchers of the field. While studies in

Information Retrieval have been largely 'system-centric', studies in Information Seeking have revolved around the needs of the user and the process of information seeking. Lately, there have been calls for collaboration between the two and a growing realization that Information Retrieval research needs extension towards more context, while Information Seeking research needs extension towards task and technology. This call is also implicit in our experience with the currently prevalent 'one-size-fits-all' search engines, which do not adequately cater to the different contexts surrounding the information need of the searcher at different times. An integrated framework is served as a 'beginning integration' that tries to answer Kuhlthau's (2005) call for collaboration between the person and system-centered aspects of information seeking/retrieval. It also takes on the calls of Ingwersen and Jarvelin (2005) and Jarvelin and Ingwersen (2004) by including context, task/environment and technology in the purview of information seeking and retrieval. The model will contribute to theory development in the fast merging area of information seeking and retrieval. Hypotheses can be derived from the model and empirically tested. The importance of this effort is highlighted by the fact that ACM SIGIR (Special Interest Group on Information Retrieval) has incorporated a workshop on Information Retrieval in Context (IRiX) since 2004. From the practitioner's perspective, the model will serve as a useful guide for developers of information systems for search – knowledge providers, content providers as well as designers of next-generation web search engines. Future work on the study will include empirical validation of different parts of the model through experiments and surveys.

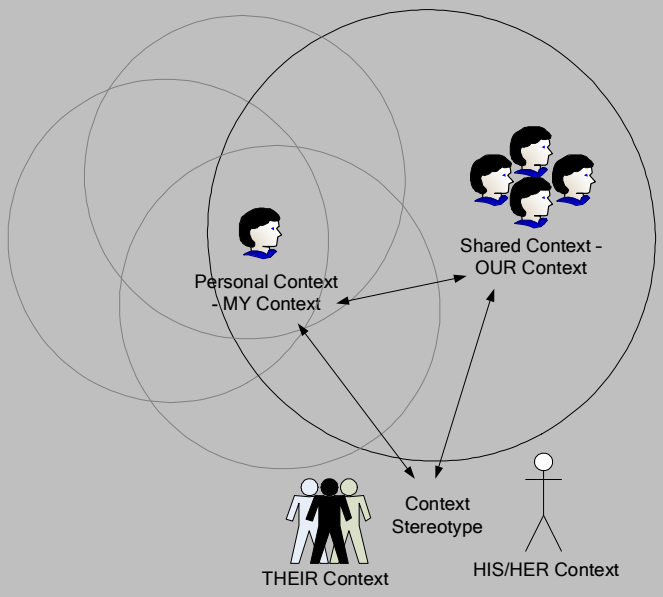
Along with the integrated framework, we also illustrated (using Dervin's Sense-Making as an example) how this process of synthesizing could be extended to take the work of a particular theorist and mapping the work of other theorists to it. We invite

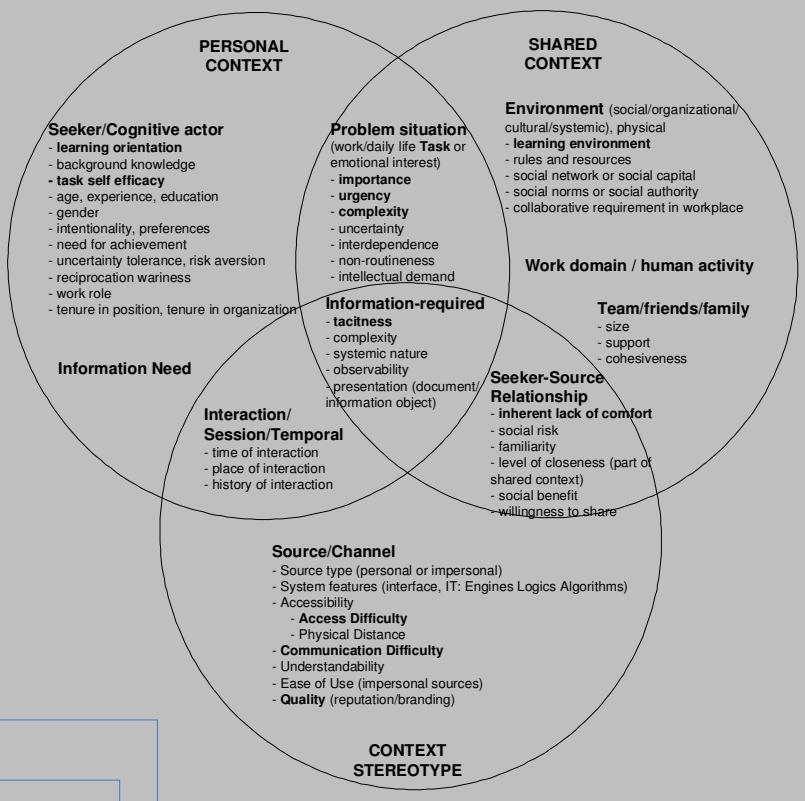
other researchers to join in this process of synthesizing – this methodological move (in the Weberian sense) that this paper in its best interpretation can be thought to be – not just another model, but a methodological move for better analysis. While the integrated framework, in itself, may not be a methodology, but the process of combining models/frameworks illustrated framework may be seen as a methodology that could be combined by other researchers.

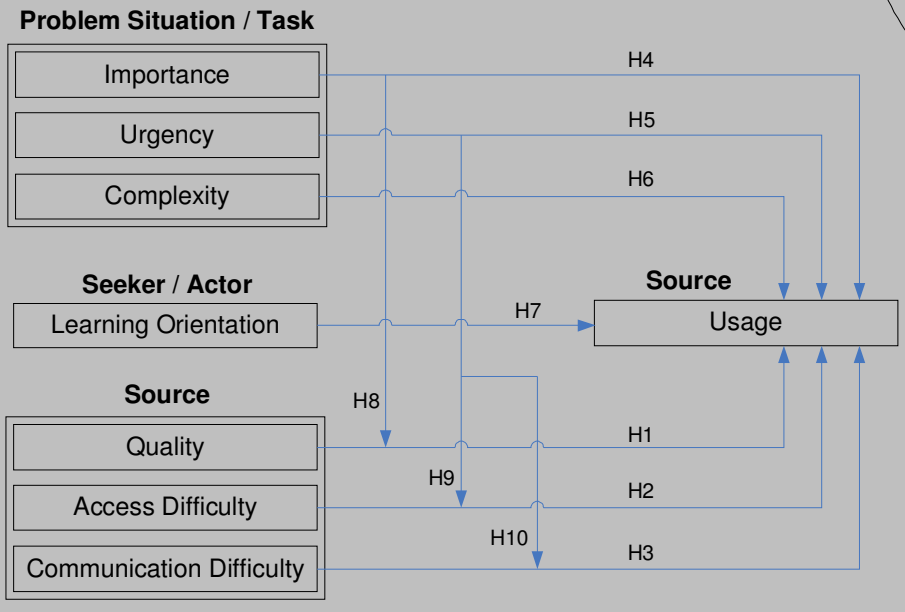
Let us now look at an empirical survey study based on a research model derived from elements of the integrated framework – source use and context.

STUDY 2 – A CONTEXT-BASED INVESTIGATION INTO SOURCE USE BY INFORMATION SEEKERS

THEORETICAL & EMPIRICAL SURVEY STUDY







CHAPTER 3 INVESTIGATING SOURCE USE: THEORETICAL FRAMEWORKS OF CONTEXT

This is the longest chapter of the thesis. It covers the theoretical approach leading to the investigation into the factors affecting source use by information seekers; the Contextual Identity Framework to define the boundaries of context; and a framework for the elements of context. Chapters 1, 2, 3 and 4 all contribute towards the literature review for Study 2. Let us now look at Study 2.

3.1 Investigating Source Use by Information Seekers

An information source can be defined as a carrier of information (e.g. a person, a book, a search engine, etc.). In Study 1, we saw an Integrated Framework of Information Seeking and Information Retrieval. Figure 17 shows parts of the Integrated Framework (in **bold**) that deal with information sources. In the model, information source can either be the Information Retrieval (IR) system (as it relates to

information searching or retrieval, as opposed to seeking[24]) or other information sources (such as human or interpersonal[25] sources). The model also incorporates 'source characteristics' as a moderating variable.

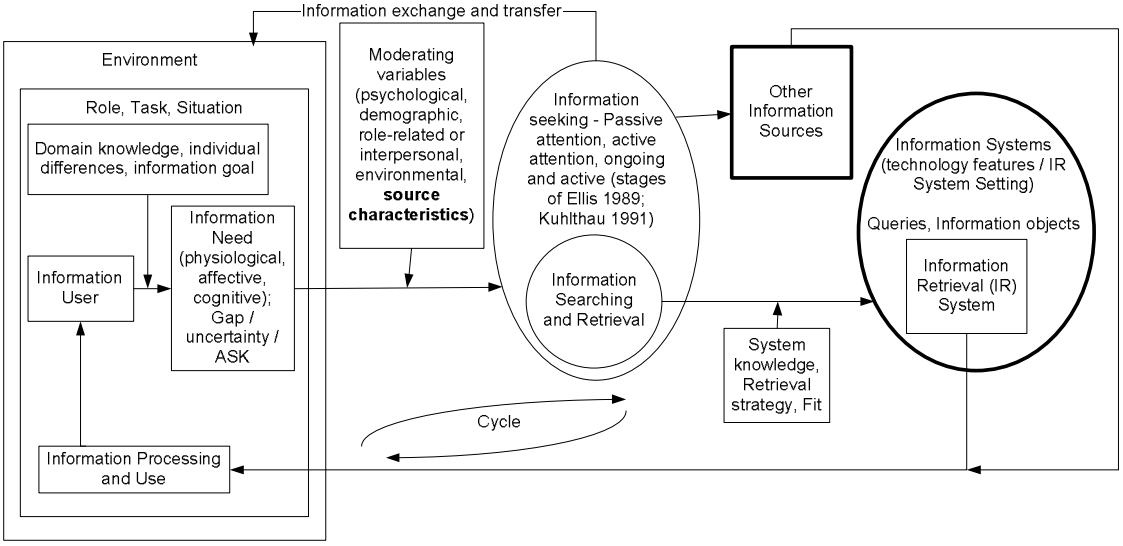


Figure 17 Information Source in the Integrated Framework

Past frameworks of information seeking and information behavior (from which the integrated framework was derived) have included information sources. Wilson's (1981) model of information behavior show information seeking behavior as making a demand either (for information) on information systems or other information sources. Krikelas (1983) shows the 'source preference' of a searcher to fulfill his/her immediate needs. Krikelas classifies information sources as 'internal' and 'external' to the searcher. External sources can consist of direct (interpersonal) contact or recorded (literature). The internal (signifying that which resides within a person) source consists either of 'memory' or 'direct (structured) observations'. Krikelas flowchart-like model also shows an arrow from 'personal files' to 'memory' (Krikelas 1983).

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[24] See Chapter 1

[25] The term 'personal' source is more commonly used instead of *interpersonal*. However, *personal* implies ownership, and one cannot always have *ownership* of a source. The term 'interpersonal' will perhaps do more justice to the nomenclature, and is thus, used here.

A few key research questions have been investigated relating to a seeker's choice [or use] of information sources (Xu *et al.* 2006), and that incorporate the seeker-source relationship. Our integrated framework (Figure 17) is useful for investigating a question such as, "What is the nature of the information seeking process?" This question, which focuses on a seeker's cognitive state in the process of information seeking, has been studied by information science researchers such as Belkin (1980), Ellis (1989) and Kuhlthau (1993). Researchers such as Ashford (1986), Choo (1994), VandeWalle *et al.* 2000, Tan and Zhao (2003) and Yitzhaki and Hammershlag (2004) have studied, "What affects the amount of information seeking?" Here, source characteristics are of lesser interest compared to factors like the seeker's personality or contextual demand (VandeWalle *et al.* 2000; Tan and Zhao 2003). The issue is why someone engages in more information seeking than others (Xu *et al.* 2006). While organizational research on this question has looked at employee's feedback seeking or newcomer's information seeking (VandeWalle *et al.* 2000), information science studies focus on the impact of task complexity and task uncertainty on the amount of information seeking (Bystrom 2002) (Xu *et al.* 2006). The third question, "**How does a seeker choose [or use] an information source**", is of particular interest in Study 2, and deals with those attributes of the source that affect the seeker's use of one or more sources. This question has been studied by organizational behavior and information science researchers such as O'Reilly (1982), Chakrabarti *et al.* (1983), Swanson (1987), Vancouver and Morrison (1995), Morrison and Vancouver (2000) and Fidel and Green (2004). In the distinction between system-centric and person-centric research in information seeking and retrieval (see Chapter 1), the question of source use lies more on the domain of person-centric research.

This question of source use is the focus of Study 2. Specifically, where people go for the information they need i.e. their use of a particular information source. This question is important because 'source choice decisions directly impact the outcome of information seeking' (Xu *et al.* 2006 p.1666). As Fidel and Pejtersen (2004) point out, in order to be able to design systems that work harmoniously with humans, one has to understand the work actors[26] do, their information behavior, the context in which they work and the reasons for their actions. 'With a wide array of possible sources, understanding what leads to selection of one source over another must be considered in designing tools and technologies for managing, disseminating, and sharing these resources' (Zimmer, Henry and Butler 2008, p.298). 'Clearly, information systems would be most effective if their design is informed by an understanding of the human-information interaction of their intended users. Yet, information systems have been designed—and widely used—almost completely unaffected by results of studies in human information behavior' (Fidel and Pejtersen 2004). Thus, this study on the source use by information seekers is important from the point of view of designers of information systems for search as well.

Let us now look at two theories guiding this study.

3.1.1 THEORETICAL APPROACH

Principle of Least Effort. Zipf (1949)'s Principle of Least Effort says that each individual will adopt a course of action that will involve the expenditure of the *probable least average* (least effort) of his work. This principle has served as a grand theory for studies in information seeking (Case 2002). Poole (1985) found that 40 of

[26] Fidel and Pejtersen (2004) based their work on the Cognitive Work Analysis which considers people who interact with information as *actors* involved in their work-related actions, rather than as *users* of systems. In this research, the terms *actor*, *user* and *person* (or *people*) are used interchangeably. In the context of an organization, the term *employee* could also be used to mean the actor.

the 51 information seeking studies he sampled supported Zipf's Principle of Least Effort. This human tendency towards economy of effort can be seen at workplaces when a professional asks the nearest coworker whether any new reports have been published on a topic, rather than conducting a thorough search of the literature himself (Case 2002). Allen's (1977) study of 19 R&D engineers found that accessibility (least effort) played a more important role in the selection of information sources, rather than the quality of information. Similar patterns were observed by Rosenberg (1967) and Orr (1970). Research on information seeking has consistently shown that people prefer personal/people sources (more readily accessible) over the more authoritative print sources (Gerstberger and Allen 1968; Chen and Hernon 1982; Hardy 1982; Chakrabarti *et al.* 1983; Choo 1994; Hertzum and Pejtersen 2000; Bystrom 2002; Yitzhaki and Hammershlag 2004). "People may simply take the path of least resistance" (Durrance 1988, p.161). People's tendency in "relying on close friends and relatives for their information" demonstrates a "law of least effort" (Dervin 1983b, p.158) (Case 2002).

Cost-benefit Paradigm. While the Principle of Least Effort claims to be a *descriptive* principle that applies across many aspects of human behavior (whether goal-oriented or not), the cost-benefit approach is more *normative* in its assumptions, and is applied towards conscious decisions regarding the expenditure of effort to achieve some goal (Case 2002). The cost-benefit paradigm proposes that people seek information in a highly rational manner. They select information sources based on their expected benefits (from obtaining the most complete and accurate information) weighed against likely costs (Hardy 1982). While the cost-benefit principle emphasizes a careful calculation of benefits versus costs, the least effort principle predicts that seekers will choose to minimize effort even if it means accepting a lower quality or quantity of

information (Case 2002). Hardy (1982)'s study of 968 US Forest Service professionals found that they were over-sensitive to the costs involved in acquiring information and under-sensitive to issues of information quality (Case 2002). Apart from Hardy (1982), most past studies in the disciplines of Information Science and Organizational behavior have largely employed the cost-benefit framework to analyze how seekers decide on using an information source (O'Reilly 1982; Chakrabarti *et al.* 1983; Swanson 1987; Choo 1994; Vancouver and Morrison 1995; Fidel and Green 2004; Yitzhaki and Hammershlag 2004; Xu, Tan and Yang 2006).

However, conflicting findings have been found with regard to the importance of the cost (source accessibility) or the benefit components (source quality) in the seeker's use of one or more information sources. Those advocating the least-effort principle include, e.g. Gerstberger and Allan (1968), Chakrabarti *et al.* (1983), Culnan (1983), Anderson *et al.* (2001) and Yitzhaki and Hammershlag (2004). Other studies have reported source quality as more important (Ashford 1986; Swanson 1987; Vancouver and Morrison 1995; Morrison and Vancouver 2000).

Also, while the cost-benefit studies have focused on the effect of source quality and accessibility on the seeker's use of a source, they have paid little attention to the different contingent variables (which would make up the 'context' of search) on the cost-benefit analysis. An exception in this regard was Morrison and Vancouver (2000), which incorporated 'need for achievement' (an intrinsic characteristic of the seeker rather than the external environment surrounding him in the information seeking process) in their study. They argued that source quality might be perceived as more important if seekers' need for achievement was high. Xu, Tan and Yang (2006) proposed a seeker-source-information need framework to understand why a particular

source was preferred over the other. Their model incorporated task importance as a moderator in the cost-benefit calculation, as well as a variable 'social risk' to study the effect of seeker-source relationship on source preference. Xu *et al.* found that in the context of interpersonal task information seeking, the least effort principle might not be adequate in explaining personal source preferences but rather, a quality-driven perspective is more adequate, and cost factors are of much less importance. They also found that the seeker-source relationship is not significant to preference for an interpersonal source, and that task importance can modify seeker's source preference decisions.

A recent study by Zimmer, Henry and Butler (2008) looked at the factors underlying the selection of sources that require direct interpersonal contact (relational[27] or [interpersonal] sources) versus those that do not (nonrelational or [impersonal] sources). They found that source accessibility and quality significantly affect usage of a source, but that this relationship was moderated by the type of source used [interpersonal or impersonal]. They found accessibility to have less effect on the use of interpersonal sources. They also found that use of each of these two types of sources was also affected by the perceived accessibility and quality of alternative types of sources. Zimmer *et al.* (2008)'s study had several limitations:

- Even though they listed 8 source types (p.307), they only classified them as interpersonal/impersonal[28], which is just one dimension in classifying source types. They also didn't study the role of synchronous sources such as phone

[27] See Chapter 4 Section 4.2.1 for various ways of classifying sources used by different researchers.

[28] Various past studies have explored interpersonal and impersonal sources as well e.g. Gerstberger and Allen 1968; Chen and Hernon 1982; Hardy 1982; Chakrabarti *et al.* 1983; Choo 1994; Hertzum and Pejtersen 2000; Bystrom 2002; Yitzhaki and Hammershlag 2004.

and online chat, as opposed to asynchronous online sources such as email and forum. They're all lumped under one source type as 'dynamic internet'. Especially in online sources, it is important to distinguish between the interpersonal aspects and impersonal aspects of these sources. As Zimmer *et al.* say, their way of classifying 'dynamic internet sources' or 'knowledge bases' is really 'a marriage …of relational and nonrelational' (p.325) source types.

- All their survey respondents were students enrolled in an MBA program working full-time in the industry. Since all the respondents were enrolled in the MBA program, the results can only be generalized to those seeing their future in business and management, as opposed to respondents across a wider cross-section. Zimmer *et al.* admit that 'a possible selection bias may arise…from using information workers who have elected to seek out additional education' (p.324).

- They did not take any other contextual variable into account apart from the effect of quality and accessibility. 'These two factors have been shown to play an important role in source selection, but they are certainly not the only factors that can be considered' (Zimmer *et al.* 2008 p.325). A large number of variables make up context which can potentially impact the use of an information source.

- Zimmer *at al.* (2008) muddle the difference between 'source types' and 'sources'[29].

[29] this has been discussed in Chapter 4 Section 4.2.1

In our study, we seek to address the conflicting findings of the importance of quality versus accessibility by incorporating variables from the 'context' surrounding information seeking that impact a person's use of one or more information sources. However, this required facing difficult questions on what 'context' really means and what its boundaries are. Despite the seemingly widespread and growing attention to the notion of 'context' in information seeking, the concept remains ill-defined and inconsistently-applied (Cool 2001). Most literature on information needs, seeking and use fails to address the problem of context theoretically (Dervin 1997; Johnson 2003; Lueg 2002; Courtright 2007). There isn't any success in defining: what context really means (Courtright 2007, in her review, highlights the contending definitions)? What are the boundaries of context? What constitutes the 'core' (main factors that lead to information seeking behavior) and what constitutes the 'surrounding' circumstances (or context)? Where do we draw the line between this core and the context? Or does this context subsume the core? What are the important variables that make up context that could be incorporated in a causal research model? These concerns become necessary to address in the study of source use by the information seeker.

A theoretical contribution of this study will be to propose 1) a theoretical framework that helps towards delineating the boundaries of context and 2) another theoretical framework that incorporates the contextual variables that will impact a seeker's cost-benefit analysis before using an information source. These variables, which are based on past studies, will enable the context in the use of one or more information sources to be empirically studied and will serve as useful moderators.

Of those variables identified in the framework, few important ones will be incorporated into our research model, and studied empirically. Though an in-depth

survey, the research question that we seek to answer is, "*Where people go for information and how people decide on an information source to use when faced with an information-seeking task or a need for information?*"

Thus, the contribution of this study is three-fold:

- A theoretical frameworks to help delineate the boundaries of context (3.2)
- A theoretical framework to define the elements of context (3.3), that would impact a seeker's cost-benefit analysis before using an information source
- An empirical survey study (of 352 working professionals in Singapore) that seeks to reconcile the conflicting findings of the relative importance of the cost (source access cost) and benefit (source quality) components before a seeker uses an information source, by incorporating contextual variables identified in the framework (Chapter 4 onwards).

Let us now understand what context means and how can we possibly define its boundary.

3.2 Delineating the boundary of 'context' in Information Behavior: Towards a Contextual Identity Framework

The contribution of this theoretical study will be to help delineate the boundaries of context through a Contextual Identity Framework, where we apply the sociological notions of identity, personal identity, social identity and stereotype. The framework has 3 components: 1) personal context or 'my' context, 2) shared context or 'our' context, and 3) context stereotype or 'his/her/their' context. Through this framework, we highlight the futility of trying to define context using any one view. It is only

when we take all the 3 views of context into consideration that we are able to adequately define, understand and study context. We hope the framework will provide a basis to further theoretical research in the meaning, role and boundary of context in information behavior.

Let us now look at how context has been understood and defined by different researchers.

3.2.1 DEFINITIONS OF CONTEXT

As per the dictionary, *context* means 'That which surrounds, and gives meaning to, something else' (Howe 1993); 'the set of facts or circumstances that surround a situation or event (WordNet 2006) or 'the circumstances in which an event occurs; a setting' (American Heritage Dictionary 2000). The situation or event here is a person's use of information source when looking for information. Our intent here is to spell out the circumstances (context) that lead to this source usage, as well as to answer if context is just the setting or more than that.

Dervin (1997) describes context as an 'unruly beast' difficult to tame methodologically. Cool (2001) describes contexts as 'frameworks of meaning' (p.8). Equivalent terms used for context have included (Courtright 2007):

- *Setting* (Bystrom 1997; Davies and McKenzie 2004; McKenzie 2004; Pettigrew 2000); Allen and Kim (2000) view contexts as the socially defined settings in which information users are found e.g. a work setting such as an office or a factory.

- *Environment* (Janes and Silverstein 2003; Lamb *et al.* 2003; Rieh 2004; Taylor 1991)

- *Information world / Life-world* (Chatman 1996; Kari and Savolainen 2003; Lievrouw 2001; Talja 1997)

- *Information ground* (Fisher *et al.* 2005; Fisher *et al.* 2004; Pettigrew 1999)

Fidel and Pejtersen (2004) use *constraints* to describe 'a host of factors external to the [information seeking] behavior itself' that influence the selection of strategies that people employ to find information. They say that in the systems approach terminology, such factors are called *constraints*, factors that affect information behavior, but cannot be changed by it (Churchman 1979). However, from a person-centric point of view, the information seeker might also be able to influence context apart from being influenced by it. This is supported by Ingwersen & Jarvelin (2005) when they say 'actors and other components function as context to one another in the interaction processes (p.19). Fidel and Pejtersen (2004)'s dimensions of cognitive work analysis (work environment, organization, work domain, activity/task, user characteristics, actors resources and values, etc.) each create a constraint for the one nested in it. 'Thus, the work environment affects how a work place is operating, and this mode of operation shapes the task that an actor performs. The task, in turn, affects the decisions that an actor makes, and these decisions influence seeking behavior. In addition, the actor's characteristics have an effect on seeking behavior and so does the social organization of the work place' (Fidel and Pejtersen 2004).

The term *situation* has been used interchangeably with context (e.g. Allen 1997), but Cool (2001) seeks to disambiguate the term situation from 'context'. In information science, the concept of situation has been investigated primarily in studies in information-seeking processes, information interaction, and IR behaviors (Cool 2001). Sonnenwald (1999) states that context is larger than a situation and may

consist of a variety of situations. 'Different contexts may have different possible types of situations' (p.180). Cool (2001) extends Sonnenwald (1999)'s notion to suggest that 'contexts are frameworks of meaning, and situations are the dynamic environments within which interpretive processes unfold, become ratified, change, and solidify' (p.8). Allen and Kim (2000) view contexts as the socially defined settings in which information users are found e.g. office…within each of these broad contexts, different situations occur…individuals may be situated in different ways in the context' (p.1). McCreadie and Rice (1999 p.58) define context as the 'larger picture in which the potential user operates; the larger picture in which the information system is developed and operates, and potential information exists', whereas situation is seen as 'the particular set of circumstances from which a need for information arises.' Courtright (2007) sees context as including those elements that have a more lasting and predictable influence on information [behavior] than situation, whereas situation is seen as a potential part of context.

Dervin (1997 p.14-15), through a 3-tiered categorization of context, argues that for many, 'context has the potential of being virtually anything that is not defined as the phenomenon of interest…a kind of container in which the phenomenon resides.' A second group struggles with trying to determine which of an 'inexhaustible list of factors' will be included in context (addressed in Section 3.3). For a third group of researchers, context is 'the carrier of meaning…an inextricable surround without which any possible understanding of human behavior becomes impossible' (Courtright 2007).

3.2.2 BOUNDARY OF CONTEXT: CONTEXTUAL IDENTITY FRAMEWORK

A complex, but important question is to reason what constitutes the 'core' (main factors that lead to source usage) and what constitutes the 'surrounding' circumstances (or context). Where do we draw the line between this core and the context? Or does this context subsume the core?

Different models for context (that help in defining the boundary of context) have been arrived at by different researchers (Courtright 2007). Taylor (1991) developed a model of context known as the *information use environment (IUE)* which consisted of four categories of elements: 1) user demographics – education and profession, 2) how searchers conceptualize the problems that lead to information seeking, 3) the constraints and opportunities of the searcher's setting, and 4) types of problem resolutions sought/needed. Another model termed *information ecologies* was developed by Nardi and O'Day (1999). Applicable both to the workplace and home, it stresses on the diverse array of human activity that takes place within a closed setting as a bounding element for context.

Courtright (2007) says that although it is generally agreed that context constitutes a 'frame of reference' (Vakkari *et al.* 1997 p.8) for information behavior, there is little agreement as to how such a frame of reference is established by/for the person with need for information or how it operates with regard to information practices. 'Those factors [influencing information behavior] that fall outside the realm of the fundamentally cognitive or psychological tend to be included, to varying degrees in both theoretical and empirical research, in the term 'context' or its equivalents' (Courtright 2007 p.275). What this implies is that apart from what is in the actor or

searcher's mind when looking for information, everything else has been viewed as context.

To help resolve the complex issue of the boundaries of context (which Dervin 1997 calls an 'unruly beast' difficult to tame methodologically), we propose the 'Contextual Identity Framework' (see Figure 18).

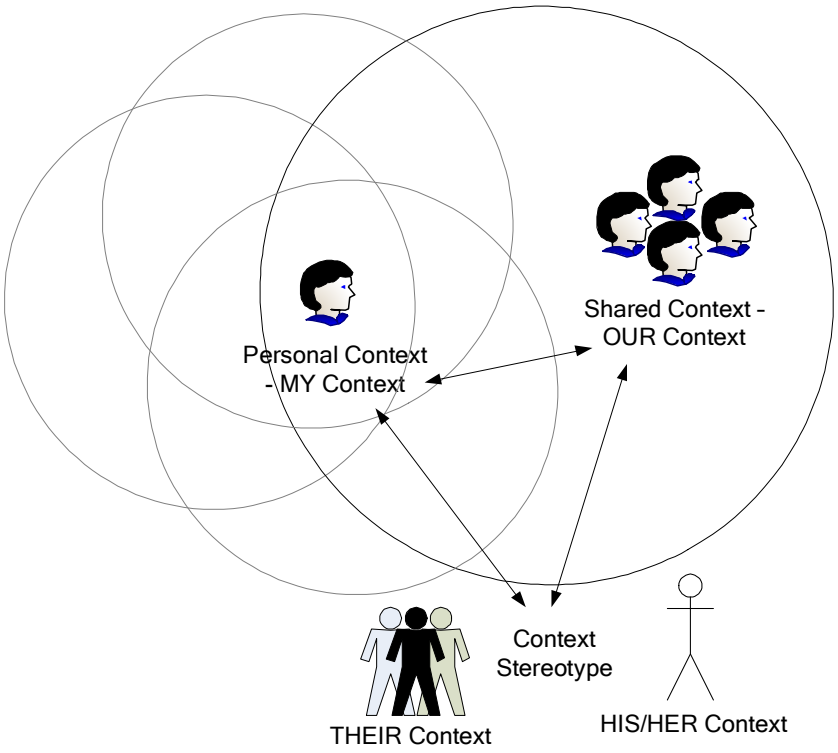

Figure 18 Contextual Identity Framework

Identity is a term stemming from cognitive theory, sociology, politics and psychology and is used to denote an individual's idea of who s/he thinks s/he is. Tajfel and Turner (1979) developed the social identity theory where a person has not one, "personal self" [personal identity], but rather several selves that correspond to widening circles of group membership. Different social contexts may trigger an individual to think,

feel and act on basis of his personal, family or national "level of self" [social identity] (Turner *et al.* 1987). While the notion of *personal identity* refers to self-knowledge that derives from an individual's unique attributes (Universiteit Twente 2004), *social identity* is the individual's self-concept derived from perceived membership of social groups (Hogg and Vaughan, 2002) (Universiteit Twente 2004). Social identity brings with it in-group, out-group differentiation. There is an affinity between those within the group. Individuals often *stereotype* others who are outside their groups of identity, drawing prefixed conclusions about them and slotting them in already formulated categories.

In the Contextual Identity Framework Figure 18, we apply the sociological notions of identity, personal identity, social identity and stereotype to help delineate the boundaries of context. The framework has 3 components:

- Personal context or 'my' context
- Shared context or 'our' context
- Context stereotype or 'his/her/their' context
- The three bidirectional arrows in Figure 18 represent the continuous interaction between the three views of context.

3.2.3 PERSONAL CONTEXT OR 'MY' CONTEXT

Courtright (2007) brings forth the challenge of context saying the shift from system-centric research to person-centric research results in the concept of context being pushed to the background. This is because in order to avoid a system-centric bias, factors external to the searcher i.e. anything which is not affective, psychological or

cognitive (which Courtright 2007 and other researchers view as 'context') are considered less important, and when considered, are stressed only to the extent they are constructed by the individual (Dervin 1997). While the concept of context remains relevant even from a user-centered perspective (Malmsjo 1997), Thomas and Nyce (2001) highlight the challenge of moving beyond merely cognitive and affective influences without losing sight of the actor or searcher at the center of information behavior. Courtright (2007) sees this as the problem of the 'ontological status of context' i.e. to what extent context depends upon searcher's constructions and to what extent contextual elements are external to the searcher.

The user-centric view espoused by researchers such as Dervin and Nilan (1986) and Kuhlthau (1988) is the 'personal context' or 'my' context in the proposed Contextual Identity Framework of Figure 18. As per the personal context, *everything*, including the factors external to the searcher (which is largely seen as constituting 'context') is seen from the affective, psychological or cognitive viewpoint of the searcher. The influence of this context is not the way it exists external to the searcher, but rather in the way it is constructed in the mind of the individual. Thus, from the viewpoint of the 'personal context' or 'my' context, everything is subjective i.e. everything is the way the searcher/actor sees it (if I am the actor/searcher, everything is the way *I* see it or think of it). Nothing is external or objective here.

3.2.4 SHARED CONTEXT OR 'OUR' CONTEXT

Shared context (our context) is the common view of context shared by a group of people that are connected by a common identity e.g. people of a certain demographic group, people of a certain profession, those working for a certain company or organization, etc. (may be compared to *social identity* of Tajfel's and Turner's 1979

social identity theory). The view of context of individuals within a shared context is shaped by a common set of ideologies or goals to strive for (e.g. the business the company is in or the composition of a particular team), is bound by a common set of rules, norms and culture (e.g. organizational rules, organizational culture) and is often limited by a common set of constraints and resources. Using Giddens' (1984) structuration theory, Rosenbaum (1993, 1996) says that above all, organizational rules and resources shape information practices (or behavior) in the information use environment (IUE) espoused by Taylor 1991, and that members' [all those who share a common context] activities reinforce these rules and resources. Similar findings were also reported by Allen and Wilson (2003), Chang and Lee (2001) and Solomon (1997, 1999) (Courtright 2007). All these information seekers are bound by a shared context, which they see as 'our' context (see Figure 18). In digital environments, in addition to organizations, *invisible colleges*[30] become more important in influencing people's information-seeking behaviors as a shared context.

Fidel and Pejterson (2004) and Courtright (2007) argue in favor of defining context within a bounded organization as opposed to context for everyday life activities, saying it is easier to do so from the viewpoints of both the searcher/actor and the researcher (Savolainen 1998; Johnson 2003). Our Contextual Identity Framework however, is not bound by any such limitations. The framework seeks to be universal in application. It should apply to information seeking situations within the boundaries of an organization, as well as outside it when a person is knowingly or unknowingly searching for information. This is because we view it from the standpoint of *identity*

[30] The term 'invisible college' mainly refers to the free transfer of thought and expertise though loosely-connected systems (e.g. Internet) without any physical or institutional presence. The concept was developed in the sociology of science by Diane Crane (1972). It is related, but differs from other concepts of expert communities such as 'epistemic communities' (Haas 1992) or Community of Practice or CoP (Wenger 1998) (Wikipedia – invisible college)

(as discussed right after Figure 18) which is intrinsic to the person irrespective of where s/he is. Nardi and O'Day (1999)'s information ecologies model applies both to the work place and home. Studies on the home environment have emphasized more on social interaction and the goals of information activities (Courtright 2007). Davenport *et al.* (1997, 2000) see the home as a discrete micro-organization. Rieh (2004) argues that the home is not a discrete context but instead contains contextual elements that interact with broader spheres of information activity outside the home. Rieh's argument is essentially representative of the interaction between the personal, shared and stereotypical context in our Contextual Identity Framework, the boundaries of which cannot be discretely fixed. Pettigrew (1999) has developed the concept of *information ground* to illustrate non-workplace boundaries such as library classes, health clinics, places of worship, hair salons, etc. where people come together for a singular purpose, but from whose behavior emerges a social atmosphere that fosters the spontaneous and serendipitous sharing of information (Courtright 2007).

While many researchers have used traditionally defined organizational boundaries to bound context, other researchers (Allen and Shoard 2005; Hirsh and Dinkelacker 2004; Lamb *et al.* 2003; Attfield and Dowell 2003; Doty and Erdelez 2002; Choo 2001; Tibar 2000; Barry 1997; Owens *et al.* 1997) find that these must be transcended in order to understand information practices (Courtright 2007). Based on Scott (1987)'s model of open-organizational systems, Lamb *et al.* (2003) examine extra-organizational factors such as regulations, industry-wide infrastructures, and client expectations that influence information seeking within an organization. Barnes *et al.* (1997) find that high-performing work teams acknowledge extra-organizational context more than low-performing teams do. All these factors, whether those within an organization (e.g. work rules, organizational culture, main business of the

company, etc.) or extra-organizational as outlined above, form part of the shared context (OUR context) of people working in an organization and shape their information seeking behavior.

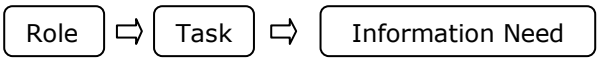

Figure 19 Relationship between role, task and need (Leckie and Pettigrew 1997)

In the shared context of an organization, Leckie and Pettigrew (1997) analyze the main contextual factors influencing information behavior to be the person's role at work, and the tasks s/he is charged with as a result of this role. The tasks, in turn, give rise to information need (see Figure 19).

The strategies deployed to meet those needs vary according to 'factors such as the corporate culture, individual habits, availability of information systems and sources, commitment to professional development, etc.' (Leckie and Pettigrew p.101).

Audunson (1999) supports the emphasis on roles by saying that roles contain sets of identifiable norms that govern information behavior. He says that when these information-seeking norms vary across similar roles, this is due to the 'strength of rules and the cohesion and degree of social control from a centre' (Audunson 1999 p.78) (Courtright 2007). In other words, a work role emphasizes a shared context in our Contextual Identity Framework of Figure 18. This shared context of work role is expected to be a more cohesive and stronger context than organizational factors (e.g. corporate culture, norms, resources), which in-turn is expected to have a stronger influence than factors outside the organization.

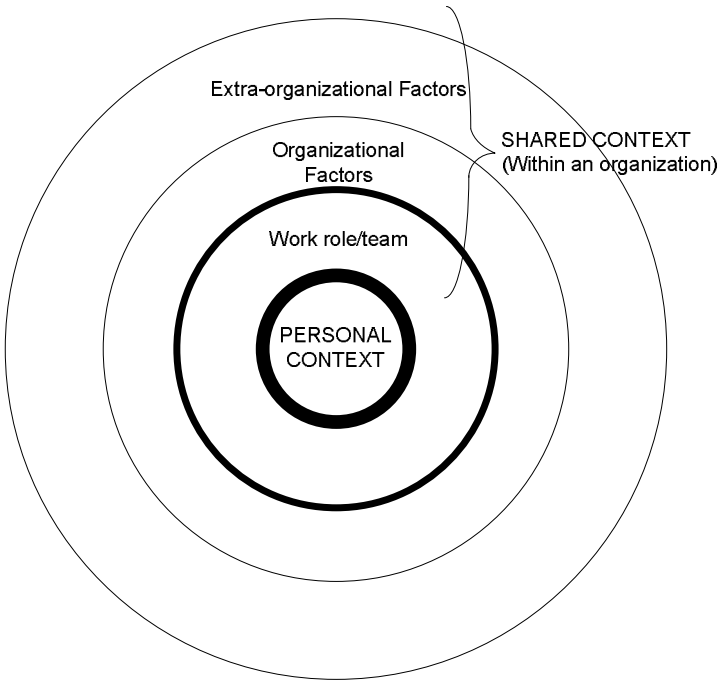

Figure 20 Concentric circles of shared context within an organization

Figure 20 above shows an employee within an organization situated in his/her personal context. S/he in turn, is surrounded by the concentric circles of shared context – a set of factors that are common to all members of a team or an employee of a particular work role. There is also a shared influence of organizational factors such as corporate norms and culture. Other factors outside the organization such as regulations, industry-wide infrastructures, etc. might also influence. The smaller circles are expected to have the greatest degree of influence on the information seeking behavior of an actor/employee in an organization. As the circle gets bigger, the degree of influence becomes increasingly weaker. However, this is subjected to individual levels of conformance or variables like individualism versus collectivism (see e.g. Triandis 1995).

Williamson (1998) has also used the model of nested contexts (similar to the concentric circles of Figure 20) where the information actor is surrounded by a circle of intimate personal networks, then wider personal networks, the mass media,

institutional sources, and finally an outer ring of context that is characterized by personal characteristics, socio-economic circumstances, values, lifestyles, and physical environments (Courtright 2007). Nested contexts can also be found in Kari and Savolainen (2003), Sonnenwald (1999) and Wilson (1981).

However, in our model of concentric circles (Figure 20), the boundaries of these circles are not to be seen as fixed. They vary according to the person's point of view. These circles have a strong or weak binding on the actor/seeker only as long as s/he thinks them to be. This view is supported by Lievrouw (2001) who views the boundaries of context as evolving dynamically through the practices of information actors. She views context as taking shape through institutional practices of generating information, organizing it and governing its distribution and on the other hand, through social practices in which individuals share and seek information. The two parts of the environment evolve over time, interact and shape each other (Courtright 2007). Actors actually arrange their social and physical environments so that they can provide needed information (Bates 2002).

Figure 21 shows the continuous shaping of context through the external environment (which is external, objective) and the way the information seeker perceives it to be (subjective, internal). Here, the *personal context* of the Contextual Identity Framework (Figure 18) may be viewed as subjective (the perception of the seeker) and *context stereotype* (discussed in the following section) may be viewed as an external, dispassionate, objective view (the setting, as espoused by Bystrom 1997; Davies and McKenzie 2004; McKenzie 2004; Pettigrew 2000). The shared context may also be viewed as subjective and it may be external (where factors in the shared context are influencing the seeker) or internal (when the seeker internalizes the shared

context and identifies with the norms, rules and other aspects of it). The three views of context do not operate in isolation. Rather, they continuously shape each other, as shown in Figure 21. E.g. an interaction between the shared context (e.g. work environment) and personal context gives rise to a task or personal situation. A source for information can either be part of context stereotype or shared context depending on the level of closeness between the seeker and the source. This relationship between the seeker and the source forms the interaction between personal context, on the one hand, and shared context/contextual stereotype on the other. The information to be sought or received also results in the interaction between personal context and shared context/contextual stereotype.

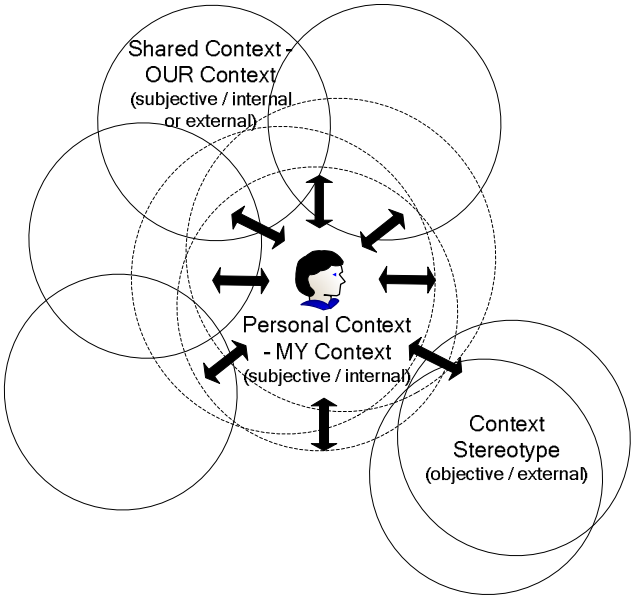

Figure 21 Continuous shaping of context through external environment and the information seeker's perception of it

While Figure 20 was an example of shared context in concentric circles, there can be different overlapping circles of shared context such as the circles of 1) work

role/team[31] 2) race/religion/nationality 3) gender/sexual preference 4) age group 5) friendship, etc. which might provide a common context to a set of people in an organization or outside it and influence information seeking behavior. These different circles also influence information behavior outside the organization. Case (2007) reviews the research on information behavior of people studied by *occupation* such as scientists and engineers, social scientists, humanities scholars, healthcare providers, managers, journalists, lawyers, etc. (pp. 250-284), studied by *role* such as citizen or voter, consumer, patient, gatekeeper, students, etc. (pp. 285-303) and those studied by *demographic group* such as age, racial and ethnolinguistic minorities, socioeconomic status, gender, etc. (pp. 303-316). Lievrouw and Farb (2003) also say that a seeker could conceivably inhabit several discrete or overlapping information environments depending upon activities and imperatives. Other research in information behavior (Johnson 2003; Lamb and Kling 2003; Solomon 1999; Sonnenwald 1999; Sonnenwald and Lievrouw 1997) and sociological theory (Pescosolido and Rubin 2000; Weber 2001; Sewell 1992; Friedland and Alford 1991) have also brought forth the concept of multiple and overlapping contexts (Courtright 2007).

The concept of a shared context or 'Our' context as espoused in our Contextual Identity Framework can be understood through Chatman (2000)'s 'small-world theory', where geographically-bounded (even dispersed, but bound together) groups live in a 'small world' governed by a worldview and will tend to behave within its norms and expectations until and unless a critical need arises that forces them to look

[31] Although ideally, work role/team should be the most important circle of shared context in a professional organization, groupism based on various factors such as ethnicity or gender is often observed in many organizations and influences or limits information seeking behavior. E.g. Cox *et al.* (1991) studied the effects of ethnic group cultural differences on cooperative and competitive behavior on a group task. They found that groups composed of people from collectivist cultural traditions (Asian, Hispanic, etc.) displayed more cooperative behavior compared to groups composed of people from individualistic cultural traditions (Anglo Americans).

beyond the worldview. Chatman (1999) defines worldview as 'a collective set of beliefs held by members who live within a small world. It is a mental picture or a cognitive map that interprets the world' (p. 213). This also makes way for an acceptance of 'certain ways in which to speak, behave, and accept or reject information' (Chatman 1999 p.211). There is a certain comfort zone within this worldview. 'People will not search for information if there is no need to do so. If members of a social world choose to ignore information, it is because their world is working without it' (Chatman 2000 p.10). Thus, any common binding factor such as a common work team, a common organization, a common goal to strive for, the same race, the same gender, the same nationality, etc. can bind a group of people into being governed by a worldview (which we term 'shared context') and can influence the information seeking behavior of all those within this circle of people sharing the common worldview. Thus, our model of shared context extends to organizations and beyond it to include all those areas where people share a common worldview or a shared context. As Courtright (2007) puts it, 'as in the organizational context models…, members of the same social world [shared context] appear to carry out roles and are governed by norms in their information [behavior]' (p.280).

Apart from the small-world theory, the concept of a shared context can also be understood using Savolainen (1995)'s model for everyday-life information seeking, where the manner in which one's 'way of life' is organized is used to denote context.

3.2.5 CONTEXT STEREOTYPE OR 'HIS' / 'HER' / 'THEIR' CONTEXT

Courtright (2007) says that while multiple, overlapping contexts renders more complex the research challenge of identifying contextual boundaries, the 'dynamic, multilayered approach appears well suited to addressing the complexity of everyday-

life information practices' (p. 281). This idea is, perhaps, the only correct way of understanding context (as shown in the Contextual Identity Framework of Figure 18). This is because at the end of the day, everything is what you think it is. While the external environment that shapes context exists independently, the person looking for information imbibes this environment as per his/her own mental makeup and perception. As information need is primarily an activity that appears in a person's mind (explained by Dervin (1983b) through her sense-making theory, Belkin *et al.* (1982) though the notion of Anomalous State of Knowledge or ASK, etc.), taking this into consideration is very important. In reality, there is nothing called an 'objective context'. All context is subjective, and varies in the mind of the searcher – in the way the person in need for information imbibes it, gets affected by it and accords it more importance or less importance. Some contextual boundaries are more fixed (e.g. organizational); some are less fixed and vary more rapidly.

Cognitive theorists define a *stereotype* as 'a cognitive structure containing the perceiver's knowledge and beliefs about a social group and its members' (Hamilton *et al.* 1992, p.135). It is a categorization and over-simplification process whereby 'individuals sharing common properties are placed in the same group' (Hamilton and Trolier 1986), often by people who do not belong to this group. Here, we extend the notion of stereotype in defining context. All instances where context is seen as a *setting* (e.g. Bystrom 1997; Davies and McKenzie 2004; McKenzie 2004; Pettigrew 2000; Allen and Kim 2000) or *environment* (e.g. Janes and Silverstein 2003; Lamb *et al.* 2003; Rieh 2004; Taylor 1991) may be seen as examples of context stereotypes (process of categorizing and simplifying).

Although stereotypes can promote failure, they can also lift a person's or group's performance and be tools that promote social progress (Haslam *et al.* 2008). Walter

Lippman was the first to suggest the functional necessity of stereotypes (Ashmore and Del Boca 1981; Rahn 1993). 'For the real environment is altogether too big, too complex, and too fleeting for direct acquaintance. We are not equipped to deal with so much subtlety, so much variety, so many permutations and combinations. And although we have to act in that environment, we have to reconstruct it on a simpler model before we can manage it. To traverse the world, men must have maps of the world' (Lippman 1922 p.11). Much of contemporary social psychology has followed Lippman's lead, viewing the formation and use of stereotypes as natural consequences of normal categorization processes of human cognition (Rahn 1993).

The view of context as 'a setting' or 'an environment' (and one that has been criticized by researchers adopting the person-centric view of information seeking) may also be viewed as an outcome of this natural categorization process of human cognition. Thus, while all context is subjective and dynamic and can be bounded only insofar as it exists in the mind of particular searcher at a particular point in time, researchers and designers of information systems for search can, nevertheless *attempt* to objectify this subjective context (the process of stereotyping). This attempt is crucial because it paves the path for designing search systems that could be applicable in various settings such as organizations, home environment, etc. However, to be truly effective, these systems must be designed keeping in mind that the context is actually subjective in nature, and the searcher must have room to modify the search system as per his/her unique set of requirements at a particular point in time. This attempt of seeing context to be objective is what Courtright (2007) terms the 'research challenge of identifying contextual boundaries' (p. 281).

Thus, the context of the *other* person, as seen from the eyes of somebody (may it be an employee in a company, a manager, any person outside an organization, or a

community of researchers trying to map the boundaries of context), is what we term *context stereotype* in the Contextual Identity Framework (Figure 18). It is the context surrounding a person B, as seen from the eyes of a person A. Thus, as opposed to 'my' or 'our' context, this is 'his', 'her' or 'their' context. Thus, this view appears more objective than 'my' (personal) or 'our' (shared) context, which are largely subjective in nature. This view, sometimes labeled 'positivist' (Dourish 2004) or 'objectivist' (Talja *et al.* 1999), presents contexts as a set of stable, delineated entities that can be conceptualized independently of the activities of their participants (Courtright 2007). In most empirical studies, context 'usually refers to any factors or variables that are seen to affect individuals' information-seeking behavior: socio-economic conditions, work roles, tasks, problem situations, communities and organizations with their structures and cultures, etc….Context refers to objective reality' (Talja *et al.* 1999 pp.752-753).

Thus, while the 'context stereotype' view is perhaps most natural to positivist research, researchers such as Talja *et al.* (1999) and Burawoy (2003) take an interpretivist standpoint and argue that the researcher also contributes to the creation of context during research. Ingwersen & Jarvelin (2005), in their model, support this view. Talja *et al.* (1999) argue that context is also created by the researcher at the intersection between actors' constructions of context-as-meaning and the researchers' examination of the actors' lives; 'context is the site where a phenomenon is constituted as an object to [researchers]' (p.754); context when viewed interpretatively is constituted 'at the crossroads between researchers and data' (p.755) (Courtright 2007).

3.2.6 RELATIONSHIP BETWEEN THE THREE VIEWS

Table 2 below summarizes and compares the three views of context espoused in the Contextual Identity Framework of Figure 18.

Table 2 Comparison between the three views of context

	Personal context	**Shared context**	**Contextual stereotype**
View	My context	Our context	His/Her/Their context
	Context of person A seen from the eyes of person A	Context of a group A, B, C seen from the eyes of either A, B or C	Context of a person B seen from the eyes of person A
	Personal, internal	Runs through a group due to the shared identity of the group	External
Objectivity	Subjective	Subjective	Objective
Degree of change	Dynamic contextual boundaries – degree of variation varies across different contexts	Largely static boundaries in so far as the shared context is concerned (boundaries of personal context will remain dynamic).	Attempt to see or form fixed, static boundaries
Layers	Multilayered, contexts Some strong, some weak	1-3 layers of largely simple contexts; the shared context is very strong	A few layers of simple, objective contexts; objective attempt to understand the strength of contexts
Reality versus simplification	Reality / complex	Trying to find commonality/sense of security in shared contexts (common norms and values; common *worldview* – Chatman 2000)	Trying to simplify context (a research imperative; important for design of search systems); slotting, convenient (not reflective of actual reality)
Boundary	Cognitive, affective, psychological	Cognitive, affective, psychological (shared boundary within group)	That which surrounds the "cognitive, affective and psychological"
Applies to	Applies only to the person concerned; excludes everyone else	Includes those within the shared context; excludes those outside the shared context	Person viewing is outside the circles of context surrounding the actor
Resides in	My mind	Our minds	His mind; her mind;

			their mind
Context is	My perception of my mind, our minds, other minds and external world	Our perception of our minds, our internal world, minds in other groups and the external world outside our group	My perception of (or an objective study of) other minds and external world

Prior research in information behavior has looked at each view in isolation (as opposed to a collective whole). Researchers adhering to a particular view have tried to justify their stand taken. Others have opposed and criticized it.

Courtright (2007) reviews literature on context classified along *social*, *relational* and *dynamic* lines. Her review of research on 'context as constructed meaning: the person in context' (pp.287-288) can be mapped to 'personal context', research on 'socially constructed context: the social actor' (p.289) can be mapped to 'social context' while research on 'context as container' (pp.286-287) can be mapped to the 'context stereotype' view of the Contextual Identity Framework.

Table 3 below shows how the three views of the Contextual Identity Framework map to Courtright (2007)'s typology (p.286-290).

Table 3 Contextual Identity Framework mapped to Courtright (2007)'s classification

Courtright (2007)'s typology	**Classification by Courtright (2007)**	**Mapping to Contextual Identity Framework**
Context as 'Container'	social, relational	context stereotype
Context as Constructed Meaning: The Person in Context	dynamic	personal context
Socially Constructed Context: The Social Actor	social, dynamic	shared context
Relational Context: Embeddedness	relational	Interaction among the three views of context
Changing Context	relational, dynamic	Largely personal context and shared context

In isolation, each of the three views is inadequate to represent the phenomenon of context in information behavior (or information needs, seeking and use / INSU) research.

An underlying assumption of the person-in-context (personal context view) type of study is that an understanding of the information needs and activities of the group or organization can be built on an accumulation of studies of individuals (e.g. Reneker *et al.* 2001). However, the individual-constructivist stance makes generalizations implausible (Frohmann 2004). Instead, there lies the danger of solipsism (Courtright 2007), the philosophical idea that my mind is the only thing that I know exists and that knowledge of anything outside the mind (other minds or the external world) is unjustified. Courtright (2007) says that this danger has not been convincingly addressed within the traditional user-centered paradigm (Dervin 2000; Savolainen 1993). In addition, person-in-context models do not adequately account for the complexity, variability and mutual interactions of contextual factors such as social networks, information technologies and organizational practices (Courtright 2007). Thus, the 'personal context view' of the Contextual Identity Framework (Figure 18), taken in isolation, is inadequate.

The socially constructed context: social actor model (shared context view) while taking care of the role of social interaction in constructing information (exemplified by our focus on source usage when looking for information in our empirical survey study; see the next chapter) cannot be sufficient to define context when taken in isolation (if the constructivist view and the objective view of context are to be totally ignored).

The context as 'container' model (context stereotype view) posits that elements of context exist objectively around an actor and could therefore be enumerated by a researcher who has observed or queried the actor's life (Courtright 2007). Taking this view in isolation, if context is seen merely as a container or backdrop for information practices, then research cannot explain variability among actors in the same or similar settings (Courtright 2007). Also, it conflicts with the person-in-context model of user-centered studies (personal context).

In order for the concept of context to be meaningful and relevant, Courtright (2007) says that contextual elements must be explicitly linked to particular information practices and comparisons among actors and contexts must be used to explain variability and thereby build more robust theories of information seeking in context. While the past decades have seen a shift from system-centric research (emphasizing 'context stereotype' type of contextual studies) to user-centered research (emphasizing 'personal context' type of contextual studies), the new challenge now for user-centered research is how to conceptualize the shaping influences of context without going back to the system-centered view where information behavior is seen as predictable according to set environmental variables (Courtright 2007). The Information Seeking in Context conferences have so far failed to arrive at a theoretical paradigm that might represent the next step forward from the classic 'user-centered' stance.

As Ingwersen and Jarvelin (2005) point out, taking context in isolation doesn't work. 'In IS&R, *actors* and other components function as context to one another in the interaction processes. There are social, organizational, cultural as well as systemic contexts, which evolve over time' (Ingwersen and Jarvelin 2005, p.19). '…*actors* and

objects associated with each component of the *cognitive* I&R *framework* function as context for their own elementary *cognitive structures* (intra-object context), as context to one another (inter-object context), and in context of the interaction processes between framework components, which themselves are contextual to each other. In the latter case, one may talk about social/organizational/cultural, as well as systemic contexts. The context of *interactive IR* processes ranges from algorithmic IR processes in context of interactive IR, as well as information seeking processes to information behavior. All IS&R components and activities are in context of common social, physical and technological infrastructures as well as their history over time.' (Ingwersen and Jarvelin 2005, p.383). Compared to systems-oriented IR research, in cognitive and user-oriented IR research 'IR is placed in context in a holistic way: all components/cognitive actors and structures of IS&R are contextual to one another;' (Ingwersen and Jarvelin 2005, p.193)

In the Contextual Identity Framework (Figure 18), all the three views of context i.e. my view, our view and his/her/their view coexist and work in tandem. E.g. factors such as the searcher's individual habit and commitment to professional development might be personal contextual factors, but are subject to influence by shared contextual factors such as corporate culture, availability of information systems and sources, etc. Also how strong or weak a particular view is might be subject to cultural influence. E.g. A person adhering to an individualistic culture might give more importance to personal context than shared context. Conversely, a person adhering to a collectivistic culture might give more importance to shared context than personal context.

3.2.7 SUMMARY OF THE CONTEXTUAL IDENTITY FRAMEWORK

Despite the seemingly widespread and growing attention to the notion of 'context' in information seeking, the concept remains ill-defined and inconsistently applied. There isn't any success in defining what context really means and what its boundaries are. To help delineate the boundaries of context, we propose a Contextual Identity Framework which sums up the three schools of thought on context – 1) those that think context is subjective and resides in the mind of the seeker (personal context or 'my' context); 2) those that think context is made up of shared norms and social influences (shared context or 'our' context); and 3) those that think context is objective and made up of the factors and environment that surround the seeker (context stereotype or 'his/her/their' context. Through the framework, we highlight the futility of trying to define context using any one view. It is only when we take all the 3 views of context into consideration that we are able to adequately define, understand and study context. As highlighted by Ingwersen & Jarvelin (2005), the seeker and surrounding objects function as context to one another during information seeking behavior, and that both inter-object and intra-object context work together. We hope the framework will provide a basis to further theoretical research in the meaning, role and boundary of context in information behavior. While Courtright (2007) has identified similar categories of contextual variables in her review paper, the major contribution this study makes is disambiguating and positing that all three views of context are necessary and prevalent, and must be incorporated into any boundary framework of context. Leaving out any one view is not going to provide answers to the many questions on context and its management.

The framework also holds practical implications for managers and practitioners. By understanding how three views of context coexist and work in tandem, managers can

better place resources such that employees feel them to be a part of their shared context (as opposed to context stereotype). E.g. employees with shared norms and similar expertise can be seated together so that they feel a greater level of cohesiveness and develop a feeling of shared context. An understanding of the uniqueness of the personal context of each employee is also important in making hiring decisions and understanding their information seeking behavior. The framework is also useful for designers of search systems to better understand how context works, and to incorporate the 3 views in their design decisions. E.g. specialty search engines geared towards doctors or lawyers are examples of search systems pertaining to a specific shared context of a common profession. 'The underlying hypothesis (and belief) is that by taking account of context, the next generation of retrieval engines dependent on models of context can be created, designed and developed delivering performance exceeding that of out-of-context engines.' (Ingwersen, Jarvelin & Belkin, 2005).

In the next section, we propose a theoretical framework incorporating the contextual variables i.e. elements and factors (making each of the three views of the Contextual Identity Framework) that will impact a person's information seeking behavior. E.g. the environment of a seeker's shared context plays upon the seeker or cognitive actor (personal context) to bring about a problem situation requiring a need for information. This gives rise to knowledge or information that needs to be sought from a source (context stereotype or shared context, depending upon the level of closeness with the source). The seeker then approaches a source (personal or impersonal) for this information. Depending upon the interaction between the seeker and the source, and the relationship shared by the seeker and the source, the source passes the knowledge sought to the seeker. Here, variables pertaining to the seeker (such as learning

orientation, background knowledge, age, gender, intentionality, self efficacy, etc.) can be seen as part of the seeker's personal context. Environment variables (such as rules and resources, team size, cohesiveness, etc.) can be seen as part of the seeker's shared context in the environment in which s/he operates (or invisible college in a digital environment). An interaction of personal context and shared context gives rise to variables pertaining to the task or problem situation (such as task importance, urgency, complexity, uncertainty, etc.). Based on this task (or otherwise, through factors such as curiosity), an information need arises (which, as per Dervin's sense-making theory or Belkin's anomalous state of knowledge or ASK can be seen as part of the seeker's personal context). This information need is fulfilled by getting information from an information source (a person, internet, books, etc.) which can be seen as part of context stereotype (if the seeker doesn't identity with them) or part of shared context (if the seeker sees them as belonging within his/her circle of shared context). Other variables from the seeker-source relationship (social risk, willingness to share, etc.), the information required (tacitness, complexity, etc.) and the interaction session (time, place and history of interaction) lie within boundaries of interaction between two or more views of context (as per the Contextual Identity Framework). The variables, based on past studies, will enable the context of information seeking behavior to be empirically studied and will serve as useful moderators.

Empirical studies using variables incorporating different views of context will also help to test and validate the framework. Chapter 4 describes one such study to test the impact of different contextual variables on the use of information sources. However, it is to be noted that the study in Chapter 4, while based on the frameworks derived in this chapter, it not meant specifically to test the contextual identity framework. E.g.

the idea of dynamic boundaries is not tested or modeled in the empirical research model of Figure 27. Findings from the study will help to shed light on the relative importance of the different views of context on source use and information seeking behavior.

3.3 A Theoretical Framework of Elements of Context

In this section, we arrive at a theoretical framework incorporating the elements of context in information seeking behavior. A need for this has been felt and a discourse has been going on since the last couple years. Nick Belkin asks in his panel at the First International Symposium on Information Interaction in Context (IIiX 2006), 'What aspects of your concept of context are *essential*, *important*, *interesting* and *unnecessary* for understanding and supporting human interaction with information?' (Ingwersen, Ruthven and Belkin 2007). Ingwersen (2005) in the 'Introduction' to the SIGIR[32] Information Retrieval in Context (IRiX) workshop says that context includes 'time, place, history of interaction, task in hand, and a range of other factors that are not given explicitly but are implicit in the interaction and ambient environment' (p.6). He lists down several elements of context that are potentially significant to information retrieval. These include *work* or *daily-life task* or *interest* features, *searcher* features, *interaction* features, *system* features, *document* features, *environmental/physical* features, and *temporal* features.

Peter Ingwersen and Kalervo Jarvelin, in their book (Ingwersen and Jarvelin 2005), propose a generalized model of any participating cognitive[33] actor(s) in context.

[32] ACM SIGIR is the Association for Computing Machinery's Special Interest Group on Information Retrieval.

[33] Cognitive means 'of, relating to, being, or involving conscious intellectual activity (as thinking, reasoning, or remembering)' (Merriam-Webster's Online Dictionary)

According to this model, 'information seekers are cognitive actors acting in a social, organizational and cultural context' (p.261). This social/organizational/cultural context, together with systemic context[34], influences the activities, perceptions, and interpretations of each individual over time. Ingwersen and Jarvelin emphasize 'that all the participating cognitive structures are in context of all other cognitive components of the model…there exists a mutual dependency of context and actor or component, including intra-component structures. For instance, images in objects naturally act as context for the surrounding text – and vice versa' (p.262). They see contexts as (p.306) historical[35] or nested around and within the components of their framework (to each component, the other components forms its context). To sum up, Ingwersen and Jarvelin (2005) emphasize that contexts 'may be of social, cultural or organizational nature, associated with objects, systems and domains, searchers' work and daily-life tasks and emotional interests, intentionality and preferences. Together with the immediate interaction (session) context, those current circumstances directly influence the involved actors' perception of the situation at hand. Within each framework component, divergent intra-component representations are contextual to one another, down to the smallest sign element.' (p.306)

3.3.1 FRAMEWORK OF ELEMENTS OF CONTEXT

While researchers have tried to list down the elements of context, there has been no clear direction in trying to make sense of which of these elements lie inside or outside the boundary of context, and which of these can be incorporated as part of context. The Contextual Identity Framework (Figure 18) provides a way to make sense of

[34] Systemic context includes information objects, interface, IT: engines, logics, algorithms (Ingwersen and Jarvelin 2005)

[35] 'constituted by the experiences and knowledge gained over time by the actor(s) dealing with a utility community and his/her peers' (Ingwersen and Jarvelin 2005, p.306)

context by understanding its three views – personal context, shared context and context stereotype. Among the various elements/factors which have been listed in past studies to make up context, we can loosely categorize them in their respective places in the different views that make up context. While these placements are largely ad-hoc and not always fixed, they nevertheless are useful in simplifying the complexity of context, especially when studying the source usage of a seeker when faced with a situation that requires looking for information. Placing them under the different views of the Contextual Identity Framework is also a first step towards answering Belkin's question on the aspects of context that are essential, important, interesting and unnecessary for understanding and supporting human interaction with information (Ingwersen, Ruthven and Belkin 2007).

Thus, based on the Contextual Identity Framework of Figure 18, we arrive at a theoretical framework of the elements[36] of context (see Figure 22), which incorporates various contextual factors.

[36] In the contextual identity framework, the personal and the shared context are subjective, while context stereotype can be seen as objective. However, a mapping of the elements of context in Figure 22 may be seen as an objective attempt to map both subjective and objective elements of context. E.g. age, gender, education etc. are largely objective, even though they are attributes of the searcher and part of 'personal context'. Subjective attributes of the same i.e. how the user construes these factors such as (perceptions of) age, (perceptions of) gender, (perceptions of) education, would also be part of the user's personal context. However, in Figure 22, for the sake of simplicity, we don't make an explicit distinction between subjective and objective attributes, while placing the factors/variables in different views of context.

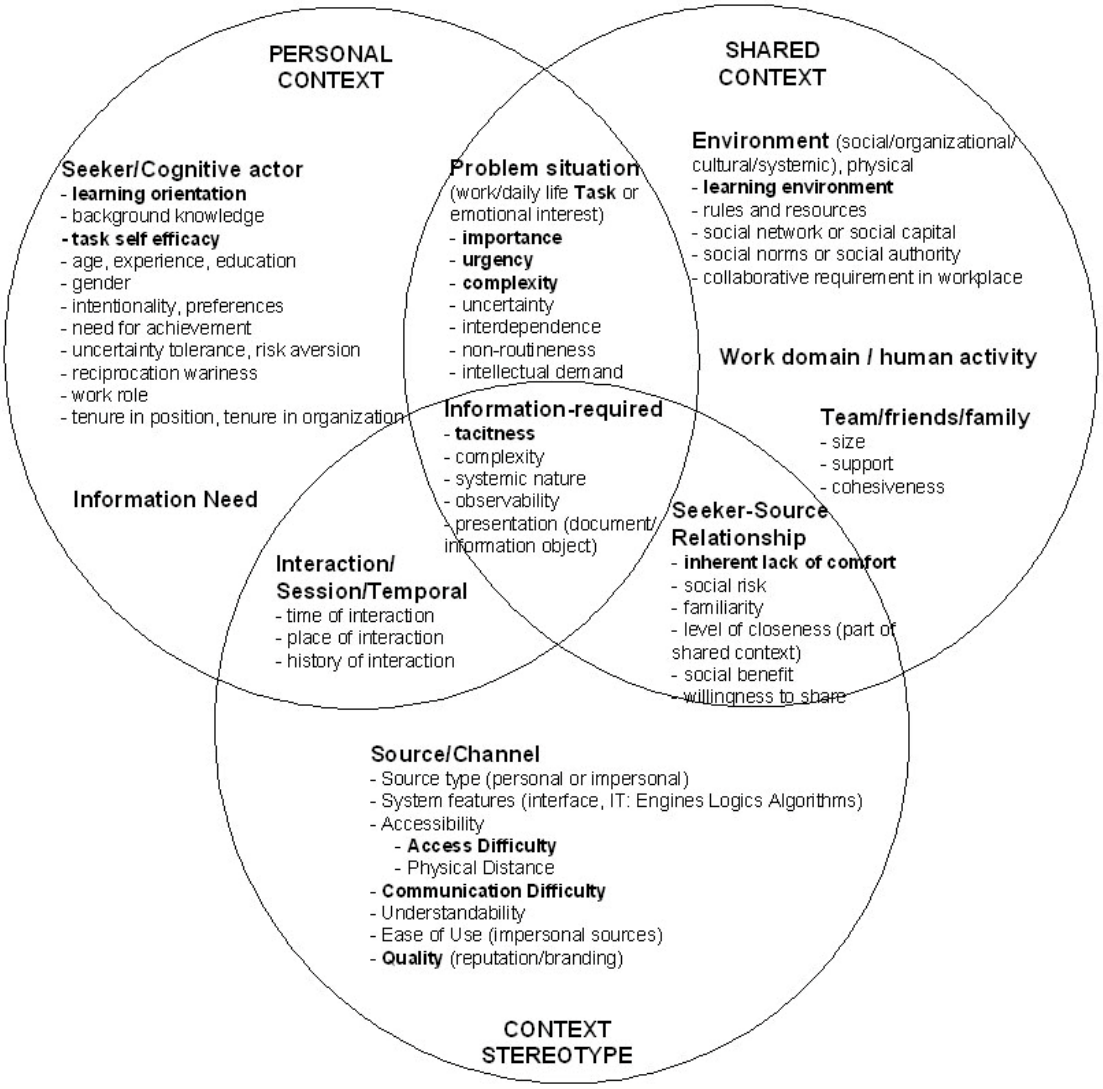

Figure 22 Theoretical Framework of Elements of Context

As per the Contextual Identity Framework of Figure 18, context can be seen from three views – personal context, shared context and context stereotype. See the previous section for a detailed discussion of each view of context. Each of the three overlapping circles in Figure 22 represents a particular view of context. While a seeker looking at context (personal context) views everything as context, s/he is influenced by and identifies with a shared context and elements that are part of it. When faced with an information need, a seeker interacts with an information source to try and get the desired information. The information behavior exhibited in this process

depends upon the degree of closeness between the seeker and the source i.e. whether the seeker views this source as: 1) part of his/her personal context (e.g. looking from memory, personal collection, etc.); 2) a shared context (great degree of closeness with the source), or 3) a context stereotype (elements that are outside the seekers' comfort zone of shared context).

Past literature on the various elements of context will be discussed in the subsequent sections of this chapter. Important representative factors have been marked in **bold**, and will be incorporated[37] in a research model for empirical survey study (see Chapter 4). E.g. 'Inherent lack of comfort' is a seeker-source relationship variable. These representative factors will be discussed in Chapter 4. These factors, in bold, are those that have been consistently studied in past studies on context and its role in information seeking behavior. As a research study will not be feasible with a huge number of variables, it is important to pick those variables that are most likely to impact source use. There is no overarching theory for the choice of these variables over others. In fact, there is hardly any theory of context – which brings forth the need for conferences such as 'Information Seeking in Context', etc. to try and define what context really means and what its elements are. Why one context variable should be chosen over other is an ongoing debate without any overarching theory at the base. Our reasons for choosing these are based on past studies and also the workflow of information seeking behavior that take place among the chosen variables.

Figure 23 shows a workflow of the interaction among the different elements of context making up the chosen variables in bold. The environment of a seeker's shared

[37] From the factors highlighted in bold, tacitness of required information will not be empirically studied because it is very similar to task complexity, which will be retained in the empirical model (see Figure 27 in Chapter 4). The variables on task self-efficacy, learning environment and inherent lack of comfort will be retained as control variables.

context plays upon the seeker or cognitive actor to bring about a problem situation requiring a need for information. This gives rise to knowledge or information that needs to be sought from a source. The seeker then approaches a source (personal or impersonal) for this information. Depending upon the interaction between the seeker and the source, and the relationship shared by the seeker and the source, the source passes the knowledge sought to the seeker.

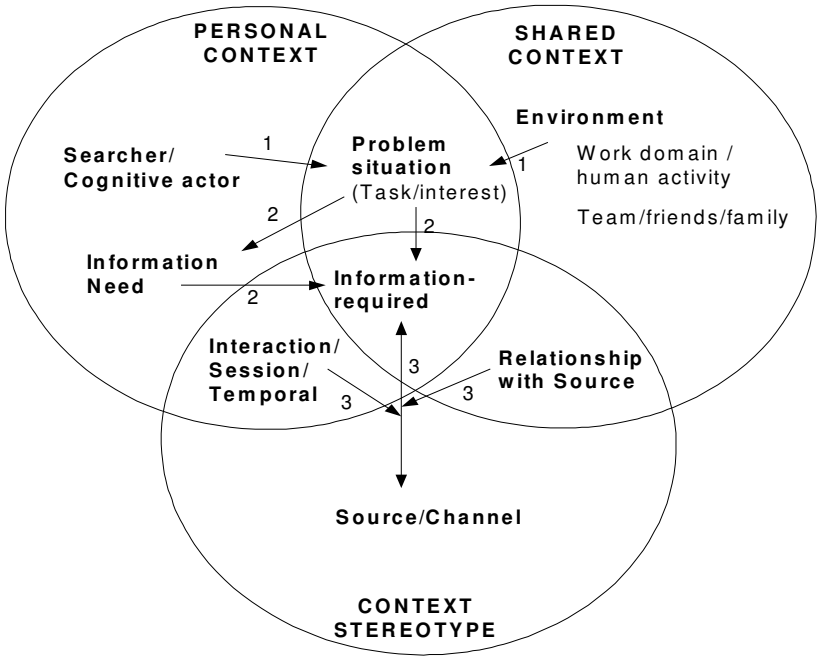

Figure 23 Workflow of interaction among the elements of context

Also, the placement of a particular variable in a particular view of context is based on a 'most likely' placement at a particular point in time. The sociological theory of identity has been used when deciding on the likely placement of each element in the particular view of context. E.g. problem situation falls under the interaction of personal and shared context, because we don't usually have tasks or situations (that require information seeking) all alone (personal context). A problem situation arises when an environment of which we are a part faces a problem which may trickle down to us in one form or the other (based on which, we start looking for information). Even when we are looking for information to satisfy our curiosity (an artifact of

personal context), it is often aroused by an external stimulant part of the environment where we operate in.

Let us look at elements in each of the three views of context (and those resulting from their interactions) in some detail.

3.3.2 ELEMENTS OF PERSONAL CONTEXT

According to Ingwersen and Jarvelin (2005), 'each actor in interactive IR and information seeking interacts with other actors at various levels under influence of social contexts and work task or interest situations over time…The perception, interpretation and cognition of the individual actor is *determined* by its/his/her prevailing cognitive structures – and *influenced* but *not* directed or dictated by the environment or domain. Hence, it is the individual perception of the situation in context that prevails' (p.30). This is what the 'personal context view' of the Contextual Identity Framework exemplifies. 'Similarly, the individual actor influences the social/organizational environment. By means of his/her perception of that context – and via social interaction – each actor may contribute to its modification over time.' (Ingwersen and Jarvelin 2005, p.30). Thus, the actor is influenced by the context and influences it as well. Ingwersen and Jarvelin (p.31) call it the principle of complimentary social and cognitive influence.

From the view of personal context, even the organization, system features, etc. are not absolute or objective components of context. Rather, these are what the seeker sees them as. Ingwersen and Jarvelin (2005) use the idea of a 'cognitive-emotional level' when highlighting perceived task, perceived interface, etc. in their model (p.278). While *everything* is part of context as per the view of personal context, the elements

that best fit within personal context (and not so well within shared context and context stereotype) are the *seeker* (and associated factors) and his/her *information need*.

Seeker / Cognitive Actor.

At the heart of any information seeking activity is the seeker or the actor. Prior research has investigated different aspects of the searcher during information search (see Figure 24, where searcher characteristics from the simplified integrated framework[38] of 2.5 are marked in bold):

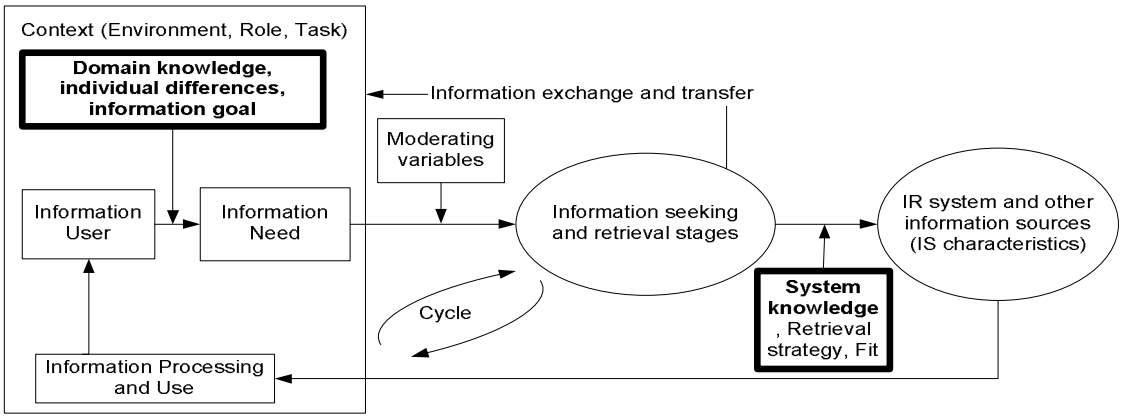

Figure 24 Searcher characteristics from the Simplified Integrated Framework

Individual differences in seekers include aspects such as the user's *cognitive abilities* (e.g. Allen, 2000), *cognitive style* (e.g. Ford and Chen, 2000; Wang, Hawk and Tenopir, 2000) and *problem-solving style* (Wu *et al.*, 1996). Borgman (1989) examined individual differences in information retrieval in terms of *personal characteristics*, *technical aptitudes*, and *academic orientation* and concluded that these factors were interrelated (Kim and Allen, 2002). Dispositional factors such as *learning orientation* (Gray and Meister 2004), *need for achievement* (Morrison and

[38] It can be argued that the IR system and other information sources, as well as other entities are all part of the context as well, and the context box surrounding the user and his/her information need could be extended to envelope all entities in Figure 24.

Vancouver 2000) and *uncertainty tolerance* determine the level of intrinsic motivation a seeker has, and can impact his/her usage of an information source (Vancouver and Morrison 1995; Morrison and Vancouver 2000; VandeWalle *at al.* 2000; Gray and Meister 2004).

Gray and Meister (2004) also studied two other dispositional variables (to study the *amount* of information sourcing rather than the source usage) – *risk aversion* and *reciprocation wariness*. Risk-averse individuals (Pratt 1964) might source more knowledge as a way of reducing the possibility of making an error[39]. Reciprocation wary individuals might source less knowledge for fear of being exploited in an exchange relationship (Lynch *et al.* 1999).

Other variables applying to the information seeker that might affect his usage of one or more information sources include demographics such as *age*, *gender*, *education*, *work role*, *tenure in position* and *tenure in organization* (experienced employees sourcing less knowledge since they know much of what is needed to perform well - Tesluk and Jacobs 1998; Gray and Meister 2004).

[39] This can be understood through the Hokkien (Chinese variant) word 'kiasu' which was recently added to the Oxford dictionary and means 'fear of losing'

Prior *domain knowledge*[40] or *background knowledge* plays a role because most seekers come with insufficient background knowledge (Miller and Jablin 1991; VandeWalle *et al.* 2000; Kwasitsu 2003). While the level of domain knowledge might affect the amount of information seeking because an expert might consider it less profitable to ask other people compared to a novice, it is unclear how domain knowledge alters the source-choice [or use] criteria (Xu *et al.* 2006).

[40] Domain knowledge is the searcher's knowledge of the search subject or topic. Allen (1991) described it as topic knowledge, defined as 'factual knowledge' of the search topic (p.188). In a recent study examining the effects of domain knowledge when retrieving information from the WWW, Miura, Fujihara and Yamashita (2006) investigated information retrieving behaviors based on the recorded data of web browsing actions as well as thinking processes using the think aloud method. They concluded that task-related domain-specific knowledge has a much greater impact on various stages of their retrieval behavior (compared to knowledge relevant to search engines or browsing i.e. system knowledge). 'At the first stage of retrieval, if they have no domain specific knowledge relevant to a certain task, they immediately face some difficulties...might not be able to comprehend which domain the task refers to…nor select sufficient keyword(s) for filtering their retrieval results. In the next stage, browsing search results, domain specific knowledge also influences their retrieval behavior. In the default setting of Google…, search results include some significant cues with hyperlinks for retrieved URLs [title, excerpt, cached link]... If retrievers have enough task-related domain specific knowledge, they would make full use of these cues to filter the results…[else have]…unproductive increment in performing their retrieval trials. Finally, domain specific knowledge…would make it easy for them to judge whether their answer is correct or incorrect.' (Miura, Fujihara and Yamashita, 2006 p.228-229). Zhang, Anghelescu and Yuan (2005), in their study of 22 engineering and science students, found that as the level of domain knowledge increases, the user tends to do more searches and to use more terms in queries. However, the search effectiveness remained the same for all participants. They concluded that the level of domain knowledge affects search behavior, but not search effectiveness. In her study of the tactics of medical students searching a factual database in microbiology, Wildemuth (2003) found that the search tactics changed over time as the students' domain knowledge changed. Studies have also shown the effect of domain knowledge on people's ability to choose appropriate search terms (e.g. Vakkari, Pennanen and Serola, 2003; Allen, 1991). Drabenstott (2002) observed that non-domain experts enlist a different set of search strategies compared to domain experts. In their study comparing text searching by students at different times of the year (with accumulating domain knowledge), Symons and Pressley (1993) found that prior knowledge affects text search success. Wildemuth (2003) looks at a few past studies, utilizing domain knowledge. Hsieh-Yee (1993) found that domain knowledge affected the amount of off-line preparation for the search, the amount of time spent monitoring their searches, and the frequency with which the terms were combined. Carmel, Crawford and Chen (1992) found that while domain experts' and novices' general browsing patterns in a hypertext database did not differ, novices used referential links, abandoned topics, selected 'unknown' topics, and examined topics of personal interest more often than experts, and they examined topics related to expert knowledge less often than experts. McDonald and Stevenson (1998) also studied the effects of domain knowledge on hypertext navigation. Bhavani and Bates (2002) used hierarchical goal decomposition to better understand the knowledge required to complete particular search tasks. (Wildemuth, 2003).

Other seeker variables such as *intentionality*[41] (goals, purposes, motivation, etc.), *perception of self* (of own capabilities, health, experiences, knowledge state), *perception of work task/interest*, *cognitive and emotional state* (uncertainty and other emotional states), *problem situation / goal uncertainty* (knowledge gap or ASK and relevance), etc. also play a role in determining the source usage of a seeker.

Information Need.

The task or problem situation gives rise to an information need (which resides in the mind of the seeker and keeps changing – constant only at a specific point in time). This need plays a vital role in the specific knowledge required and sought by the seeker. Information Need has been discussed in detail in Chapter 1 Section 1.1

Let us now look at the second circle in our theoretical framework of elements of context (Figure 22), the elements that make up the circle of shared context.

3.3.3 ELEMENTS OF SHARED CONTEXT

The view of 'personal context' posits that all context is to be seen from the point of view of the seeker or the actor. However, actors are social beings as well who construct information through social interaction and not only inside their heads (Frohmann 2004; Bates 2002; Lievrouw 2001; Audunson 1999; Talja *et al.* 1999; Talja 1997; Tuominen 1997; Tuominen and Savolainen 1997) (Courtright 2007). This

[41] Limberg (1997) has developed the concept of the influence of differing information goals. She found that within the same assignment, the goals of fact-finding, getting a right answer of analyzing and synthesizing resulted in quite different outcomes. Todd's (1997) similar findings developed the companion concept of information intents (Kuhlthau 2005). Information goal might explain the different approaches to information seeking by individuals with the same or similar task.

In a longitudinal study of an information worker comparing novice and expert approaches to work tasks, Kuhlthau (2004) found that the expert had quite different goals in information seeking than the novice. The novice was looking for the right answer. The expert was seeking to add value to the client's knowledge. Here is how this expert in Kuhlthau's study explains the change in his information goal. 'The task has changed from when I first started. It is not to buy or sell but to add value. The best way I can help my more sophisticated client is by adding value to their knowledge base. The young analyst who is not confident in his industry worries about getting the story right. Now my attention is on adding value.' (Kuhlthau 2004, p.171). These information goals result in a very different outcome within the same assignment (Kuhlthau 2005).

is what the shared context view of the Contextual Identity Framework (Figure 18) signifies. In the theoretical framework of elements of context (Figure 22), the elements that best fit within the shared context are *environment*, *work domain or human activity* and the *team* (or *friends/family* in everyday life information seeking).

Environment.

The environment the seeker is surrounded by, and is part of, influences his/her information seeking process and the type of source s/he uses. This environment, which provides the shared context to the seeker, may be of an organizational (most often researched), social, cultural or even systemic/technological nature.

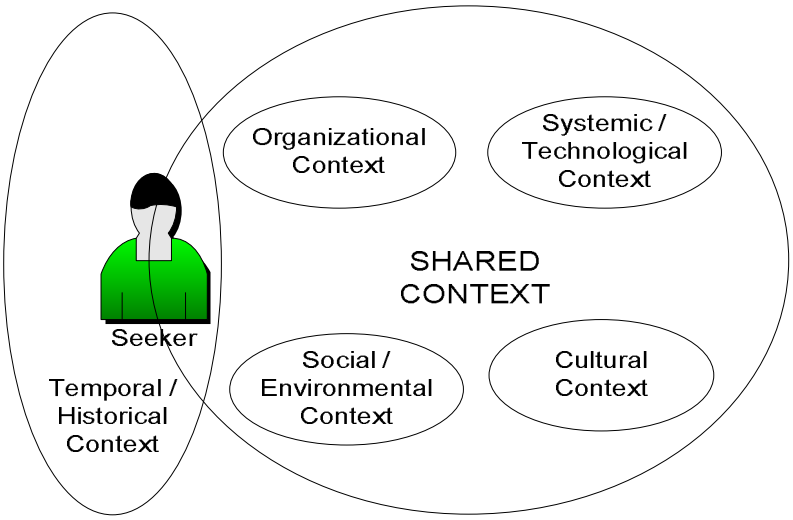

Figure 25 Searcher surrounded by 4 types of shared context

Figure 25 shows a searcher surrounded by one or more of these 4 types of shared context – 1) the organizational context (place where he works), 2) the system/technology that increasingly forms a part of the seeker's context and that s/he interacts with during the search process, 3) the social context s/he is surround with, as well as 4) the cultural context of the seeker. The part of the searcher within the circle of shared context is the one influenced by this shared context. However, the searcher also has a mind of his/her own (personal context). Thus, half of the searcher is shown

to lie outside the shared context. This shared context (organizational/social/cultural/systemic) has a history and also varies with time (represented by a vertical oval in Figure 25). 'Social interaction may instigate [information seeking and retrieval] activities, but may also form part of their fulfillment[42]' (Ingwersen and Jarvelin 2005, p.261).

Table 4 below summarizes different studies done on environmental variables in both workplace as well as everyday life settings (Courtright 2007):

Table 4 Environmental variables studied in workplace / everyday life settings

	Workplace settings	**Everyday life settings**
Rules and Resources	Eskola 2005; Attfield and Dowell 2003; Johnson 2003; Chang and Lee 2001; Seldan 2001; Audunson 1999; Rosenbaum 1993, 1996; Solomon 1997; Taylor 1991	Johnson 2003; Lievrouw and Farb 2003; Lievrouw 2001; Hjorland 2000; Williamson, Schauder and Bow 2000; Green and Davenport 1999; Williamson 1998; Davenport *et al.* 1997; Harris and Dewdney 1994
Culture (strategies, preferences, interests)	Allen and Shoard 2005; Allen and Wilson 2003; Bruce *et al.* 2003; Mackenzie 2003; Widen-Wulff 2003; Sundin 2002; Selden 2001; Mutch 2000; Fabritius 1999; Leckie and Pettigrew 1997; Loughridge 1997; Owens *et al.* 1997	Fisher *et al.* 2004; Meyer 2003; Lievrouw 2001; Sligo and Jameson 2000; Pivec 1998; Savolainen 1995
Social networks or social capital	Mackenzie 2005; Foster 2004; Widen-Wulff 2003; Given 2002; Huotari and Chatman 2001; Selden 2001; Haythornthwaite and Wellman 1998	Courtright 2005; Johnson 2004; Meyer 2003; Hersberger 2001; Lievrouw 2001; Chatman 2000; Sligo and Jameson 2000; Pettigrew 1999
Social norms or social authority	Sundin 2002; Olsson 1999; Solomon 1997	Fisher *et al.* 2004; McKenzie 2003; Sligo and Jameson 2000; Chatman 1999; Savolainen 1999
Collaborative requirement in workplace	Prekop 2002; Talja 2002; Sonnenwald and Pierce 2000; Solomon 1997; Sonnenwald and Lievrouw 1997	

[42] Ingwersen and Jarvelin cite an example (p.264) where the author of an information object e.g. a research paper is influenced by his/her socio-organizational or cultural environment through social interaction. This environment could have included colleagues and friends in the past, the peer community, and presently in the context of his/her utility community i.e. the author's perception of potential (future) readers.

Work domain/Human activity.

Another aspect of shared context that arises out of the environment is the work domain of the actor/seeker or the human activity s/he is engaged in. The situation/task often arises out of this domain or activity and gives rise to information need and information seeking. Courtright (2007) cites various studies on *work domain* or *role*[43], as well as *human activity*[44].

Team (or friends/family).

The people an actor interacts with in a shared context (a team in organizational settings and friends/family in everyday life setting) form part of the actor's shared context. With respect to a team in an organization, variables such as team-size, support, cohesiveness, etc. influence the information seeking behavior of an individual.

After having looked at elements from the personal and shared contexts, let us look at what elements take shape when an interaction between the personal and shared contexts happens.

3.3.4 ELEMENTS FROM INTERACTION BETWEEN PERSONAL AND SHARED CONTEXTS

Problem situation (or Task).

'Information need' can be characterized in various ways (see Chapter 1 Section 1.1 Morrison (1993) classified information need into a) task mastery information need, b) role clarification information need, c) acculturation information need and d) social

[43] Fidel and Pejtersen 2004; Talja, Savolainen and Maula 2004; Torma and Vakkari 2004; Bruce *et al.* 2003; Kari and Savolainen 2003; Talja 2003; Tibar 2000; Audunson 1999; Olsson 1999; Barry 1997; Leckie and Pettigrew 1997; Sonnenwald and Lievrouw 1997; Taylor 1991

[44] Davies and McKenzie 2004; Thivant 2003; Nardi and O'Day 1999; Keane 1999; Solomon 1997

integration information need. Of these, task problem solving is the most common information need (Gerstberger and Allen 1968; O'Reilly 1982; Yitzhaki and Hammershlag 2004; Xu *et al.* 2006).

The interaction of an individual (in personal context) with the elements of a shared context (social/organizational/cultural/systemic environment) gives rise to a problem situation that bring about a need for information in an individual and the subsequent information seeking process from a source. In an everyday-life setting, this situation can be a daily-life task or something of emotional interest or entertainment value to the searcher. In an organizational setting, the variable most often studied (that gives rise to an imposition of information need on the actor) is the *Work Task*.

Information needs and information-seeking processes depend on the task of the user, because the task imposes information requirements that must be met for the task to be completed (Wersig, 1975). For effective information retrieval, tasks or problems that the user brings to the system must be understood (Ingwersen, 1992) (Kim and Allen, 2002). Kim and Allen (2002) cite a number of empirical studies that have supported the premise that user's search performance and/or patterns differ depending on the task. Saracevic and Kantor (1988) have found that the specificity and complexity (*broad* and *specific* questions) of search task have an impact on search performance. Several studies have used task with different levels of specificity to investigate the impact of tasks on search behavior. Marchionini's (1989) *closed* and *open* tasks, Qiu's (1993) *general* and *specific* tasks, Kim's (2000) *topical* and *factual* tasks and Matthews, Lawrence and Ferguson's (1983) *subject* and *known-item* searches.

In the course of promoting a seven-step strategy to web searchers, Pffafenberger (1996) divided tasks based on the amount of information needed for a topic into three

types of questions: 1) *Finding specific information* 2) *Collecting a few sources* of high quality information 3) *Collecting everything on a topic* i.e. conducting an exhaustive search to retrieve all available material.

Spool *et al.* (1999) defined four types of questions: 1) *Simple fact questions*, simplest type with only one correct answer 2) *Judgment questions*, where user must locate as well as analyze potential answers 3) *Comparison of fact questions*, where the user researches two or more questions to arrive at an answer 4) *Comparison of judgment questions*, situations involving comparisons and judgments (Bhavani *et al.*, 2001)

Bhavani *et al.* (2001) come up with a taxonomy (see Table 5) of tasks derived after analyzing 100 email requests.

Table 5 Bhavani et al. (2001) Taxonomy of tasks

What the user requires from the search

What the user knows		**Factual**	**Sample**	**In-depth of Exhaustive**
	Fuzzy or incomplete information	My question is about poetry from the sixteenth century. I think that it was a poem by a guy named Bishop, but I'm not sure; I heard this poem or saying at the end of the movie 'Forces of Nature'…	I am interested in finding out the history of the town of Pomeroy, Washington. Any newspapers, local records, etc. would be helpful.	I am trying to gather information on the cave dwellings of early American Indians in the southwest. I believe the tribe was anasazzi, but not sure.
	Accurate or precise information	I am looking for the amount of gold that is in Fort Knox as well as the amount of gold geologist think is still in the earth.	I need a sound file of the lord's prayer spoken in Danish.	Names of tests used in Washington State to place a child in a higher grade, in elementary school, that his age dictates i.e. Kindergarten aged child into Grade I.

Several studies have bound context closely to Task or Problem Situation (Algon 1997; Kuhlthau 1996, 1997; Hultgren and Limberg 2003; Limberg 1997, 1999) (Courtright

2007). Table 6 lists several of these studies in the workplace and everyday-life settings.

Table 6 Studies of Task or Problem Situation as an element of context

	Workplace settings	**Everyday life settings**
Task or Problem Situation	Zach 2005; Fidel and Pejtersen 2004; Jarvelin and Ingwersen 2004; Pharo 2004; Allen and Wilson 2003; Chang and Lee 2001; Hertzum 2000; Gorman 1999; Algon 1997; Bystrom 1997; Kuhlthau 1996, 1997; Leckie and Pettigrew 1997; Solomon 1997; Bystrom and Jarvelin 1995	Julien and Michels 2004; Rieh 2004; Ikoja-Odango and Ocholla 2003; Johnson 2003; Hersberger 2001; Pettigrew 1999; Sonnenwald 1999; Dervin 1997; Harris and Dewdney 1994

Elements of a work task situation can include natural manifestations, simulated situations, requests for information, pressures (cost, time), domains, goals, information preferences, strategies, pressures, constraints (cost, time), etc.

There can be different aspects to task such as *complexity* and *uncertainty* (Bystrom 2002; Bystrom and Jarvelin 1995; Culnan 1983; O'Reilly 1982), *interdependency* (Campion *et al.* 1993), *non-routineness* (Lawrence and Lorsch 1967), *intellectual demand* (Gray and Meister 2004) and *task importance* (Xu *et al.* 2006). Table 7 summarizes the important Task variables that have been studied:

Table 7 Task Variables

Complexity	Bystrom's empirical research (Bystrom 1997, 2000; Bystrom and Jarvelin 1995) concludes that perceived task complexity is the principal determinant of information sources and the number of sources consulted (Courtright 2007). Task complexity (Ingwersen and Jarvelin 2005, p.287-288) may vary depending on the type of task, such as – 1) automatic/routine tasks of information processing 2) normal tasks – of information processing or decision nature or 3) genuine tasks – genuine but known decision, or genuine unknown decisions
Uncertainty	Task uncertainty has been defined as routines or standardization of the task (O'Reilly 1982), amount of information the seeker has (Ashford 1986), anxiety and feeling of being overwhelmed (Kuhlthau 1999), lack of predictability, lack of information, and uncertain sources (Anderson *et al.* 2001) (Xu *et al.* 2006).
Interdependency	The amount of required interaction with coworkers establishes how interdependent (Campion *et al.* 1993) the work is (Gray and Meister

	2004). Higher levels of interdependence will increase the cognitive load associated with a job, and thus increase its perceived intellectual demands (Gray and Meister 2004).
Non-routineness	The degree to which an individual's work is free from stable, repetitive processes determines the degree to which it is non-routine (Lawrence and Lorsch 1967). Higher levels of non-routineness will increase the cognitive load associated with a job, and thus increase its perceived intellectual demands (Gray and Meister 2004).
Intellectual Demand	"Ignorance is not simply a lack of information but also an inability to use the information that is available. This inability depends on the difficulty, or ease, of information transfer" (Roberts and Dietrich 1999, p.984). A job's intellectual demands can be defined as "the normal cognitive load perceived by individuals in performing their work" (Gray and Meister 2004, p.824). Knowles *et al.* (1998) put forth that adults need to know the reason to learn something, and that people are ready to learn something when it will help them cope with real-life tasks or problems (Knowles 1980). Work that is highly intellectually demanding produces a greater need for knowledge and triggers learning behaviors (Gray and Meister 2004).

Let us know look at the elements from interaction between personal context, shared context and context stereotype.

3.3.5 ELEMENTS OF INTERACTION BETWEEN THE THREE VIEWS OF CONTEXT

Information required.

The interaction between elements of the personal context and shared context gives rise to a problem situation, and a subsequent need for information in the actor's mind. Based on this information need, the actor approaches an information source (personal or impersonal) to get the required information to handle the problem situation or task. In the theoretical framework of context (Figure 22), source is positioned under context stereotype because the source is often viewed different from the seeker[45]. However, if the source is close to the person (for personal sources) or if the person is

[45] Krikelas (1983), however, classifies information sources as 'internal' and 'external' to the searcher. External sources can consist of direct (interpersonal) contact or recorded (literature). The internal (signifying that which resides within a person) source consists either of 'memory' or 'direct (structured) observations'. Our notion of information sources in this study maps to the 'external' information sources of Krikelas' (1983) model (see Figure 7 in 2.3).

familiar and comfortable with an impersonal source, then the source becomes part of the person's shared context. Thus, since the 'information required' is an outcome of the interaction between the personal context and the shared context, and seeks fulfillment from a source in the context stereotype, it is placed at the point of intersection of personal context, shared context and context stereotype in the theoretical framework of elements of context (Figure 22).

A number of variables associated with the information required have been studied by past researchers. Based on Winter (1987), Roberts and Dietrich (1999) suggest that the difficulties or costs of transferring information is a function of 3 major factors – the *tacitness* of information, the *observability* of information and the *systemic*[46] *nature* of the information. Tacitness of knowledge required (discussed in Chapter 4) is the most representative among the attributes of information, with a direct bearing on the use of one or more information sources. However, since tacitness of knowledge required is very similar to task complexity, we dropped it in favor of the latter in our empirical survey study described in Chapter 4.

The other two factors from information sought by the seeker are summarized below.

Table 8 Factors of information required

Systemic nature	Systemic nature of information is the extent to which an element of information is independent or part of a system. This has obvious relevance to when expert advice is sought (Roberts and Dietrich 1999). The systemic nature of information is related to task interdependency (see Table 7).
Observability	Observability of information involves the extent of disclosure of underlying information that is made necessary by its use (Roberts and Dietrich 1999). Roberts and Dietrich highlight that secrecy, monopoly control and professional autonomy in an organization have the effect that observability is not present.

[46] affecting an entire system (WordNet 3.0 2006)

Let us now look at the factors that would result when personal context interacts with either contextual stereotype or with the shared context.

3.3.6 ELEMENTS OF INTERACTION BETWEEN PERSONAL AND STEREOTYPE/SHARED CONTEXTS

Interaction / session / temporal.

There is a context associated with the actual interaction (or session) between the seeker and the source, during the process of information seeking. Factors such as time of interaction, place of interaction and the history of past interaction all have a bearing upon the information seeking process.

Let us now look at the elements from interaction between the shared context and context stereotype.

3.3.7 ELEMENTS OF INTERACTION BETWEEN SHARED AND STEREOTYPE CONTEXTS

Seeker-Source Relationship (Source cost).

The degree of success in the process of a seeker getting information from a source depends to a large extent on the relationship shared by the seeker and the interpersonal source i.e. the cost incurred by the seeker in getting the information out of the source. In terms of the Contextual Identity Framework (Figure 18), it depends on the extent to which the source is part of the shared context of the seeker. If the seeker is not comfortable with the source, then s/he would view him in the circle of context stereotype. If the seeker is very comfortable with the source, then s/he might see him as part of his/her shared context. The relationship may be seen as continuum. This implies that the seeker might place a particular source in between the two circles

of context stereotype and shared context. To highlight this interaction, the theoretical framework of elements of context (Figure 22) shows this relationship placed in the intersection between shared context and context stereotype.

For human or interpersonal sources, the seeker-source relationship has been found important in a number of studies (e.g. Ashford 1986; Miller and Jablin 1991; Pettigrew, Fidel and Bruce 2001). There can be different aspects to this relationship such as *social risk* e.g. embarrassment, loss of face, revelation of incompetence (Ashford 1986) or *social benefit* (e.g. relationship building, making an impression) and other factors such as *willingness to share* and *level of closeness*.

For impersonal sources such as library or search engines, factors that help determine whether the seeker sees the source as part of his/her shared context can be *ease of information extraction*, *comfort level in using the system*, etc. The searcher's *system-knowledge*[47] will also determine his/her level of comfort in using an impersonal source such as an online search engine or a knowledge repository. Dimitroff (1992) operationalized system-knowledge as the user's mental model of the information system, made up of eight components (e.g. contents of database, Boolean search capability, etc.). Hoelscher and Strube (1999) focused on Web expertise, defined 'as a type of media competence' (p.305) (Wildemuth, 2003).

The next section looks at the elements of context stereotype (or shared context)

[47] searcher's familiarity/expertise with the Information System and searching techniques

3.3.8 ELEMENTS OF CONTEXT STEREOTYPE (OR SHARED CONTEXT)

Source / channel.

As discussed above, the seeker may see the source as belonging to a context stereotype (not part of his/her in-group) or within his/her shared context depending on the relationship (or system familiarity) the seeker has with the source. Under general circumstances, this source is an external element and placed under context stereotype in Figure 22. It is only the closeness of the relationship shared by the seeker with the source that might pull the source within the shared context of the seeker. This is different from the placement of the environment, which surrounds the seeker (the seeker is situated in the environment), and is thus part of the seeker's shared context.

Christensen and Bailey (1997) define *information source* as a repository that can provide knowledge or information. Xu *et al.* (2006) define sources as carriers of information, a definition implicitly assumed in past studies (e.g. Chakrabarti *et al.* 1983, Kuhlthau 1999, Morrison and Vancouver 2000 and O'Reilly 1982). Xu *et al.* differentiate between an information source, information content and a channel. The same content or information can be available from multiple sources, and a specific source can provide different types of information. One source can also be better in providing one type of content compared to another type. While past studies have used the terms *channel* and *source* synonymously (Gerstberger and Allen 1968; Hardy 1982; Swanson 1987; Bystrom and Jarvelin 1995; Case 2002), we will adopt Xu *et al.* (2006)'s definition of channel as the mode-of-communication in the way content is delivered from source to receiver e.g. face-to-face, phone, email, etc. (as Daft and Lengel (1986) have discussed in their media richness theory). Zimmer, Henry and Butler (2008) look at the concepts of uncertainty (absence of information) and

equivocality (multiple interpretations of available information) and posit that 'uncertainty affects *what* information is sought (source selection) and equivocality affects *how* that information is sought (media [or channel] selection)' (p.300).

Impersonal sources increasingly have systemic/technology components (e.g. search engines, digital libraries, etc.). These might consist of systemic and interactive features and information objects. *Information Objects* deal with knowledge representation, thesaural nets and full contents/structures. *Interfaces* have functions with interactive features. The *information technology (IT)* components consist of retrieval engines, database architecture, indexing algorithms and computational logics (Ingwersen and Jarvelin 2005). In Chapter 4 we discuss the classification of source types used in the survey study.

In this section, we have attempted to map the different variables/elements of context studied in information behavior to the three views of context (and their interactions) arrived at in the Contextual Identity Framework (Figure 18). We also discussed our reasons for the mapping and summarized the past research studies on the various elements of context. By doing this mapping, we hope to have taken the first step towards answering Nick Belkin's question: 'What aspects of your concept of context are *essential*, *important*, *interesting* and *unnecessary* for understanding and supporting human interaction with information?' (Ingwersen, Ruthven and Belkin 2007).

In the next chapter, based on the Contextual Identity Framework and the Theoretical framework of Elements of context (Figure 22) arrived at, we come up with a research model and hypotheses for a survey study.

CHAPTER 4 EMPIRICAL RESEARCH MODEL AND HYPOTHESES

We now move from a theoretical focus to an empirical focus. Based on the two theoretical models of context arrived at, we design a study for a context-based investigation into source use by information seekers. In this chapter, we come up with an empirical research model and arrive at hypothesis. In Chapter 5, Chapter 5 we design a survey study and describe the data collection and analysis. Findings from the survey are discussed in Chapter 6, along with implications for research and practice. Let us now concentrate on the variables that will be part of our survey study.

Figure 26 shows the variables from the 'theoretical framework of the elements of context' (3.3 Figure 22) that will be incorporated in the empirical research study. While various studies have looked at different variables to study source usage, the variables below were chosen because of their degree of importance in helping disambiguate the relative importance of source quality and cost in the use of an information source. This was also made necessary to contribute to the parsimony of

the research model and to try and keep the survey study manageable. 'Typically, the cost of acquiring full context is simply too high, compared to the benefits, let alone possible privacy issues' (Hawking *et al.*, 2005).

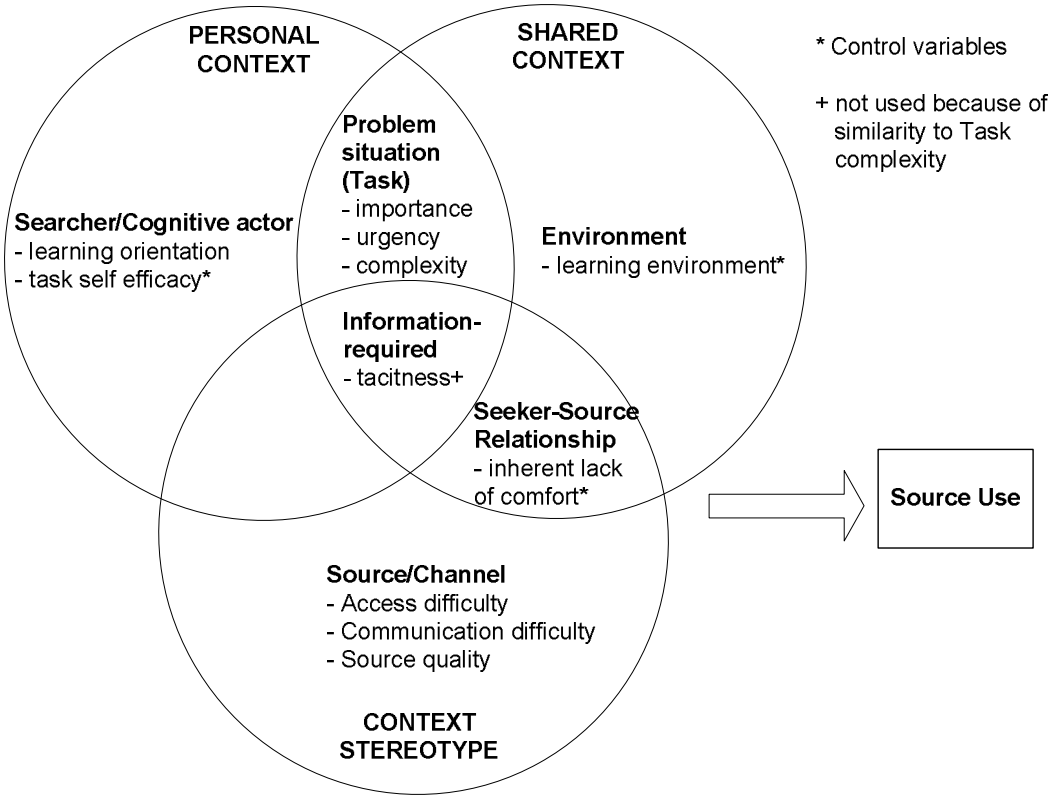

Figure 26 Elements from the context framework incorporated for survey study

From the variables above, the searcher's task self efficacy, the learning environment and inherent lack of comfort will be incorporated as control variables (along with other control variables detailed in Table 9 in the next section). Tacitness of required information will be dropped in favor of task complexity because of the similarity between the two (the only difference is that tasks complexity works at a higher level, while tacitness is more specific to the particular piece of information required in a particular session). Let us now look at the empirical research model arrived at.

4.1 Research Model and Hypotheses

Figure 27 shows the research model. Using the model, we will investigate the contribution of source/channel cost (access difficulty / communication difficulty) or source quality towards a searcher's use of one or more information sources, taking contextual variables of seeker, and task into account. Variable from the environment will be used as control variable.

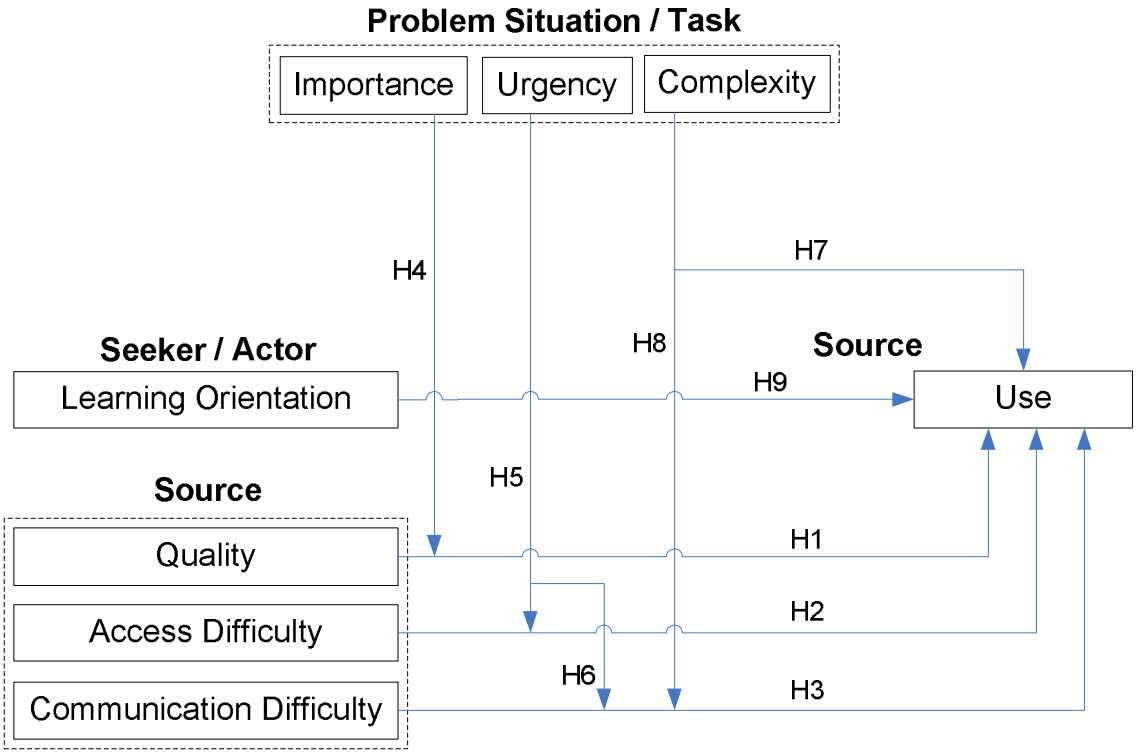

Figure 27 Research Model

Table 9 shows the variables that have been incorporated in the research model, the type of variable (dependent, independent, mediating or moderating), the contextual element each variable pertains to (source, channel, seeker or situation/task), the view of context as per the Contextual Identity Framework of Figure 18 (personal context, shared context, context stereotype or their interactions) and the hypotheses they form. Control variables that are not included in the research model, but studied nevertheless,

are also included in Table 9. In the 'context view' column, '/' represents 'OR' while ',' represents interaction or overlapping contexts. E.g. source quality can lie within one of the two views of context stereotype or shared context (depending on the level of sharedness the seeker feels with the source). Task complexity, on the other hand, is an attribute of task (or problem situation) that belongs to a context view arising out of the interaction between personal context and shared context (represented by a comma). Since context is dynamic and depends on individuals and relationship between source and seeker, a question can be asked as to how we can predetermine the type of context. The placing of a variable in a particular context view is only a 'most likely' scenario. The fluid nature of context prevents us from making any hard-walled placements in a particular context view.

Table 9 Variables

Variable type	**Variable name**	**Contextual element pertaining to**	**Context View**	**Hypotheses**
Dependent	**Source Use (USE)**	Source	context stereotype / shared context	H1, H2, H3, H4, H5, H6, H7
Independent	**Source Quality (QUA)**			H1
	Communication Difficulty (CMM)			H3
	Access Difficulty (ACC)	Source/Channel		H2
	Task Complexity (CMP)	Situation / Task	personal context, shared context	H6
	Learning Orientation (ORT)	Seeker / Actor	personal context	H7

Independent/ Moderator	**Task Importance (IMP)**	Situation / Task	personal context, shared context	H4, H8
	Task Urgency (URG)			H5, H9, H10
Control	Learning Environment (ENV)	Environment	shared context	Not applicable
	Team size			
	Tenure in work role/position	Seeker / Actor	personal context, shared context	
	Task Self Efficacy (EFF)	Seeker / Actor	personal context	
	Gender			
	Age			
	Education			
	Inherent Lack of Comfort (CFT)	Seeker, Source	context stereotype, shared context	

In the literature review below, we discuss the variables of Table 9, while also arriving at the hypotheses incorporated in the research model of Figure 27. Since tacitness of required information (pertaining to the interaction between the personal context, shared context and context stereotype in Figure 22) is very similar to the complexity of the task or problem situation, we will not include it our research model (in favor of task complexity, which is at a higher level, as opposed to the information required at a particular instance). Variables pertaining to the time, place and history of interaction will not be included as well, as they're more suited to an experiment or think-aloud research methodology (as opposed to the survey research methodology we're adopting in this study). We will first look at the source variables. This will be followed by variables pertaining to the problem situation or task. Seeker (or actor)

variables will be covered in Section 4.4 The final two sections in this chapter will cover variables pertaining to environment, and the seeker/source relationship respectively.

Let us now look at the variables pertaining to the source[48]. Since we've classified source under context stereotype or shared context (depending on the degree of closeness the seeker feels with the source), all source variables will fall under context stereotype or shared context in our theoretical model (of elements of context) of Figure 22.

4.2 Source Variables

Before we look at the source variables, it is important to arrive at a classification for the different source types to be incorporated in this study.

4.2.1 TYPES OF SOURCES

Sources can be categorized as 1) [*inter*]*personal*[49] or relational (e.g. Rulke *et al.* 2000) or human (colleagues, friends, supervisor, internal and external experts, etc.) and 2) *impersonal* or non-relational (e.g. Rulke *et al.* 2000) or non-human (documents, manuals, journals, books, libraries, electronic repositories, digital libraries, Google search, etc.). A recent study by Zimmer, Henry and Butler (2008) has also classified sources as relational (interpersonal) and non-relational (impersonal) and studied their

[48] The variable 'access difficulty' pertains to the channel as well. The distinction between channel and source has been discussed in Section 0in 3.3

[49] The term 'personal' signifies ownership. Since we can rarely *own* human information sources, the term '*interpersonal* sources' is more appropriate and has been used in this study.

determinants. Past studies have consistently shown that people (following the least effort principle) prefer interpersonal sources over impersonal sources[50].

Knowledge could also reside within an organization (internal) or outside its boundaries (external[51]). Choo (1994), Kuhlthau (1999) and Xu *et al.* (2006) classify information sources into *internal [inter]personal, external [inter]personal, internal impersonal and external impersonal.* However, there are other classifications as well. Gray and Meister (2004) distinguish between dyadic information sourcing (dialogue between one seeker and one source), published information sourcing (one published source read by many seekers) and group information sourcing (many sources exchanging information with many seekers). Binz-Scharf and Lazer (2006) include a table (p.12245) classifying information sources. We add a column to it (see Table 10 below) to include the classification by Choo (1994), Kuhlthau (1999) and Xu *et al.* (2006).

Table 10 Classification of Information Sources

Binz-Scharf and Lazer (2006)			**Classification as per Choo (1994), Kuhlthau (1999) & Xu *et al.* (2006)**
Source	**Interaction features**	**Considerations for usage**	
Search engines	Anonymous	Quality control through linking process	External Impersonal
Professional websites	Anonymous	Established practice; Helpful in directed search	External Impersonal
Listserver	One-to-many; Asynchronous	Fast answers because of large n; Prestige versus embarrassment	External Interpersonal
E-mail	One-to-one; Asynchronous	Pre-existing relationship important; Easy to evade	Internal/External Interpersonal
Print publications	Anonymous	Peer-reviewed; Relatively hard to	External Impersonal

[50] See Gerstberger and Allen 1968; Chen and Hernon 1982; Hardy 1982; Chakrabarti *et al.* 1983; Choo 1994; Hertzum and Pejtersen 2000; Bystrom 2002; Yitzhaki and Hammershlag 2004

[51] See Choo 1994; Bystrom and Jarvelin 1995 for studies on knowledge residing outside organizational boundaries

		search	
Phone	One-to-one; Synchronous	Pre-existing relationship important; Relatively easy to evade	Internal/External Interpersonal
Face-to-face	One-to-one; Synchronous	Pre-existing relationship important; Very difficult to evade	Internal/External Interpersonal

In this study, we focus more on the interpersonal-impersonal dimension as opposed to internal-external. Zimmer and Henry (2007), in their exploratory study, found that differences in antecedents of interpersonal (relational) and impersonal (non-relational) source use exist. However, they also found that knowledge bases appear to behave as personal sources. As information technology has blurred the line between interpersonal and impersonal sources (Zimmer and Henry 2007), we first classify the sources into the following six types in this study, which also takes the channel or mode of communication into account (see Table 11):

Table 11 Initial classification of sources

SNo	Source	Description	Examples
a.	Interpersonal-face-to-face	Interpersonal source through face-to-face/direct meeting	People, colleagues, friends
b.	Interpersonal-phone	Interpersonal source through phone (voice only)	Landline/mobile
c.	Interpersonal-electronic-synchronous	Interpersonal source through electronic/online means where an instant response is expected	Video/voice/chat (e.g. video conferencing, Skype/yahoo with audio/video, 3G phones with video, etc.) Voice/chat only (e.g. skype/yahoo/Google talk/MSN Messenger, etc. without webcam) Chat/Instant Messaging

d.	Interpersonal-electronic-asynchronous	Interpersonal source through electronic/online means where an instant response is NOT expected	Email Messaging in social networking websites (Orkut, Facebook, Friendster, etc.) Forums/blogs (posting queries in specialized forums)
e.	Impersonal-physical	Physically accessing impersonal sources	Books (from the library) Hard copies of Journals/conference proceedings Hard copies of Manuals/reports
f.	Impersonal-electronic	When one is not directly reaching out to a person online but is accessing electronic/soft copies or online resources	Web search engines (Google, Yahoo, Live search, etc.) Professional websites (company websites, Wikipedia, etc.) Online/soft copies of journals/ conference proceedings/ books/ manual/ reports Finding answers in pre-posted entries in forums/blogs

In Table 11, three dimensions of classification of information sources/channels have been used 1) interpersonal-impersonal 2) physical-electronic 3) synchronous-asynchronous, where the first two relate more to the source, while synchronous-asynchronous relates to the channel of communication, and applies only to interpersonal sources. Based on this initial classification and these three dimensions, we arrive at five source types in Table 12 in our final classification for the survey study.

Table 12 Classification of Source/Channel Types in the survey study

SNo	Source/ Channel Type	Description
1.	**Face-to-face**	Meeting a person face to face (people, colleagues, friends)
2.	**Phone / Online Chat**	Calling a person using landline/mobile or reaching out to a person through online voice/video/chat/instant messaging (Skype, Yahoo/MSN messenger, Google talk, etc.)

3.	**Email / Online Forums**	Reaching out to a person through email, messaging in social networking websites (Friendster, Facebook, Orkut, etc.) or through online forums/blogs (posting queries in specialized forums).
4.	**Book / Manual**	Physically accessing books (from the library, company, etc.), magazines, hard copies of manuals, reports, journal/conference proceedings, printouts, etc.
5.	**Online Information**	Electronic/online sources of information such as web search engines (Google, Yahoo, Live search, etc.), online knowledge bases, professional websites (company websites, Wikipedia, etc.), electronic/soft copies of journals/conference proceedings/books/manuals/reports, finding answers in pre-posted entries in forums/blogs, etc.

Figure 28 shows the five chosen source/channel types classified as per the dimensions of interpersonal-impersonal, physical-electronic and synchronous-asynchronous.

Face-to-face is classified as interpersonal-physical-synchronous. An interpersonal-physical-asynchronous dimension (i.e. where a person is present but is not respond to a query immediately) doesn't make sense in general day-to-day settings[52] and has been excluded.

Phone and online chat have been clubbed together as a channel type because they fall under the same dimension of interpersonal-electronic-synchronous. When you ask a query to a person over the phone or chat, you can expect an instant reply. In both the cases, the person is not physically present before you. Phone has been classified as an electronic channel because of the prevalence of digital and Voice-over-IP phones and voice chats using Skype, Google Talk, etc.

[52] This dimension is possible in certain rare cases e.g. when a celebrity is present on stage and invites questions from the audience to be written on chits of paper and passed on to him/her. The celebrity then chooses a few chits and then responds to those questions during this talk. This could be considered an asynchronous form of answering questions even when the person answering is present physically. But as opposed to 'face-to-face', here, the person (interpersonal source) is 'on stage'. Snail mail or a letter sent through the postal system might also be considered an example of the interpersonal-physical-asynchronous dimension.

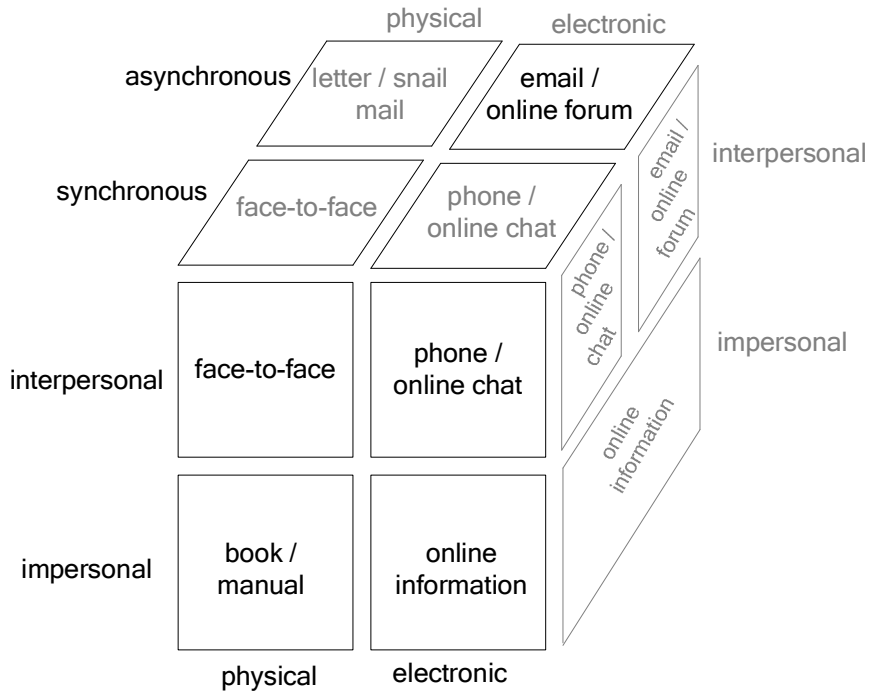

Figure 28 Classification of source/channel types along dimensions

Table 13 shows the simplified view of the source/channel types along dimensions.

Table 13 Simplified view of source/channel types along dimensions

	Physical		**Electronic**	
	Synchronous	**Asynchronous**	**Synchronous**	**Asynchronous**
Interpersonal	Face-to-face	Letter / snail mail	Phone / online chat	Email / online forum
Impersonal	Book / manual		Online information	

Both email and online forums[53] provide asynchronous channels of communication to the information seeker where a user has to post a query and wait for a response. They are thus classified under the dimension interpersonal-electronic-asynchronous.

For impersonal sources, the classification of synchronous and asynchronous channels of communication doesn't really make sense. There is no easy answer to whether you get an immediate response from a book or not. For online sources, a query using a

[53] A query sent in the form of a SMS (short message service) using a mobile phone also uses an asynchronous channel of communication.

search engine may be considered to be synchronous (there is an immediate response) but it depends on the speed of the internet connection, as well the search engine under use. For other forms of online information e.g. an e-book, a digital repository, website, etc., we cannot easily answer whether they give an immediate response (synchronous) upon querying or not. We will thus classify impersonal sources in the physical-electronic dimension only.

Thus, books and manuals are classified as impersonal-physical, while any type of online source of information is classified as impersonal-electronic.

It is important to distinguish between source (or channel) types and sources (or channels). Some past studies in source usage have muddled this distinction e.g. in a recent study, Zimmer, Henry and Butler (2008) ask for survey responses like "The information I get from [information source] is clear in meaning" (p.331), where 'information source' could be one of these eight – printed media, static internet, dynamic internet, knowledge bases, supervisor, department coworkers, other coworkers and others outside the organization. However, all these are 'types of information sources' and not 'information sources'. When a survey respondent answers a question, he doesn't know e.g. which printed media is being spoken about. A specific book that the person read (a particular information source) might be clear in meaning but another book s/he borrowed from a friend (another 'information source', but same 'type of information source') may not be clear in meaning. Thus, while the responses may apply to different types of sources, they do not apply to different sources as the authors of this study conclude.

We resolve this problem in our study by asking the respondent to think of a *typical* source of information for each of the 5 types of sources/channels. Figure 29 shows a

snippet from our survey questionnaire (discussed in the next chapter and attached in Appendix C) where the survey respondent chooses a typical source of information.

To get information to solve the above **specific problem/part of the task**, think of **a typical source of information** for each of the following types of sources. If you happen to choose the same person for Q37-39, think of the difference in meeting the person face-to-face, reaching through phone/chat and through email/forum/blog.

Type of source	Specify name or nickname
37. The person with whom you would typically (or could) discuss this problem **face to face** e.g. Mr. A	(MyFace2FaceSource)
38. The person with whom you would typically (or could) discuss this problem on **phone or online chat** e.g. Miss B (or Mr. A on phone)	(MyPhone/ChatSource)
39. Typical person to **email** or **post online queries** about the problem e.g. Mr. C (or Mr. A on email), or Mr. D in an online forum	(MyEmail/ForumSource)
40. Typical **book/manual/report** to help in the problem e.g. Book-A	(MyBook/Manual)
41. Typical **online/electronic** information source to help in the problem e.g. Google, company digital library, intranet, etc.	(MyOnlineInfoSource)

Figure 29 Classification of source types along dimensions

Let us now look at the variables pertaining to the information source, incorporated in our empirical research model of Figure 27. In our model, three variables belong to the information source. These are 1) source use (dependent variable), source quality and communication difficulty with the source. A fourth variable, access difficulty is more a reflection of the channel. Let us look at each of these source variables.

4.2.2 SOURCE USE

Prior studies have used different dependent variables for source use E.g. Xu *et al.* (2006) use 'preference' as a dependent variable for source choice and define it as a measure of a source's relative quality among all sources and one's preference to use and one's dependence on it. Other qualitative studies (e.g. O'Reilly 1982; Morrison and Vancouver 2000) have used frequency of information seeking from a specific source as a dependent variable. Zimmer, Henry and Butler (2008) have two items for dependent variable – one for frequency of use, and the other for percentage of time spent using a particular source, in relation to other sources.

In this study, our dependent variable is 'source use'. We opt for use, as opposed to preference or choice, because it is a more objective measure based on past usage (where as preference would call for a response based on a hypothetical future use). Furthermore, we study different aspects or dimensions of use – perceptual (perceived frequency of use) as well as behavioral (frequency of use; percentage of use or most used; order of use or first used).

4.2.3 SOURCE QUALITY

Source quality pertains to the benefit aspect of the cost-benefit evaluation of an information source. Different researchers have identified different dimensions of source quality (e.g. Zmud 1978; Low and Mohr 2001; McKinney, Yoon and Zahedi 2002) of source quality. This dimensions have included accuracy, relevance, specificity, reliability and timeliness (O'Reilly 1982); expertise of interpersonal sources (Vancouver and Morrison 1995); reliability, precision, timeliness, comprehensiveness and conciseness (Swanson 1987); topicality, novelty, understandability, scope and reliability (Xu and Chen 2006); reliability, relevance, scope and novelty of information content the source carries (Xu *et al.* 2006). In this study, we define source quality as the novelty, reliability, breadth and depth of information content the source carries that has applicability and relevance to the task at hand.

While individuals do not always use the highest quality information available, the amount of faith placed in the information is related to how the user perceives its quality (Allen 1984). Information quality has been shown to determine information system use (Goodhue and Thompson 1995; Wixom and Todd 2005). Sources providing understandable, reliable and useful information are expected to be used

more often than sources providing information of lower quality (O'Reilly 1982). Given equal levels of accessibility, individuals prefer higher quality sources (Gerstenberger and Allen 1968; Allen 1984) (Zimmer and Henry 2007). Source quality affects the persuasive effect of knowledge on decision-making (Zimmer *et al.* 2008). This finding holds irrespective of whether the seeker is using a knowledge management system [an impersonal source] or reaching out to a knowledge broker such as a consultant [an interpersonal source] (Ko, Kirsch and King 2005; Zimmer *et al.* 2008). An important objective of information seeking is to reduce uncertainty (Ashford 1986; Miller and Jablin 1991; Vancouver and Morrison 1995; Morrison 2002) and improve task competence (VandeWalle *et al.* 2000; Tan and Zhao 2003). A source is, therefore preferred when it offers quality information (Xu *et al.* 2006). Economic research puts forth that people continue searching when perceived marginal benefit exceeds marginal cost, until the two are equal (Stigler 1961). This can also be explained by the information foraging theory which says that one explores an information source until marginal return is lower than average return in the environment (Pirolli and Card 1999). This has also been supported empirically by studies such as Ashford (1986) and Morrison and Vancouver (2000). The latter study found source expertise to have more weight than accessibility when choosing among five information sources. We thus, hypothesize:

H1: The perceived quality of an information source positively affects the use of that source.

4.2.4 ACCESS DIFFICULTY

Under access difficulty (or access cost), we consider the time and effort required, and the difficulty encountered (or the cost incurred) in accessing (*reaching*) a particular

information source i.e. establishing the channel of communication with the source. Access difficulty, or lack of source accessibility, is one of the cost factors in the cost-benefit framework in the choice of information source. Fidel and Green (2004), in their interviews with 32 engineers, found 19 aspects mentioned under the general term of source accessibility, highlighting that information seekers themselves are unclear about what access cost is.

Accessibility has been studied from several perspectives such as physical distance or *physical proximity* (cost pertaining to access to the source – Gerstenberger and Allen 1968; Chakrabarti *et al.* 1983; Culnan 1983; McCreadie and Rice 1999; Fidel and Green 2004; Xu *et al.* 2006), social and cognitive availability (e.g. Zmud *et al.* 1990; Zimmer and Henry 2007) or *understandability* (which we see as source cost, rather than the cost of accessing the source). Past literature (e.g. Chakrabarti *et al.* 1983; Fidel and Green 2004) has also considered availability of source as one of the dimensions of accessibility, but it should be considered a prerequisite for source evaluation (Xu *et al.* 2006). Zimmer, Henry and Butler (2008) make an important point that access to technology is not the same as access to information. In arguing that accessibility is perceptual and not physical, they say that 'accessible sources are not only those that can be reached but also those that are dependable and convenient' (p.302). Through this statement, Zimmer *at al.* club the dimensions of physical access, dependability and convenience under the general definition of accessibility. However, in this study, we define access difficulty as the time and effort required, and the difficulty encountered in *reaching* a particular information source. Thus, it is a property of the channel – be it physical (e.g. face to face, book), electronic (e.g. website, search engine, forum), synchronous (e.g. phone or chat) or asynchronous (e.g. email or forum). Communication difficulty with the source (described in the next

section) and inherent lack of comfort with the source (included as a control variable[54]) are cost factors encountered *after* reaching the source i.e. once access has been gained, and are thus, studied separately.

According to the least effort principle, source accessibility is a dominant factor in source selection, while quality plays a minor role (Gerstberger and Allen 1968; Kwasitsu 2003; Yitzhaki and Hammershlag 2004). To answer why seekers consider accessibility before source quality, O'Reilly (1982) argued that the value of information is inherently ambiguous in the seeking process, thus seekers don't worry too much about quality. Another aspect argued was time pressure driving people to the most convenient source. Orr (1970) and Swanson (1987) attributed the insignificance of quality to lack of variance in source quality in past studies. Later studies involving studies of different quality (Chakrabarti *et al.* 1983; Hertzum and Pejtersen 2000; Anderson *et al.* 2001; Yitzhaki and Hammershlag 2004) still found support for the least effort principle (Xu *et al.* 2006).

The hypothesis follows naturally from the least effort principle (people will want to exert less effort in gaining access to a source) and the cost-benefit framework (Hardy, 1982) where people will want to minimize the cost associated with using information, which has been characterized as the effort expended in gaining access to information (Gerstberger and Allen 1968).

H2: The difficulty in accessing an information source negatively affects the use of that source.

[54] Inherent lack of comfort is a variable of the seeker-source relationship and is described in Section 4.6

4.2.5 COMMUNICATION DIFFICULTY

Apart from *accessibility* or *access cost* covered in the previous section, there could be various other costs associated with a source, such as communication difficulty (covered here) or *social risk* with interpersonal sources (covered in Section 4.6.1). Other factors such as *ease of information extraction* (also called 'ease of use') might be important for impersonal sources such as computerized systems, but are not applicable to interpersonal sources (Hardy 1982; Chakrabarti *et al.* 1983; Culnan 1985). Cost may pertain to both information content (*understandability* - Swanson 1987; Xu and Chen 2006; Xu *et al.* 2006), as well as the source that carries that content (Xu *et al.* 2006).

The difficulty the seeker faces in communicating with the source (after the seeker has reached the source i.e. gained access to the source) is one of the cost factors in the cost-benefit calculation of the seeker when deciding to use a source. *Immediacy of feedback* (or *synchronicity*) is also part of communication difficulty, and may apply to both interpersonal and impersonal sources/channels. *Immediacy of feedback* is the ability of the source/channel to support rapid bidirectional communication (Dennis and Valacich 1999). In other words, it is the interactivity (or ability to converse) between the seeker and the impersonal/interpersonal source. When feedback is high, Dennis and Valacich term it a condition of high *synchronicity*. Such rapid, bidirectional communication is possible only when there is sufficient ease of interaction and very little communication difficulty between the seeker and the source.

Thus, if the "conversation" with the source is painful or difficult, or if it is difficult to make the source understand or to extract useful information from it, then it is not

likely to appeal to a seeker for use. Since communication difficulty is a cost to the seeker in his cost-benefit calculation (Hardy 1982) and since individuals tend to minimize the cost, and potential loss, associated with using information (Gerstberger and Allen 1968), we, therefore, hypothesize:

H3: The difficulty in communicating with an information source negatively affects the use of that source.

After looking at the variables associated with the source, let us look at the variables associated with the task or the problem situation.

4.3 Problem Situation / Task Variables

In studying the 'task' (when studying organizational information seeking) or the 'problem situation' (when studying everyday life information seeking), we look at three variables – importance, urgency and complexity of the task or problem situation.

4.3.1 IMPORTANCE OF THE TASK / PROBLEM SITUATION

Based on the elaboration likelihood model in psychology (Petty and Cacioppo 1986, who term task importance as 'personal relevance'), task importance can potentially modify the cost-benefit calculation in source choices (Xu *et al.* 2006). Xu *et al.* define task importance as the importance of the outcome of the task to the seeker's well-being. The elaboration likelihood model posits that the effort spent on information processing is affected by the personal relevance of the information processing task. If people are encouraged to evaluate the content of the information, they are more likely to base their judgment on the merit of the content of the information (called the central route of processing). Conversely, if people are unwilling or unable to process a piece of information, they will devote less cognitive capacity to it, and the judgment

will be based more on peripheral cues, as opposed to the central route. The elaboration likelihood model has been shown to be applicable to information seeking (Posavac and Herzenstein 2003; Cho and Boster 2005; Xu *et al.* 2006). Thus, if a seeker considers a task or problem situation as important, s/he will be more willing to incur physical and cognitive cost, as well as social risk to solve the problem. Such a seeker is likely to take pains to get quality information from a source. Thus, quality of the source would be important to such a seeker. We, thus, hypothesize:

H4: The positive effect of the quality of an information source on the use of the source is higher when the task is more important to the seeker, compared to when the task is less important.

4.3.2 URGENCY OF THE TASK / PROBLEM SITUATION

Urgent tasks are those tasks that need to be accomplished sooner than later. There is a deadline associated with such tasks, and a need to be answerable to some party (a colleague, a superior or an external party). Depending on available/allocated time, urgent tasks are, thus, accorded high priority by the actor/seeker as compared to other tasks. Freed (1998) defines *task urgency* as the expected time available to complete the task before a specific, undesirable consequence occurs (which would occur if the task were to be deferred for too long). This differs from *task importance*, which quantifies the undesirability of the specific, undesirable consequence occurring (Freed 1998). Freed gives an everyday example of waiting too long to monitor the fuel gauge, which might result in running out of gas while driving (specific, undesirable consequence). In this example, running out of fuel will usually be associated with a relatively low urgency and fairly high importance.

Thus, if a seeker is faced with an urgent task (which needs to be accomplished soon), s/he will want to reach the most accessible source (thus access difficulty will be an impediment), so as to get the task accomplished within the stipulated deadline / timeframe. This is because of the urgency of the task, which might drive the seeker to a certain level of desperation. Thus, we hypothesize:

H5: For a more urgent task, the difficulty in accessing an information source has a higher negative effect on the use of the source compared to a less urgent task.

We also hypothesize task urgency to moderate the relationship between communication difficulty and source use. More urgent task-related communications inclines actors towards channels with a real-time, synchronous response capability (Straub and Karahanna 1998) (least communication difficulty). All things being equal, urgent tasks would be predicted to show a strong association with synchronous channels such as face-to-face, telephone, etc (Straub and Karahanna 1998). A seeker faced with an urgent task will want to reach the source that is most easy to "converse" with (thus communication difficulty will be an impediment), so as to get the task accomplished within the timeframe required.

H6: For a more urgent task, the difficulty in communicating with an information source has a higher negative effect on the use of the source compared to a less urgent task.

4.3.3 COMPLEXITY OF THE TASK / PROBLEM SITUATION

Leckie and Pettigrew (1997) argue that tasks arising out of work roles in an organization give rise to information need. The extent to which work features many courses of action leading to multiple, possibly conflicting, outcomes determines how complex it is (Campbell 1988). Task complexity has been defined as the number of

sources needed (O'Reilly, 1982), coordination and joint problem solving needed (Anderson *et al.*, 2001), or the amount of relevant external information needed (Culnan, 1983).

Tacit[55] knowledge/information is knowledge that is difficult to express and to communicate to other people using symbols (Hill and Ende, 1994; Nelson and Winter, 1982; Spender, 1993). Higher levels of complexity will increase the cognitive load associated with a job, and thus increase its perceived intellectual demands (Gray and Meister 2004), and make the required information increasingly tacit. More complex tasks require more, and often different, information (Zimmer and Henry 2007). Information can serve to reduce complexity as the more an individual knows about a task, the easier it is to accomplish that task (Vakkari 1999). Zimmer, Henry and Butler (2008) argue using Shanon and Weaver (1949)'s mathematical theory of communication that 'while individuals satisfice in their information gathering and act in other rationalizing ways, in instances where individuals seek additional information, the task they are trying to address could be an important determinant in the type of source used' (p.325). Bystrom's empirical research (Bystrom 1997, 2000; Bystrom and Jarvelin 1995) concludes that actor-perceived task complexity is the principal determinant of information sources and the number of sources consulted (Courtright 2007). Past literature has consistently found that task complexity and uncertainty increase the number of sources searched or the total amount of information searched (Culnan, 1983; Ashford, 1986; Anderson *et al.*, 2001; Bystrom,

[55] The concept of tacitness was put forth by Polanyi (1966) who started with the fact that "we can know more than we can tell" (p.4). He gives an example of how we can recognize a known person's face from among a million, or another person's mood at a given point in time, but cannot usually tell how we do so. Even if somebody is able to match a person's face using facial features in a police station, we do so "only by knowing how to match the features we remember with those in the collection, and we cannot tell how we do this. This very act of communication displays a knowledge that we cannot tell." (p.5). Thus, the degree of tacitness of any information determines the degree to which it can be articulated and communicated. Tacit knowledge that many professionals acquire by 'learning by doing' can only be understood in the context of particular actions, and may be shared to a significant degree by individuals who have a common (professional) experience (Roberts and Dietrich 1999).

2002). Task complexity has also been found to affect the use of a source throughout a task lifecycle (Kuhlthau 1999; Bystrom 2002). The more complex the task at hand, the more the need to use the information source frequently. Thus, we hypothesize:

H7: The complexity of the task at hand positively affects the use of the information source.

It follows from Dennis and Valacich (1999)'s theory of media synchronicity that high synchronicity (high feedback) is required for tasks that are convergent in nature (that require developing a shared meaning for information; source and the seeker understand each other's views). When the information being sought has a high degree of tacitness (i.e. the task is complex), it requires the source and the seeker to be able to communicate interactively and develop a shared meaning for information before the source can adequately give the required information to the seeker. When a task requires a piece of knowledge that is more 'hands-on' or difficult to codify (complex task), the immediacy of feedback of the source being chosen becomes very important. Zimmer and Henry (2007) argue that when easily codified information is needed (arising out of a complex task), one would choose an impersonal source whereas when information was needed that is difficult to codify (arising out of a simple task), an interpersonal source would be chosen. Thus, if a seeker is engaged in a complex task that requires information with a high degree of tacitness, s/he will choose a source with the least associated costs, such as one with high immediacy of feedback (high synchronicity) i.e. a source that the seeker finds the easiest to communicate with.

H8: The negative effect of communication difficulty with the source on the use of the source is higher when the task at hand is complex compared to when the task is

less complex.

In this section, we have looked at the variables that apply to the task or problem situation. In our survey, apart from the items ascertaining the complexity of the task, we will also capture information on the current task the actor/seeker is working (part of the personal or shared context) on.

In the next section, we will look at those variables that apply to the seeker.

4.4 Seeker / Actor Variables

In our research model (Figure 27), we include one variable from the seeker – learning orientation. Other seeker variables are examined as control variables.

4.4.1 SEEKER'S LEARNING ORIENTATION

The most potent motivators for adult learning are internal, such as self-esteem (Knowles *et al.* 1998). The education psychology literature puts forth that individuals hold relatively stable dispositions towards learning, and describes two types of dispositional goal orientation (Dweck and Leggett 1988). People with strong *performance orientation* believe that competence is unlikely to change, while those with strong learning orientation believe that their competence can be improved (Steele-Johnson *et al.* 2000), and thus they 'persist, escalate effort, engage in solution-oriented self-instruction, and report enjoying the challenge' (Brett and VandeWalle 1999, p.864) (Gray and Meister 2004). In their survey of 417 employees in a global organization, Gray and Meister (2004) found that learning orientation featured significant direct effects on knowledge sourcing and learning outcomes, as well as a significant moderating effect on the relationship between knowledge sourcing and learning outcomes. Since they believe that competence can be improved, information

seekers with higher learning orientation will want to improve their knowledge, skills and abilities by consulting coworkers (Gray and Meister 2004), and referring to other information sources. The higher the learning orientation of a seeker, the higher will be his/her inclination to use one or more information sources frequently.

H9: The learning orientation of the seeker/actor positively affects the use of the information source.

Let us now look at other variables which are included as control variables.

4.4.2 CONTROL VARIABLES PERTAINING TO SEEKER

Task Self Efficacy. Self efficacy is 'people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances' (Bandura 1986, p.391) and was first outlined in Bandura (1977)'s self efficacy theory. As per Bandura (1977, 1986), self efficacy can be understood to be the belief in one's effectiveness in performing specific tasks. Thus, it is one's own judgment of one's ability to perform a task based on various factors such as one's performance accomplishments, vicarious experience (gained by observing others perform activities successfully), social persuasion, as well as physiological and emotional states (Staples *et al.* 1998). Seekers do not often have sufficient domain or background knowledge in the domain of the task or problem situation that the seeker faces (Kwasitsu 2003; Miller and Jablin 1991; VandeWalle *et al.* 2000), leading to a low assessment of self efficacy. The level of background knowledge might affect the amount of information seeking because an expert might consider it less profitable to ask other people than novices do (Xu *et al.* 2006). Xu *et al.* (2006) found the effect of background knowledge (which they used as a control variable) on source choice to be

insignificant. We include the seeker's task self efficacy as a control variable, to see if it has any effect on information source use by the seeker.

Variables from the personal context of the seeker that will be incorporated as control variables will be *gender*, *age* and *education*. These will cover the demographic data of the seeker. *Nationality* and *primary language* will also be captured as demographic data, but won't be considered in hypothesis testing because these are not expected to influence a person's information seeking process and subsequent source use.

Variable from the personal or shared context of the seeker that will be captured will be *tenure in work role/position*. *Work role/position* and *tenure in organization* will be captured as demographic data, but won't be considered in hypothesis testing. *Tenure in work role/position* is chosen over *tenure in organization* as a control variable because it works at a more specific level of analysis. Also a person's age is expected to correspond with *tenure in organization*. Since we are incorporating *age* as a control variable, *tenure in work organization* may not be necessary.

4.5 Environment Variables

Variables pertaining to the environment have been incorporated as control variables.

4.5.1 LEARNING ENVIRONMENT

The knowledge management literature has widely acknowledged the importance of a favorable learning environment (that fosters learning) in an organization (e.g. Agarwal *et al.* 1997; Alavi and Leidner 2001; Chen and Lin 2004; Carmen *et al.* 2006). Descriptive studies have identified culture as a major catalyst, or alternatively a major hindrance (e.g. in organizational cultures that promote knowledge hoarding)

to knowledge creation and sharing. A knowledge-friendly organizational culture has been identified as one of the most important conditions leading to the success of knowledge management initiatives in organizations (Davenport and Prusak 1998). An organization with a learning culture and a favorable learning environment will encourage its employees to keep seeking (and transferring) knowledge in order to improve their skills, abilities and performance. Seekers in such an environment can be expected to frequently use more or more information sources to fill the gaps in their knowledge. We include learning environment as a control variable in our study.

4.5.2 OTHER CONTROL VARIABLES PERTAINING TO ENVIRONMENT

Team size will also be captured as control variables. This will be part of the seeker's shared context. *Company specialization* and *company size* will be studied for demographic purposes but not used by hypothesis testing. The variable *team size* works at a more specific level and could affect source choice more than *company size*, which works at a higher level.

Let us now look at inherent lack of comfort, which pertains to the seeker/source relationship and which we incorporate as a control variable.

4.6 Seeker / Source Relationship Variable

There could be various costs associated with a source. We've looked at *access cost* in Section 4.2.4 and *communication cost* (including *immediacy of feedback* or *synchronicity*) in Section 4.2.5 *Social risk* is a cost which applies only to interpersonal sources (see Xu *et al.* 2006), while *lack of ease in information extraction* applies in case of impersonal sources. Factors such as *immediacy of feedback* (or *synchronicity*) may apply to both interpersonal and impersonal sources/channels.

4.6.1 INHERENT LACK OF COMFORT

For impersonal sources, other factors such as the amount of knowledge of the search system (Dimitroff, 1992; Hoelscher and Strube, 1999) will affect whether a person prefers to use the information source or not. E.g. even if an information source provides very rich information, a person is unlikely to use it if s/he doesn't know how to retrieve information from the repository.

Seeking information from interpersonal sources might reveal ignorance on the part of the seeker or make the impression of exploiting the interpersonal source, instead of investing one's own time first (Binz-Scharf and Lazer 2006). As an interviewee highlighted in Binz-Scharf and Lazer (2006)'s case study of a community of US forensic scientists, "I'd probably go online. I would also read papers, and then if I didn't necessarily find what I was looking for I think probably at that point in time if I were able to connect with people at meetings, I would just come out and say, 'Gee I'm having a problem with such and such. Can you help me with it?'" Another social risk is of an answered question requiring actions that are more costly in the future than the cost of simply referring to an impersonal source for an answer (Binz-Scharf and Lazer 2006). The interpersonal source's power, social status and practice affect the seeker's social risk in information seeking (Xu *et al.* 2006). Dispositional factors in the seeker's personality such as reciprocation wariness (Lynch *et al.* 1999) also play a role. Thus, variables from the seeker-source relationship, such as, inherent lack of comfort, social risk, (low) degree of familiarity, etc. act as barriers that increase the cost of using a source for getting information.

In this study, we include the seeker's *inherent lack of comfort* with an information source as a control variable to see if it has any effect on the use of the source by this seeker.

In this chapter, we have arrived at an empirical research model, as well as hypotheses that need testing. In the next chapter, we examine the research method, and look at data collection and analysis for the survey study.

CHAPTER 5 METHODOLOGY AND FINDINGS

"Like Agatha Christie's fictional detective Hercule Poirot, the social detective must have an effective method because method is one's contact point with the world. The types of constructs and propositions in our theories, as well as the degree of certainty attached to them, are all dependent on our methodological repertoire."

- M. Scott Poole and Robert McPhee (1994, p.43)

5.1 Research Design

Surveys are appropriate for research questions about self-reported beliefs or behaviors (Neuman, 2003). As the constructs in our model deal with perceived attributes of the actor or information seeker towards the context of search, as well as the behavioral measure of the use of one or more information source(s), the survey research method (through a quantitative perspective) would be an appropriate methodology for our research. This methodology was also chosen because it enhances generalizability of results (Dooley 2001; Kankanhalli, Tan and Wei 2005).

5.2 Instrument Development and Data Collection

5.2.1 OPERATIONALIZATION OF CONSTRUCTS

Table 14 Definition of Constructs

Attribute of	Construct	Abbreviation	Definition
Source	Use	USE	The degree to which the person actually used[56] the information source.
	Quality	QUA	The novelty (Xu and Chen 2006), reliability (O'Reilly 1982; Swanson 1987; Xu *et al.* 2006), breadth and depth of information content the source carries that has applicability and relevance (Xu *et al.* 2006) to the task at hand
	Access Difficulty	ACC	The time and effort required, and the difficulty encountered in accessing/ reaching a particular information source i.e. establishing the channel of communication with the source (*before* the person actually starts using it)
	Communication Difficulty	CMM	The difficulty in interacting with, conversing with, and understanding the information source (once the person has reached the source)
Problem situation / Task	Importance	IMP	Importance of the outcome of the task with the seeker's well being (Xu *et al.* 2006)
	Urgency	URG	Need to accomplish the task sooner than later
	Complexity	CMP	The degree to which a task is challenging, difficult to understand, requires considering many aspects and takes a long time to learn
Environment	Learning Environment	ENV*	The degree to which the seeker's work environment is favourable for learning and information seeking.
Seeker / Actor	Learning Orientation	ORT	The seeker's attitude towards learning – degree to which the seeker believes that his/her competence can be improved (Steele-Johnson *et al.* 2000)
	Task Self Efficacy	EFF*	The degree to the information seeker considers himself/herself an expert in doing the task at hand
Seeker-Source relationship	Inherent Lack of Comfort	CFT*	The degree to which the seeker feels uncomfortable, nervous, embarrassed or concerned about his/her image[57]/self-image[58] before using an information source

* Control Variables

[56] We examine 3 aspects of source use – frequency of use of each source, percentage of time each source was used (Zimmer *et al.* 2008) and the order of using each source as compared to other sources (of other source types). Both perceived and behavioral aspects of frequency of use are studied.

[57] The way another person(s) sees the seeker

[58] The way the seeker sees himself/herself

Table 14 above provides the definition of constructs used in the empirical research model of Figure 27. As suggested by Stone (1978), wherever possible, survey items (questions) were adapted from prior studies to enhance validity. When items were not available, new questions were developed based on survey of literature. Items and their sources have been listed in Appendix A.

5.2.2 CONCEPTUAL VALIDATION

Since some of the survey items were self-developed (while the rest were adapted from prior studies), all the items were subject to a two-stage conceptual validation exercise using the procedure recommended by Moore and Benbasat (1991) (see Kankanhalli, Tan and Wei 2005 for an example of prior usage of this procedure). The first stage consisted of 'unstructured sorting', and the second stage 'structured sorting' of all items in the survey.

Unstructured Sorting. In the first stage, 4 graduate students (let us call them 'judges') from the Department of Information Systems, School of Computing were given an envelope each. Each envelope consisted of strips of paper, with a survey item printed on each strip. There were a total of 52 strips in each envelope (one for each survey item) to cover the 52 initial survey items belonging to 11 constructs[59] in total. The strips in the envelope were randomly mixed. Each judge was asked to take out the strips and put them in different piles such that each pile had related questions (those that measured a common construct). If any question appeared to belong to more than one pile, the judges were asked to place them in a separate pile. After completing the grouping exercise, the judges were also supposed to give a name or

[59] the 8 constructs in the research model of Figure 27, as well as 3 control variables (Learning Environment (ENV), Task Self Efficacy (EFF) and Inherent Lack of Comfort (CFT)) not indicated in the model.

label (as well as definition) to each pile (to indicate the construct that all the items in that pile measured), and fill a form shown in Figure 30. A mock example using hypothetical items from a hypothetical research model was also shown to each judge to demonstrate how to conduct the sorting exercise.

Your Name_____ Contact No. _____

Label	Definition	Pile No. (staple each pile and assign a number to it)	No. of items in pile

:

Total No. of items in all piles (fill in the end) _____

Figure 30 Form each judge filled for unstructured sorting

This process was very useful in identifying ambiguously-worded survey items/questions. The names/labels given by the judges for the different piles were very close to the names of the actual constructs. As shown in Table 15, the 4 judges correctly placed close to 87% of the survey items into their rightful construct piles.

Table 15 Results of Unstructured Sorting Exercise

Target Category	**Actual Category**												**Total Qs**	**Hit Rate (%)**
	USE	**QUA**	**CFT**	**CMM**	**ACC**	**ENV**	**EFF**	**CMP**	**IMP**	**URG**	**ORT**	**Other**		
USE	19											1	20	95
QUA		19										1	20	95
CFT			13		5							2	20	65
CMM		1		5	6								12	41.67
ACC		1			19								20	95
ENV						17						3	20	85
EFF							20						20	100
CMP								19				1	20	95
IMP									16				16	100
URG							1			19			20	95
ORT											18	2	20	90
AVERAGE														86.97

After the first round of sorting, a number of items from different constructs were altered because they were either ambiguous or did not fit well with the other items in the pile. Table 29 in Appendix B shows the items changed after the first round of sorting i.e. unstructured sorting. Portions of items changed (to remove ambiguity) are highlighted in **bold**. On the suggestion of judges, 5 items were added after the first round of sorting. These were IMP4 (task importance), CFT6 (inherent lack of comfort), CMM1 / CMM3 (communication difficulty with the source) and USE1 (source use). Kim and Mueller (1981) posit that it is desirable to have 3 or more items per construct to ensure better measurement properties for each construct. These additions took the total number of items/questions from 52 to 57.

Structured Sorting. Four more students participated as judges in the second round of sorting. Here, the job of the judge was made easier than that of the judge in the first round. This is because the number of categories was specified beforehand, and the labels and definitions provided for each construct (see Figure 31). All the judge had to do was to determine which label and definition each item best conformed to. A 'does not fit' category was also provided for putting the items that the judge thought did not fit in any of the specified categories.

Your Name_____ Contact No. _____

Pile No. (staple each pile and assign a number to it)	Label	Definition	No. of items in pile
1.	Source Use	The degree to …	
2.	Source Quality	The novelty, rel…	
:			
11.	Task Complexity	The degree to …	
00.	Does not fit	Item(s) that do..	

Total No. of items in all piles (fill in the end) _____

Figure 31 Form each judge filled for structured sorting

Each judge was given the 57 reworded items (printed in individual strips of paper, mixed and put inside an envelope). This time, all judges correctly placed close to 91% of items in the correct construct piles (see Table 16).

Table 16 Results of Structured Sorting Exercise

Target Category	Actual Category												Total Qs	Hit Rate (%)
	USE	QUA	CFT	CMM	ACC	ENV	EFF	CMP	IMP	URG	ORT	Other		
USE	16	1										7	24	66.667
QUA		17										3	20	85
CFT			24										24	100
CMM				17								3	20	85
ACC					20								20	100
ENV						19					1		20	95
EFF							20						20	100
CMP		1					1	16				2	20	80
IMP							1	1	18				20	90
URG										19		1	20	95
ORT											20		20	100
AVERAGE														90.606

For items placed in the 'does not fit' category or in wrong categories, further changes were made to remove ambiguity. Table 30 in Appendix B shows the items changed after the second round i.e. structured sorting. Portions of items changed are highlighted in **bold**. One item QUA6 was added for source quality to cover the depth of knowledge that an information source has. This took the total number of items to 58 (see Appendix B) for the final questionnaire of Appendix C.

5.2.3 PRE-TEST

A pre-test was conducted, whereby the survey was administered on 12 graduate students of the School of Computing. These participants were not paid. The results were not included in the analysis. The purpose of the exercise was to fine-tune the survey instrument to arrive at the final version of Appendix C. Detailed feedback on the questionnaire and the items was sought from each participant.

5.2.4 FACE VALIDITY

The face validity of items from the questionnaire was ascertained through group discussion and through consultation with experienced researchers in the field.

5.2.5 PILOT TEST

After the pre-test, a pilot test was conducted on a sample of 110 respondents to verify and finalize the survey instrument. The pilot test was done on a working population (same as the sample for the main data collection). Each respondent was paid a remuneration of S$10 for filling out the questionnaire.

The valid responses were between 98 and 106 depending on source type (see Table 17).

Table 17 Sample Size of Pilot Data across Source types

	OnlineInfo	Book&Manual	Email&Forums	Phone&Chat	Face2Face
N	103	98	101	101	106
Invalid cases	7	12	9	9	4

An exploratory factor analysis (EFA) was conducted on the pilot data. One item USE4 from the construct 'Source Use' was found to be problematic. As USE4 was the only item found to be problematic, there was no change made to the survey questionnaire of Appendix C. The dropping of USE4 was deferred until after the confirmatory factor analysis (CFA) on main data. The analysis of pilot data is described in Section 5.3.1 A question might be raised about the rationale for doing the pilot test if there was no change in the questionnaire after it. Conducting the pilot test was necessary to make sure that the questionnaire was designed properly, and that the EFA loadings satisfied the convergent and discriminant validity requirements. Since the EFA results loaded well, and as there was no change in the questionnaire, we went

ahead with the main data collection. Both the pilot data and main data were administered on a similar sample, and using the same data collection methodologies. An exploratory factor analysis done on the main data (to make sure pilot and test data are similar) showed similar loadings.

5.2.6 FINAL QUESTIONNAIRE

The final survey instrument (used both for pilot and main data collection) is shown in Appendix C. Wherever possible, items in the questionnaire were adapted from those use in prior research studies. New items were developed wherever appropriate. Appendix A details all the survey items and their respective sources. We discuss them briefly below.

Dependent Variable. Source Use is the dependent variable. The '*frequency* of use' of each source is the primary dimension of use explored in this study, and will form the basis for hypothesis testing. We also captured the '*percentage* of use' and the '*order* of use' for use in possible post-hoc analysis. The 4 items for 'frequency of use' were adapted from Xu *et al.* (2006), Jarvenpaa *et al.* (1999), Zimmer and Henry (2007) and Davis (1989) respectively. One item (USE4) was found to be problematic during the pilot data analysis but was retained until after the analysis of main data (dropped subsequently). The item for 'percentage of use' of each source was adapted from Zimmer and Henry (2007). The item for order of using each source was self-developed.

Antecedents. 3 items for task importance were adapted from Xu *et al.* (2006). 2 were self-developed. 3 items for task complexity were adapted from Zander and Kogut (1995) and Lord and Ranft (2000). 2 items were self-developed. The 5 items for task urgency were self-developed. For learning orientation, 3 items were adapted from

Gray and Meister (2004) while 2 were self-developed. For source quality, 3 items were adapted from Xu and Chen (2006) and Xu *et al.* (2006), 1 from O'Reilly (1982) and Xu *et al.* (2006), while 2 were self-developed. For access difficulty, 4 items were self-developed, while 1 was adapted from Xu *et al.* (2006). All items for communication difficulty were self-developed.

Control Variables. For task self efficacy, 3 items were adapted from Xu and Chen (2006) and Xu *et al.* (2006), 1 item was adapted from Xu *et al.* (2006), while 1 was self developed. All 5 items for learning environment were self-developed. 3 items for inherent lack of comfort were self-developed, while the other 3 were adapted from Ashford (1986) and Xu *et al.* (2006). Past literature has found factors such as tenure to affect information seeking (Ashford 1986; O'Reilly 1982). We therefore include them as control variables. The items for the control variables 'tenure in position' and 'age' are from Gray and Meister (2004). We also include gender, education and team-size as control variables.

Demographic Data. Other demographic data captured in the questionnaire included industry, company size, locations in Singapore, tenure in organization (from Gray and Meister 2004), role, nationality and language.

The searcher's current task, specific information sought and typical sources used were also sought. However, these were included to help the respondent better answer the questions at hand and are not for the purpose of analysis.

The questionnaire uses the seven-point Likert scale (1 = strongly disagree, 7 = strongly agree). Appendix A summarizes all the items for the constructs and the control variables.

5.2.7 MAIN DATA COLLECTION

As there was no change in the questionnaire after the collection of pilot data, we moved on to the main data collection. The target population of this study is working people. The study population is the group of working Singapore professionals between the ages of 19 to 61 (majority between 20 and 40) who use a computer for their work. As it is impractical to obtain a sampling frame of this magnitude, we used a sample consisting largely of professionals working in various parts of Singapore, including the Central Business District, the offices in the West, East, North and Central parts of Singapore, Science Park and companies based in the National University of Singapore.

Data was collected over 3 weeks in June/July 2008. Data was collected in person and studied statistically analyzed following the psychometric procedure to determine support for the hypotheses arrived at. Permission for conducting the survey was taken from the Institutional Review Board of the National University of Singapore (NUS-IRB). As the survey instrument had a large number of questions (4 pages) (multiplied by the 5 source types for questions pertaining to source), each respondent was paid S$10[60] as an incentive to fill out the questionnaire correctly. Each completed questionnaire was checked to ensure that the survey was completely filled and there is no missing data.

Places where office employees gathered to eat (near office areas) were the typical locations used for collecting survey data. Such an environment mandated the used of convenience sampling. Response rate was dependent on the person(s) sitting on each table. In a typical food court, almost everyone eating (or having tea/coffee) at a

[60] S$10 can buy 3 meals in a typical Singapore Food Court or Hawker Center.

particular point in time was approached. The number of persons who refused to answer the survey was noted each time. Typically, 4 out of 10 people approached agreed to fill the questionnaire, leading to an approximate response rate of 40%.

The total number of respondents[61] was 352. 6 questionnaires were incomplete or erroneously filled (no response provided for any of the 5 source types).

The valid responses were between 322 and 341 depending on source type (see Table 18).

Table 18 Sample Size of Main Data across Source types

	OnlineInfo	Book&Manual	Email&Forums	Phone&Chat	Face2Face
N	336	322	334	333	341
Invalid cases	16	30	18	19	11

A small percentage of the respondents (8.81%) chose not to answer questions pertaining to all the 5 source types (instead choosing between 1 and 4 source types). See Table 19. This led to differing sample sizes (see Table 18 above) for the data pertaining to the 5 types of sources.

Table 19 Number of source types chosen by survey respondents

No. of source types chosen	No. of respondents	
0	6	1.70%
1	2	0.57%
2	6	1.70%
3	15	4.26%
4	8	2.27%
5	315	89.49%

[61] Since there was no difference in the questionnaire, sample or data collection methodology between the pilot and main data collection, both the data sets were mixed to increase the sample size and to achieve greater statistical power.

5.2.8 DEMOGRAPHIC DATA

Appendix D lists the demographic data of survey respondents.

Industry. About 26% of respondents were from the banking and finance industry, about 20% from the software/technology industry, about 13% from the education industry and approximately 10% from manufacturing. Rest were from other industries.

Company Size. More than 50% of the respondents listed their companies to have more than 500 employees.

Team Size. About 36% of the respondents worked in 2-5 person teams and about 27% in 6-10 person teams.

Company Location in Singapore. About 46% of the respondents worked in the Central Business District (Raffles Place, City Hall, Tanjong Pagar, Tiong Bahru, Collyer Quay, Harbourfront) of Singapore, about 21% in the western part of Singapore. Rest worked in other parts of the island.

Organizational Tenure. More than 43% of the respondents were new employees with an organizational tenure of less than 1 year. About 22% had been in their second year of work and about 13% in their third year of work.

Role. About 60% of the respondents were in executive/professional positions in various professions, about 29% were in middle management or project leader roles and less than 4% in top management.

Role Tenure. The mean tenure in the role was about 2 years (23.41 months). About 57% of the respondents had been in their respective roles for less than a year. About 23% of respondents were in their role in the period of 1-2 years.

Gender. There was a gender bias towards males (only 26.88% of the respondents were females) in the response set. As no purposeful gender bias was exhibited between approaching males or females for filling out the questionnaire, the skewed gender distribution might reflect the distribution of males versus females in professional jobs (requiring use of a computer) in Singapore.

Age. The mean age of respondents was 30.46 years. A vast majority (58.67%) of the respondents were in their twenties. About 30% were in the thirties age-group.

Nationality. About 50% of the respondents were Singaporeans, 20.5% were Indians, 8.67% were Malaysians, 5.78% were from China, while the rest were from other countries. The 50% distribution between other nationalities shows the multinational work culture of Singapore.

Education. 53.76% of the respondents were graduates, while 32.37% were postgraduates. Only 13.87% of the respondents were below these education levels.

Language. Almost 82% of the respondents listed English as their primary language. About 10% listed Chinese, while the rest listed other languages.

5.3 Data Analysis and Results

We carried out data analysis using SPSS 16.0 and LISREL 8.80. For the pilot test, we conducted Exploratory Factor Analysis (EFA). For the main survey, we conducted the Confirmatory Factor Analysis (CFA) and hypothesis testing using Hierarchical Linear

Modeling (HLM for Windows 6.06). Post-hoc analysis was conducted using moderated multiple regression. For the pilot and main data sets, along with the complete data set, 5 separate data sets were created corresponding to the 5 types of sources being studied.

5.3.1 PILOT DATA

Psychometric analysis was performed as per the procedure recommended by Anderson and Gerbing (1988). Exploratory Factor Analysis (EFA) was performed to test the convergent and discriminant validity of the instrument. EFA allows for underlying factors/components to emerge naturally from the data without imposing any constraint. Well-designed items for a construct emerge highly correlated with each other and with the underlying latent factor (convergent validity). Problematic items which do not load to any factors or which load to more than one factor (affecting discriminant validity) can be identified and eliminated during EFA.

EFA (Principal Component Analysis with Varimax rotation). In our study, EFA with principal component analysis (Hair *et al.* 1995) was used to extract the factors. Major principal components with eigenvalue greater than 1 were extracted as constructs. The major components were then rotated using Varimax rotation to form interpretable factors. To satisfy convergent validity, factor loading (correlation between an item and the latent construct) should be greater than 0.5 (Hair *et al.* 1995). To satisfy discriminant validity, the correlation between an item and an unintended construct should be less than 0.4 (Hair *et al.* 1995).

The rotated component matrices for the pilot data sets corresponding to the 5 types of sources are listed in Appendix E. The number of latent factors extracted with eigenvalue greater than 1 corresponded to the number of constructs i.e. 11 (including

the 3 control variables 'lack of comfort with source', 'seeker's task self efficacy' and 'learning environment'). For each of the 5 data sets (corresponding to each source type), the extracted factors together explained about 79% of the variance.

The item USE4 "I used [typical source for the respective source type] (several times a day; about once a day; several times a week; about once a week; about once in 2-3 weeks; less than (once in 2-3 weeks); didn't use at all)" from the dependent variable 'source use' was found to have low loading (<0.5) for the data sets corresponding to phone (loading 0.431) and face-to-face (loading .363). Also, 12 latent factors were extracted (for 11 constructs) with eigenvalue > 1 in the case of face-to-face. This item could have been problematic because it didn't use the 7-point Likert scale, like the other 3 items for the frequency of use. Thus, the EFA analysis was repeated after dropping USE4.

The rotated component matrices were clean[62] after dropping USE4 (see Appendix E). However, since the loading for USE4 was above 0.5 for the data sets of the other 3 source types, we decided to retain it in the questionnaire and examine it again during the Confirmatory Factor Analysis (CFA) on main data.

The communalities[63] examined indicated that all items across the 5 source types had a high portion of variance (in the ranges of 0.7, 0.8 and 0.9) explained by all the factors except for the items indicated in Table 20, where communality values are in the ranges of 0.6 and 0.5. Communality values above 0.5 are acceptable. The empty cells in Table 20 indicate values in the ranges of 0.7, 0.8 or 0.9.

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[62] The two items that had loadings less than 0.5 were USE3p with a loading of 0.488 for the phone/chat data set and CMP4 with a loading of 0.496 for the face-to-face data set. Since the loadings were close to 5, did not exhibit low loadings for the data sets corresponding to the other 4 source types, and since there was no theoretical justification to drop these items, there was no strong reason to drop them.

[63] the proportion of a variable's variance explained by a factor structure (www.siu.edu/~epse1/pohlmann/factglos/)

Table 20 Items with communalities < 0.7

	Online Info.	Book/Manual	Email/Forum	Phone/Chat	Face-to-face
URG1		.690	.676		
CMP1	.658	.665	.672	.656	.634
CMP4	.544	.642	.539	.545	.525
CMP5	.690	.681		.694	.679
USE3	.669	.590	.513	.556	
QUA1		.659			
QUA3			.627		.610
ACC1	.641				
ACC5				.664	.690
CMM1	.638	.608			
ENV1				.684	

As there was no change in the questionnaire after the exploratory factor analysis, we proceeded to carry out the main study with our study population.

5.3.2 MAIN STUDY

Instrument Reliability Testing / Descriptive Statistics and Cronbach's Alpha. Reliability measures the degree to which observed scores are "free from errors of measurement" (American Psychological Association, 1985) or the internal consistency of a latent variable (Nunnally and Bernstein, 1994). It measures the degree to which the measurement items in the same latent variable agree with each other. In this study, we used Cronbach's α, which is the de-facto measure of scale reliability (Peterson, 1994), to measure the inter-item reliability. A summary of descriptive statistics about the subjects' rating combined with Cronbach's α is reported in Appendix F. 6 tables are reported – 1 corresponding to the constructs for the entire data set, and 5 tables for the 5 source types examined. As the results show, the Cronbach's α of each latent variable is greater than 0.8, which indicates that the measurement items are reliable (Nunnally and Bernstein, 1994).

Table 21 shows the mean values of the constructs across the data sets corresponding to different source types.

Table 21 Comparing the means across different source types

Property of	Construct	All records N=352	Online Info. N=336	Book/ Manual N=322	Email/ Forum N=334	Phone/ Chat N=333	Face-to-face N=341
Task / Problem Situation	IMP	5.837	5.822	5.843	5.837	5.83	5.844
	CMP	4.241	4.232	4.251	4.249	4.239	4.233
	URG	5.008	4.993	5.031	5.023	5.02	5.001
Seeker / Actor	ORT	6	5.986	5.991	5.982	5.988	5.988
	EFF*	5.029	5.011	5.033	5.02	5.026	5.017
Environment	ENV*	5.573	5.538	5.559	5.57	5.562	5.565
Source (online information)	QUA		4.73	4.159	4.611	4.703	5.196
	ACC		3.042	3.613	3.619	3.599	3.55
	CMM		3.607	3.78	3.565	3.373	3.133
	USE		4.752	3.873	4.4	4.67	5.166
Seeker/ Source	CFT*		2.449	2.554	2.846	3.035	2.927

* Control variables

From an examination of the means in Table 21, we can see that the respondents reported high degree of task importance and task urgency. They also reported having expertise in their tasks at hand, and working in environments that were favorable to learning and information seeking. They also rated themselves as having a highly positive orientation towards learning. They were neutral about the complexity of the task at hand.

Means and Ranking of sources. Table 22 lists the ranking of sources based on each construct pertaining to the source/channel.

Table 22 Ranking of sources on different parameters

Property of	Construct	Online Info. N=336	Book/ Manual N=322	Email/ Forum N=334	Phone/ Chat N=333	Face-to-face N=341
Source (online information)	Quality	4.73 (Rank 2)	4.159 (Rank 5)	4.611 (Rank 4)	4.703 (Rank 3)	5.196 (Rank 1)
	Access Difficulty	3.042 (Rank 5)	3.613 (Rank 2)	3.619 (Rank 1)	3.599 (Rank 3)	3.55 (Rank 4)
	Communication Difficulty	3.607 (Rank 2)	3.78 (Rank 1)	3.565 (Rank 3)	3.373 (Rank 4)	3.133 (Rank 5)
	Use	4.752 (Rank 2)	3.873 (Rank 5)	4.4 (Rank 4)	4.67 (Rank 3)	5.166 (Rank 1)
Seeker/ Source	Lack of comfort with source*	2.449 (Rank 5)	2.554 (Rank 4)	2.846 (Rank 3)	3.035 (Rank 1)	2.927 (Rank 2)

* Control variable

Source Quality and Source Use. Face-to-face was ranked the highest in terms of quality, followed by online, phone/chat, email/forum and book/manual respectively. This implies that people prefer face-to-face sources the most, and corresponds to the results from past studies that found people preferring interpersonal sources over impersonal sources (Gerstberger and Allen 1968; Chen and Hernon 1982; Hardy 1982; Chakrabarti *et al.* 1983; Choo 1994; Hertzum and Pejtersen 2000; Bystrom 2002; Yitzhaki and Hammershlag 2004). However, online information (impersonal) was ranked higher than phone or chatting with someone online. This is perhaps because with easy access to online information has made seekers look here first, before disturbing anyone over phone or chat. Email is ranked below phone/chat. The least preferred is book (perhaps due to the difficulty in going to the library and finding the right book or piece of information for a task at hand).

The ranking of 'source use' was in the same order as the ranking of 'source quality'. This implies that there is a direct correlation between source quality and source use. Sources which are rated higher are used more. 'Source use' in the tables above refers to the user's perceived frequency of use.

Difficulty in accessing the source. The means for channel cost are close to each other for email/forum and for books/manual (though surprisingly, it is marginally higher for email/forum). The most easily accessible was online information followed by face-to-face sources and sources over phone/chat. Given the digital society in Singapore and the high percentage of respondents (around 86%) who were graduates and above, they exhibited a comfort level in accessing online information. Face-to-face and phone/chat had means for access cost close to each other.

Source Cost. The difficulty in communicating with the source was highest for book/manual (difficult to comprehend many books), followed by online information. This implies that people still have difficulty getting easy answers to their questions even though search engines bring forth many links. The communication difficulty is least for face-to-face, followed by sources over phone/chat. This is because of the many verbal and non-verbal cues, and immediacy of feedback (Dennis and Valacich 1999) that a person receives during face-to-face communication.

The seeker-source relationship (lack of comfort with the source) becomes a big impediment when calling a person (or chatting with him/her) and meeting him/her as evidenced by the high ranking to these source types. This lack of comfort is also evidenced when reaching a person asynchronously over email or forum (though the degree of discomfort is lower than that of face-to-face or phone). Seekers exhibited the highest degree of comfort accessing online data, followed by books/manuals. Since these are impersonal sources, there is no relationship which one needs to protect or avoid before accessing information from online sources or books.

Let us now move on to Confirmatory Factor Analysis (CFA).

5.3.3 MEASUREMENT MODEL TESTING (CONFIRMATORY FACTOR ANALYSIS)

The measurement model (i.e. the Confirmatory Factor Analysis model) describes how well the latent variables link with their observed measures (Byrne, 1998). The purpose of the measurement model testing is to ensure high construct, convergent and discriminant validities. This test of our study was conducted using LISREL 8.80.

Convergent validity measures the correlation between item measures of a given construct using different methods of measurement. To assess it, there are three criteria suggested by Anderson and Gerbing (1988). First, the standardized factor loadings must be statistically significant. Second, the composite factor reliability (CFR) and the Cronbach's Alpha should be greater than 0.8. Finally, the average variance extracted (AVE) of each factor should be greater than 0.5. The results of this study on these criteria are listed in Appendix G (for each of the 5 source types). The tables in Appendix G show that all the standardized factor loadings are statistically significant. The only loading that is below the 0.5 cut-off is for USE3e (an item for use under the email/forum source type). The loading for USE3e is 0.49. Since this value is close to the cut-off of 0.5, it can be considered acceptable. The CFR values and Cronbach's Alphas are greater than 0.8 in all cases except for Use of Email/forum where CFR=0.789 and Cronbach's Alpha=0.769. AVEs are all greater than 0.5 (greater than 0.6 in majority of the cases). These indicate that the convergent validity of this study is established.

Items dropped. 4 items were dropped during CFA (including USE4, which was also found to be problematic during EFA on pilot data) for both theoretical, as well as statistical reasons.

CMP4 “This task requires me to consider so many aspects” was a self-developed item which did not fit will the other items in this construct. Respondents were perhaps unclear on what the ‘many aspects’ are, as most tasks could require considering many aspects or factors (though the complexity of these aspects might differ).

ORT1 “I always push myself to learn more” was again a self-developed item which did not fit well with the other 4 items in this construct. The other four items corresponding closely to learning based on tasks (organizational learning) but this item spoke of learning in general. While the other 4 items may be easier for a respondent to agree with, they might not be clear if they *always* push themselves to learn more.

CMM1 “While using [] for my problem, the “conversation” with [] is painful” did not fit with the other 4 items in this construct. All the other items had the word ‘difficult’ in them and spoke of some form of communication difficulty. Terming a conversation as painful could signify a higher degree of disagreement, as compared to the other items in this construct.

USE4 “I used [typical source from a source type] (several times a day; about once a day; several times a week; about once a week; about once in 2-3 weeks; less than (once in 2-3 weeks); didn’t use at all)” was also found to be problematic during EFA on pilot data. The other 3 items on frequency of use used the 7-point Likert scale, while this item did not. Absolute ordinal values had to be provided, which might have differed with the subjective ratings of the other 3 items.

Let us now examine the discriminant validity.

Discriminant Validity. Discriminant validity measures the degree to which a measure disagrees with measures of different constructs i.e. the uniqueness of item measures in defining a latent construct (Churchill, 1979). It helps to protect against the risk of method effects (Dooley, 2001). Discriminant validity was examined using the method proposed by Lastovicka and Thamodaran (1991). They suggested using Average Variance Extracted (AVE), which provides information about the amount of variance captured by the construct in relation to the amount of variance due to measurement error. For every construct, if the square root of its AVE is greater than its correlation with other constructs, then discriminant validity is established.

Appendix H lists the results of discriminant validity testing (for each of the 5 source types) using this method. The diagonal line elements are the square root of corresponding AVE, which are all greater than their correlations with other constructs. This indicates that the requirement of discriminant validity is fully satisfied.

Goodness of Fit. Fit indices were also evaluated for all the five source types to see if the model fit is satisfactory. A summary of the overall fit indices is listed in Table 23 below. All of the indices were above the suggested levels, except for GFI (cut-off 0.9), AGFI (cut-off 0.9) and standardized RMR for the source type email/forum (should be < 0.05). GFI is sensitive to sample size, but the sample size in this study[64] should be satisfactory. While a GFI index of 0.90 is preferred, many studies have cited an index of .8 (or close to it) and above as acceptable. The model fit has room for further improvement by dropping more items.

[64] N is between 322 and 341 for the data corresponding to the 5 source types studied

Table 23 Summary of overall fit indices across 5 source types

	Online Info	book/ manual	email/ forum	phone/ chat	face-to-face
Degree of freedom	1219	1219	1219	1219	1219
Chi-square	2257.46, p=0.0	2195.55, p=0.0	2207.73, p=0.0	2138.02, p=0.0	2155.24, p=0.0
Relative Chi-square (chi-square / degree of freedom)	1.852	1.801	1.811	1.754	1.768
Root Mean Square Error of Approximation (RMSEA)	0.05	0.05	0.049	0.048	0.048
Normed Fit Index (NFI)	0.93	0.92	0.93	0.93	0.93
Non-Normed Fit Index (NNFI)	0.96	0.96	0.96	0.97	0.97
Comparative Fit Index (CFI)	0.97	0.96	0.97	0.97	0.97
Incremental Fit Index (IFI)	0.97	0.96	0.97	0.97	0.97
Relative Fit Index (RFI)	0.92	0.92	0.92	0.92	0.93
Root Mean Square Residual (RMR)	0.12	0.11	0.12	0.12	0.11
Standardized RMR	0.048	0.047	0.053	0.049	0.047
Goodness of Fit Index (GFI)	0.79	0.79	0.8	0.8	0.8
Adjusted Goodness of Fit Index (AGFI)	0.77	0.76	0.77	0.78	0.78
Parsimony Goodness of Fit Index (PGFI)	0.7	0.7	0.7	0.71	0.71

5.3.4 HYPOTHESIS TEST

Given acceptable convergent and discriminant validities, the test of the hypotheses was carried out using hierarchical linear modeling (HLM 6 software). "Much social research involves hierarchical data structures. In organizational studies, researchers might investigate how workplace characteristics, such as centralization of decision making, influence worker productivity. Both workers and firms are units in the analysis; variables are measured at both levels. Such data have a hierarchical structure with individual workers nested within firms...Similar kinds of data occur in developmental research where multiple observations are gathered over time on a set of persons" (Raudenbush and Bryk 2002, p.3). The data in our study is also hierarchical in nature because we collect data at two different levels. On the first level

is data which changes from source-type to source-type, even though it might be provided by the same person. On the second level is data that is fixed across source types i.e. data that pertains to the information seeker and his/her context (seeker, task, environment, etc.). When every person provides responses corresponding to the same fixed number of source types, it is conventional to view the design as source types crossed by persons. But when the use of source types varies from person to person, we may view source types as nested within persons.

'Despite the prevalence of hierarchical structures in behavioral and social research, past studies have often failed to address them adequately in the data analysis' (Raudenbaush and Bryk 2002, p.5) because of 'inadequacy of traditional statistical techniques for modeling hierarchy' (p.5). Raudenbaush and Bryk say that in social research, these limitations have generated concerns about aggregation bias, misestimated precision, problems of unit of analysis and measuring change, an impoverished conceptualization discouraging the formulation of explicit multilevel models with hypotheses about effects occurring at each level and across levels. 'With recent developments in the statistical theory for modeling hierarchical linear models,... an integrated set of methods now exists that permits efficient estimation for a much wider range of applications' (Raudenbaush and Bryk 2002, p.5). We were able to make use of hierarchical data modeling to study source use across persons. In arriving at this, the modeling provided by the HLM 6.0 software takes care of the 'within person (across sources)' analysis.

In the hierarchical linear model used for analysis, the Level-1 coefficients included the source-centric variables (that change for each source type) quality (QUA), access difficulty (ACC), communication difficulty (CMM) and seeker's level of comfort with

source (CFT). 4 dummy variables 'o' (onlineInfo with respect to face-to-face), 'b' (book/manual with respect to face-to-face), 'e' (email with respect to face-to-face) and 'p' (phone with respect to face-to-face) were also included.

The Level-2 predictors (which are fixed across source types) included the control variables team count (TEAMCOUN), role tenure (ROLETENU), gender (GENDER), age (AGE), education (EDUCATIO), seeker's task self efficacy (EFF) and environment (ENV). Fixed effects for task importance (IMP) and task urgency (URG) were also included. Variables from the research model of Figure 29 included in this level were task complexity (CMP) and seeker's learning orientation (ORT).

In the survey questionnaire of Appendix C, we sought different aspects of the dependent variable 'use of information source' from the respondent. See items USE1 to USE6 in Appendix A. USE1, USE2 and USE3 deal with the user's perception of the frequency of use. USE4 is an objective[65] assessment of the frequency of use[66]. USE5 seeks to study the percentage of time each source is used. USE6 seeks to find out the order of using each source. The responses received for these 6 items on the dependent variable 'use' were, thus, analyzed at a number of levels, to understand different aspects of source use:

- usePerceptual (average of USE1, USE2 and USE3): perceived frequency of information use.

[65] Since the data are collected from self-reports based on the respondents' memory, one may argue that USE4 cannot really be considered 'objective' and that it still represents the respondents' subjective perception and memory. However, on a comparative basis, USE4 (which measures use based on specific timeframes such as several times a day, about once a day, several times a week, etc.) can be considered more objective than USE1, USE2 and USE3 which measure the frequency of use based on a 7-point Likert scale.

[66] USE4 was found problematic (in loading together with the other items of USE) during EFA and CFA because it objectively measures the frequency of information use, as compared to USE1, USE2 and USE3, which are based on the user's perceptions, as indicated on a 7-point Likert scale. Thus, it had been dropped from the overall analysis. Here, we look at USE4 separately to study the objectively-measured frequency of information use.

- useFrequency (USE4): objectively-measured frequency of information use.

- useMost (adapted from USE5): the percentage of use of the particular source type / the percentage of used of the most-used source i.e. maximum percentage

- useFirst (adapted from USE6): the order of using the source i.e. source that was used first (before other sources); used second; used third; used fourth; last used

- useBehavioral[67]: average[68] of the 3 behavioral measures of use – useFrequency, useMost and useFirst.

The HLM analysis was repeated for each aspect of 'use' listed above. Since 'useBehavioral' is an average of behavioral measures already addressed, it is discussed under post-hoc analysis.

For each case, the model specified (in equation format) is listed in Table 24. B0 to B8 are level-1 coefficients. G0-G11, G20-G80 are level-2 coefficients and are also called

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[67] The use of the label useBehavioral may be contested if one is to argue that there is not enough distinction between *usePerceptual* and *useBehavioral*, since all the data is based on self-reported perception and useBehavioral does not represent a quantified measure. However, when we look at the items USE1 to USE6 in Appendix A, we see that USE1, USE2 and USE3 are based on a 7-point Likert scale while USE4, USE5 and USE6 still provide an objective criteria (such as a specific timeframe of use, the most used source, or the source first used) for the user to recall. Thus, we use the terms *usePerceptual* and *useBehavioral* to distinguish between the two.

[68] In order to average useFrequency, useFirst and useMost to arrive at a behavioral measure of use, each of these were made equivalent (such that there values were between 1 and 7).

E.g. to arrive at useMost, let us say the values of USE5 (which measured the percentage of use of each source relative to other sources) i.e. the percentage of use of the 5 respective source types were 20%, 20%, 10%, 25% and 25% (leading to a total of 100%). The maximum percentage among these is 25%. The percentage values were converted to values between 1 and 7 by using the formula (percentage/maximum percentage)*7. The five values were converted to a) 20/25 * 7 = 5.6; b) 20/25 * 7 = 5.6; c) 10/25 * 7 = 2.8; d) 25/25 * 7 = 7; e) 25/25 * 7 = 7; Thus, the five respective values for useMost were 5.6, 5.6, 2.8, 7 and 7.

Similarly, to arrive at useFirst, USE6 (which measured the order of using each source from 1 (first used) to 5 (last used)) was used. The USE6 values were converted between 1 to 7 by dividing 1 to 7 in five using steps of 1.5 such that the first-used source (USE6 for a particular source-type is 1) was mapped to 7; the second-used source was mapped to 5.5; the third-used source was mapped to 4; the fourth-used source was mapped to 2.5; and the source that was last used (a value of 5) was mapped to 1. Thus, for USE6 values of 1, 2, 3, 4 and 5, the respective values for useFirst would be 7, 5.5, 4, 2.5 and 1.

fixed effects. QUA (source quality), ACC (difficulty in accessing the source), CMM (difficulty in communicating with the source), etc. are the level-1 predictors discussed above. TEAMCOUN (team count), ROLETENU (role tenure), IMP (task importance), CMP (task complexity), etc. are level-2 predictors discussed above. 'R' in the equation for level-1 is a level-1 random effect. U0 in the first equation for level-2 is a level-2 random effect. The level-2 (fixed) predictors were centered around their grand-mean, and the level-1 (changing across source types) predictors were centered around their group means, as recommended by Raudenbush and Bryk (2002).

Table 24 Model specified (in equation format) for HLM analysis

LEVEL-1 COEFFICIENTS	***LEVEL-2 PREDICTORS***
INTRCPT1, B0	*INTRCPT2, G00* *TEAMCOUN, G01* *ROLETENU, G02* *GENDER, G03* *AGE, G04* *EDUCATIO, G05* *IMP*, G06* *CMP*, G07* *URG*, G08* *EFF*, G09* *ORT*, G010* *ENV*, G011*
QUA SLOPE +, B1	*INTRCPT2, G10* *IMP*, G11*
ACC SLOPE +, B2	*INTRCPT2, G20* *URG*, G21*
CMM SLOPE +, B3	*INTRCPT2, G30* *CMP*, G31* *URG*, G32*
CFT SLOPE +, B4	*INTRCPT2, G40*
O SLOPE, B5	*INTRCPT2, G50*
B SLOPE, B6	*INTRCPT2, G60*
E SLOPE, B7	*INTRCPT2, G70*
P SLOPE, B8	*INTRCPT2, G80*
+ predictor centered around its group mean	** predictor centered around its grand mean*

LEVEL-1 MODEL *(variables that change for each source type)*

$$Y = B0 + B1*(QUA) + B2*(ACC) + B3*(CMM) + B4*(CFT) + B5*(O) + B6*(B) + B7*(E) + B8*(P) + R$$

LEVEL-2 MODEL *(fixed variables across source types)*

$$B0 = G00 + G01*(TEAMCOUN) + G02*(ROLETENU) + G03*(GENDER) + G04*(AGE) + G05*(EDUCATIO) + G06*(IMP) + G07*(CMP) + G08*(URG) + G09*(EFF) + G010*(ORT) + G011*(ENV) + U0$$

$$B1 = G10 + G11*(IMP)$$

$$B2 = G20 + G21*(URG)$$

$$B3 = G30 + G31*(CMP) + G32*(URG)$$

$$B4 = G40$$

$$B5 = G50$$

B6 = G60
B7 = G70
B8 = G80

Table 25 below lists the results of HLM analysis for both the perceptual and behavioral aspects of source use. The table shows the standardized coefficients from the HLM models. The final estimation of variance components are reported at the bottom of the table. While significant coefficient values have been marked with (***, **, * with decreasing levels of significance), values which are close to significance are indicated with (+ p<0.06). Examining these values may give us a better picture of the relationships of the antecedents to different aspects of source use. Education has been reverse-coded and thus suffixed with an '(R)' in the table below (as well as the tables in Appendix I on post-hoc analysis, discussed later).

Table 25 Results from HLM analysis

Final estimation of fixed effects (with robust standard errors)

		usePerceptual		**useFrequency**		**useMost**		**useFirst**	
Hypothesis	Ind. Variable	Std. Coeff.	P-value	Std. Coeff.	P-value	Std. Coeff.	P-value	Std. Coeff.	P-value
Control	Gender	0.198	0.083	0.160	0.242	-0.077	0.586	-0.060	0.168
Control	Age	0.011	0.178	0.017	0.098	0.006	0.583	-0.001	0.820
Control	Role Tenure	-0.001	0.281	-0.001	0.500	-0.001	0.671	0.000	0.293
Control	Team Count	0.041	0.299	0.025	0.598	0.025	0.603	0.011	0.572
Control	Education (R)	**-0.118***	0.048	0.020	0.740	0.098	0.115	0.010	0.599
Control	ENV	**0.185*****	0.000	0.049	0.434	0.027	0.654	0.030	0.128
Control	CFT	-0.115+	0.058	-0.094	0.158	**-0.179***	0.018	**-0.185***	0.018
Control	EFF	0.090	0.078	0.038	0.524	0.079	0.224	-0.003	0.860
Dummy	onlineInfo	-0.163	0.117	**0.299***	0.011	**0.742****	0.001	0.341	0.072
Dummy	book/ manual	**-0.620*****	0.000	**-0.779*****	0.000	**-1.139*****	0.000	**-1.138*****	0.000
Dummy	email/ forum	**-0.392*****	0.000	-0.195	0.082	**-0.926*****	0.000	**-0.687*****	0.000
Dummy	phone/ chat	**-0.155***	0.037	-0.062	0.496	**-0.697*****	0.000	**-0.521*****	0.000
	IMP	-0.057	0.349	-0.027	0.705	-0.024	0.765	0.001	0.960
	URG	-0.018	0.621	0.006	0.887	0.016	0.734	-0.021	0.140
1	QUA	**0.622*****	0.000	**0.467*****	0.000	**0.655*****	0.000	**0.670*****	0.000
2	ACC	-0.054	0.187	**-0.218*****	0.000	-0.103	0.074	**-0.128***	0.018
3	CMM	**-0.079***	0.044	-0.007	0.868	-0.070	0.205	-0.096	0.068
7	CMP	**0.094***	0.020	**0.110****	0.010	0.075	0.106	0.006	0.647
9	ORT	0.036	0.488	0.018	0.821	-0.068	0.352	0.002	0.930

4	IMP * QUA	**0.074***	0.042	**0.112***	0.018	**0.105***	0.034	**0.143****	0.005
5	URG * ACC	0.001	0.978	0.029	0.331	0.014	0.733	0.035	0.369
6	URG * CMM	-0.003	0.912	**-0.069***	0.012	-0.061	0.127	-0.023	0.533
8	CMP * CMM	0.021	0.421	0.021	0.451	0.009	0.817	0.050	0.165
Final estimation of variance components									
S.D.		0.676		0.845		0.684		0.019	
Variance component		0.457		0.713		0.468		0.000	
df		334		334		334		334	
chi-square		868.340		928.655		519.112		78.202	
P-value		0.000		0.000		0.000		>.500	
level-1 S.D.		1.172		1.387		2.030		1.811	
level-1 variance component		1.374		1.923		4.120		3.279	

+ p<0.06 (close to significance) * p<0.05 **p<.01 ***p<.0001

Hypothesis 1: "The perceived quality of an information source positively affects the use of that source" is strongly supported across all source types.

Hypothesis 2: "The difficulty in accessing an information source negatively affects the use of that source" is supported for the behavioral measure of frequency of use and of first use, but unsupported for perceived frequency of use and amount of use.

Hypothesis 3: "The difficulty in communicating with an information source negatively affects the use of that source" is supported for perceived frequency of use but not supported for behavioral aspects of use.

Hypothesis 4: "The positive effect of the quality of an information source on the use of the source is higher when the task is more important to the seeker, compared to when the task is less important" is supported for all aspects of source use (both perceptual and behavioral).

Hypothesis 5: "For a more urgent task, the difficulty in accessing an information source has a higher negative effect on the use of the source compared to a less urgent task" is unsupported.

Hypothesis 6: "For a more urgent task, the difficulty in communicating with an information source has a higher negative effect on the use of the source compared to a less urgent task" is supported for the behavioral measure of frequency of use, but unsupported for other behavioral (useMost, useFirst) and perceptual aspects of use (usePerceptual).

Hypothesis 7: "The complexity of the task at hand positively affects the use of the information source" is strongly supported for frequency of use (both perceived and behavioral measures), but not supported for first or most usage of the information source.

Hypothesis 8: "The negative effect of communication difficulty with the source on the use of the source is higher when the task at hand is complex compared to when the task is less complex" is not supported.

Hypothesis 9: "The learning orientation of the seeker/actor positively affects the use of the information source" is not supported.

Other variables. The direct effects of task importance and task urgency on source use was found to be insignificant across all aspects of use.

From the control variables, the effect of the demographic variables gender, age, role tenure, team count, as well as the seeker's task self efficacy on source use was found to be insignificant. Decrease in education level was found to have a negative effect on perceived frequency of use, but the effect of education on the behavioral aspects of use was insignificant. The effect of a learning environment on perceived frequency of use was found to be significant, but the effect on behavioral aspects of use was insignificant. The effect of lack of comfort with the source was found to negatively affect the first and most usage of the source but had no effect on the behavioral

measure of frequency of use. The negative effect of the lack of comfort with the source on perceived frequency of use was almost significant (p=0.058).

Following were the findings of the effect of each source type (as compared to face-to-face) on different aspects of source use:

Online information is used more frequently, and for a higher percentage of time, as compared to face-to-face. Online information may be deduced to be slightly more popular as first choice (p=0.072, almost significant) as compared to face-to-face.

Book/manual is used less (frequently, lesser amount of time, chosen later) as compared to face-to-face.

Email/forum is chosen after face-to-face, is used for a lesser percentage of time and perceived to be used less frequently as compared to face-to-face. In behavioral measure of frequency of use too, email/forum is likely to be used less compared to face-to-face, as the effect is close to significance (p=0.082).

As compared to face-to-face, phone/chat is used for a lesser amount of time, chosen later and is perceived to be used less frequently as compared to face-to-face. However, the negative effect of phone/chat (as compared to face-to-face) on the objective measure of use frequency was not found to be significant.

5.3.5 POST-HOC ANALYSIS

An average of the three behavioral measures of the dependent variable USE i.e. useFrequency, useFirst and useMost was taken to arrive at a single behavioral measure of use. Table 41 in Appendix I summarizes the results of the HLM analysis with usePerceptual and useBehavioral as dependent variables. As expected, the

significant effects for useBehavioral are those found to significant for either useFrequency, useFirst or useMost.

We also carried out post-hoc analyses to study the individual impact of the various contextual variables on the choice of a particular source type. For each aspect of the dependent variable USE (i.e. usePerceptual, useFrequency, useMost, useFirst, useBehavioral), this analysis was carried out using moderated multiple regression, and was repeated for the five types of sources[69]. "Moderated multiple regression extends ordinary least squares regression with products of independent variables. The products of independent variables are used to capture the enhancing or suppressing effect between independent variables, i.e., moderator effects." (Xu *et al.* 2006, p.1674). SPSS 16.0 was used to carry out the regression analysis. A matrix plot of all variables showed that linear regression is an appropriate model for 'use' and all its antecedents. The four standard assumptions for linear regression i.e. independent identical normal distributions all held[70]. Average values[71] were first computed to arrive at a measure for each construct. These measures were then standardized. For interaction effects, pair-wise products of standardized values of constructs were computed (Task Importance x Source Quality; Task Urgency x Difficulty in accessing

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[69] For moderated multiple regression using each aspect of use and a particular source type, it is possible to do a stepwise regression to identify the different contributions of main effects and moderator effects. Here, the dependent variable (e.g. usePerceptual) can first be regressed on the control variables (gender, age, role tenure, education, ENV, CFT, EFF). Then, the main effects of IMP, URG, QUA, ACC, CMM, CMP, ORT can be added to the model. Finally, the moderator effects (IMP*QUA; URG*ACC; URG*CMM; CMP*CMM) can be added to the model. However, given the large number of dependent variables, and the different types of sources, stepwise regression was not used in the final analysis to prevent the reporting from getting too complicated. There was no significant difference in the final results when all variables (control, main effects and moderator effects) were added hierarchically and when they were added all at once.

[70] Checking for linearity and normality (histogram plotting the frequency distribution of the regression standardized residual shows a perfect normal curve for all source types, normal P-P plot of regression standardized residual is a straight line for all source types); checking for mean=0 (regression will enforce it); checking for constant variance (graph of residuals vs each predictor variable is random and there is no discernable pattern); checking for pairwise correlations (graph of residuals vs each predictor variable is random and there is no discernable pattern of positives followed by negatives or vice versa).

[71] e.g. IMP= (IMP1+IMP2+IMP3+IMP4+IMP5)/5

the source; Task Urgency x Difficulty in communicating with the source; Task Complexity x Difficulty in Communicating with the source). For each source type, the dependent variable USE[72] was regressed against all its antecedents (variables contributing to main and interaction effects, as well as control variables).

Table 42 (usePerceptual), Table 43 (useFrequency), Table 44 (useMost), Table 45 (useFirst) and Table 46 (useBehavioral) in Appendix I list the results of the regression analysis for each source type, alongside the results of the HLM analysis for that particular aspect of 'use'. The tables show Beta values from the regression model of each aspect of USE against its antecedents for each source type.

In the bottom of these five tables, the adjusted R-square[73] (coefficient of determination) values are also indicated. E.g. let us look at Table 42 for perceived frequency of use. For the source types 'onlineInfo' and 'book/manual', the model accounts for 36.3% of variability in the data set. For 'phone/chat', it accounts for 32.2% of variability in the data set. This percentage is lower for the 'face-to-face' and email data sets (26.6% and 16.4% respectively). In each table, while significant Beta values have been marked with (***, **, * with decreasing levels of significance), values which are close to significance are indicated with (+ $p<0.06$). Examining these values gives us a picture of the relationships of the antecedents to each aspect of use across the different source types.

[72] 'Frequency of use' is used for hypothesis testing

[73] the proportion of variability in a data set that is accounted for by the statistical model

5.4 A brief Qualitative Analysis of the Tasks, Information Sought and the Sources listed by respondents

After all the statistical analysis, some amount of qualitative analysis of the tasks, information sought and the typical information sources listed by the respondents may be able to shed additional light on the results, as this reflects the scope of the sampling and can be important for interpreting the statistical results.

Analysis of tasks and information sought. Table 47 in Appendix J lists examples of the tasks[74] respondents were working on when surveyed and the information sought[75] from the source(s) for a specific problem/part of the task.

To allow for ease of comprehension, the task and the information sought have been classified as per the particular industry or line of business of the organization the respondent was working in.

Analysis of typical sources specified by the respondents. The tables in Appendix K include a qualitative analysis of typical sources specified by the survey respondents. To get information to solve the specific problem/part of the task specified by the respondents (see the righmost column in Table 47 in Appendix J), the respondents were asked to think of a typical source of information for each of the 5 types of sources: 1) face-to-face (MyFace2FaceSource) – Table 48 in Appendix K; 2) phone/chat (MyPhone/ChatSource) – Table 49 in Appendix K; 3) email/online forum

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[74] *Question to respondent:* A task/project/problem situation you're involved in currently, and that is expected to continue for at least a few weeks _____

[75] *Instruction to respondent:* For the task/project/problem situation that you specified, recall a 'specific problem/part of the task' where you had to (or will have to) look for information from one or more sources (e.g. asking a colleague face to face, through phone or on chat, referring to a book or a report or doing a search on the Internet). *Question to respondent:* Information I was/am looking for (or 'will look for') _____

(MyEmail/ForumSource) – Table 50 in Appendix K; 4) book/manual (MyBook/Manual) – Table 51 in Appendix K; and 5) online information (MyOnlineInfoSource) – Table 52 in Appendix K.

For the face-to-face source, 69% of the respondents specified a name for a typical person with whom s/he would interact face-to-face to get information. Around 15% of the respondents specified a senior/manager at work. The rest either didn't specify any name for a source, or mentioned a colleague (2.6%), customer/client (2.4%) or a friend (0.6%) with whom they would get the information for this particular task that they were involved in (see Table 48).

For the person with whom the respondent would typically (or could) discuss the problem on phone or online chat, 66% of the respondents specified a name for such a person. 7% mentioned a customer/client, around 6% mentioned a senior/manager at work with whom they would get the information on phone or chat (the percentage was higher 15% for face-to-face interaction with managers), 4.5% mentioned a colleague, 1.5% mentioned a friend, while the rest did not indicate a typical phone/chat source (see Table 49).

For a person to email or to post queries on online forums, 60% of the respondents specified the name of a person to email, 7% specified a senior/manager at work, around 7% specified an online forum (names of specific forums identified are listed in a footnote in Appendix K), around 6% specified a customer, client or an agent, while 3% mentioned a colleague whom they would email (see Table 50).

Around 37% respondents specified the name/topic of a book they would refer to, 26% mentioned a report or a manual, while a large number (34.5%) didn't specify a typical

book or manual (see Table 51). Different topics for books identified and the different kinds of manuals/reports identified by respontents are listed in a footnote in Appendix K.

For online/electronic information sources, 42% specified the Google search engine as the source they would use for their specific problem (this is not surprising looking at Google's tremendous popularity and the lion's share of the search engine market it owns). Around 20% mentioned websites and internet sources in general, without any particular names. 11.5% of respondents would use their company's intranet or digital library to get information. Other sources mentioned included Yahoo, Wikipedia, client's intranet, Lawnet, the Microsoft Developer Network (MSDN), Ask.com, Google Scholar and Medline. When analyzing, wherever two online sources were mentioned by a respondent e.g. Google and Wikipedia, a count/weight of 0.5 each was given to Google and Wikipedia each. In a few cases where 3 online sources were mentioned, a count/weight of 0.33, 0.33 and 0.34 were given to the online sources to arrive at the final percentages indicated in Table 52.

We will discuss the findings in the next chapter.

CHAPTER 6 DISCUSSION, LIMITATIONS AND IMPLICATIONS

In the previous chapter, we saw the results of the HLM analysis for hypothesis testing and subsequent findings. We also saw the results of the post-hoc regression analyses for each source type. Let us now discuss these findings:

6.1 Discussion

Quality versus Accessibility. When we started this study, we set out to disambiguate the conflicting findings of the relative importance of source quality and accessibility in the use of an information source. While some studies had found source quality to be more important (e.g. Ashford 1986; Swanson 1987; Vancouver and Morrison 1995; Morrison and Vancouver 2000), other studies found accessibility to be more important (e.g. Gerstberger and Allan 1968; Chakrabarti *et al.* 1983; Culnan 1983; Anderson *et al.* 2001; Yitzhaki and Hammershlag 2004). We sought to address these conflicting findings by incorporating variables from the 'context' surrounding information seeking that impact a person's use of one or more information sources.

The verdict from our study is very clear about source quality, and presents interesting results for accessibility. When contextual variables are taken in to consideration, the effect of source quality on source use is strongly significant. This finding holds across all aspects of source use (both perceptual and behavioral). From the post-hoc regression analysis results of Appendix I, we can see that this finding holds across all source types and irrespective of classification between source types.

The effect of access difficulty on source use differs based on different aspects of source use. While the effect of access difficulty on perceived frequency of use is insignificant, access difficulty does have a strong negative effect on the behavioral measure of frequency of use. This implies that while people like to believe that they don't place much emphasis on access difficulty, they do when it comes to an objective measure of use frequency. Access difficulty also hinders the first use of a source. This is intuitive. As a first choice, we will not pick a source that is difficult to access. The effect of access difficulty of a particular source on the amount of usage of that source is insignificant. Thus, while users do place emphasis on quality, the difficulty in accessing a source ensures that people don't use that source often enough, and don't pick it as their first choice.

When post-hoc (regression) analysis is carried out on individual source types, the effect of access difficulty on perceived use is insignificant for each source type. However, the negative effect of access difficulty on the behavioral measure of use frequency is significant for book/manual and face2face (and insignificant for onlineInfo, email and phone/chat). This finding also implies that technology has ensured that people (especially in a setting like Singapore), have easy access to onlineInfo, email and phone/chat (all requiring internet/phone connectivity) so access

difficulty in these cases in not an issue. The negative effect of access difficulty on the percentage of use of book/manual is significant, but insignificant for other source types. This implies that a book that is difficult to get will be used for a lesser amount of time, and that a user is not as sensitive to the access difficulty of other source types, when it comes to amount of usage. Interestingly, the access difficulty of face-to-face is a greater hindrance to its first use, as compared to other types of sources. From the dummy variable results (against useFirst) in Table 25, we can see that face-to-face is one of the first used sources (the coefficient of book/manual, email/forum and phone/chat with respect to face-to-face is negative), while that of onlineInfo with respect to face-to-face is positive but not significant (though close to significance p=0.072). Because of this importance of face-to-face sources for first use, the access difficulty of face-to-face could be a greater hindrance to first use, as compared to other source types.

The quality component has the highest impact for useFirst and useMost, followed by usePerceptual and then useFrequency. This makes sense because the quality of a source is a big factor when people decide to pick up that source for use or using it for the greatest amount of time.

On examining the impact of the quality component on perceived frequency of use, for example, we see that the quality component has the highest impact in the use of online information (as compared to personal sources like face-to-face or interacting with a person over email). This implies that while a seeker may be more relenting in the case of a person s/he is meeting face-to-face or communicating via email, s/he doesn't want to compromise on the quality of the online material (or book) s/he is reading that is relevant to the task at hand.

Source Cost. Source cost is characterized by 'difficulty in communicating with the source' and 'lack of comfort with the source'. Interestingly, it was found that while people perceive communication difficulty as a big impediment to source use, the relationship was not found significant to any behavioral aspect of use.

In the post-hoc analysis, only in the behavioral measure of frequency of use of online sources did communication difficulty have a significant negative effect. The relationship between communication difficulty and the perceived frequency of use of book/manual was weakly significant ($p=0.073$), as compared to other source types. This implies that if a book or manual is hard to read or understand, a seeker might think that s/he is more likely to reject it (as compared to any other source type being difficult to communicate with), but in actual frequency of use, the user shows more sensitivity towards online sources. In both cases, this sensitivity towards the communication difficulty of impersonal sources such as onlineInfo and book/manual might be because of the lack of verbal cues and immediacy of feedback (Dennis and Valacich 1999) in such sources.

We used the 'lack of comfort with a source' as a control variable in our study. It was found to have a significant negative effect on the first use of the source, as well as the amount of time a source is used. The negative effect between lack of comfort and perceived frequency of use was also close to significance ($p=0.058$), while the effect on the behavioral measure of frequency was insignificant. This implies that lack of comfort with the source (a measure of seeker-source relationship) is a major contextual factor in determining source use.

Lack of comfort was found to be more positive in the perceived frequency of use of books and manuals as compared to other types of sources. This implies that if a seeker

is uncomfortable with an interpersonal source (who he communicates with either face-to-face, phone/chat or over email), the person thinks s/he is more likely to avoid seeking information from that source. This is so as to maintain his/her self image and to save face or the relationship. Even in the case of websites, search engines or online data, a searcher is more likely to patronize those s/he is familiar or comfortable with. But, this lack of comfort level is not so much an impediment when it comes to books or manuals because the person has no relationship to maintain and no face to loose in front of the book. Degree of familiarity also doesn't come into question in the case of books. This is because people are mostly reading new books or manuals depending on their work requirements (unless a student is revising his/her book before exams). In the behavioral measure of frequency though, this effect of lack of comfort was insignificant across all source types.

Lack of comfort was found to be more positive in the percentage of use of email as compared to other source types. This implies that if a seeker is not comfortable with a synchronous source (online, phone/chat, face-to-face), the person is more likely to avoid seeking information for a large amount of time from that source.

Task Variables. The effect of task complexity on source use was significant for both perceived and behavioral measures of frequency of use (but insignificant for the most use or first use of a source). Whenever there is a complex task at hand, there are many unknown factors – leading to a gap in a person's understanding (according to Brenda Dervin's sense making theory) or an anomalous state of knowledge (or ASK, as stated by Nick Belkin). In order to fill this increased need for knowledge, the seeker is forced to consult an information source frequently in order to bridge this gap.

The strong relationship with books/manuals (both for perceived and behavioral measures of frequency) shows that a complex task forces individuals to dig deeper into books for answers that are not readily available. For a complex task, online information is also used often (relationship to behavioral measure of frequency is significant) and for a large percentage of time. This shows the increased reliance on online information for solving complex tasks in a world where more and more information is online, and people have increased access to digital information. A weak relationship ($p<0.077$) with email/forum for perceived frequency of use shows that a person might also email someone s/he knows frequently or post a query into online forums to solve a complex task.

In the post-hoc analysis, task importance was seen to have a negative effect on the perceived frequency of use of books/manuals. This means that when there is an important task at hand, the seeker perceives that s/he would much rather speak to someone face to face, search for information online, call or chat with someone or email someone, before having to look towards books. Task importance was also seen to have a significant positive effect on the behavioral measure of frequency of use of phone/chat. This implies that for important tasks, seekers often choose to phone or chat with someone.

Task urgency was found to have a strong effect on the frequency of (both perceptual and behavioral) use of phone or online chat. This finding explains why when we need information quickly, we don't hesitate to call someone up quickly or ping someone on online chat. The weakly negative relationship ($p=0.069$) of task urgency on the perceived frequency of use of books explains why when we need something quick, we'd rather talk to someone than to dig deep into books for answers to our questions.

Interestingly, task urgency was found to have a significant positive effect on the first use of email over other sources. Perhaps it might be because of the desirability of information communicated in writing to provide greater clarity for an urgent task.

Seeker variables. A seeker's learning orientation was found to be insignificant to source use when separate source types are not considered (HLM analysis). The regression analysis showed learning orientation to have a positive effect on the use of online sources. This means that in the digital era where a large number of people have internet access, a motivated individual perceives himself to frequently search for information online, before looking at other sources. However, this relationship was found to be insignificant for behavioral measure of use frequency. Interestingly, learning orientation was found to have a weak negative effect on the use of interpersonal sources such as face-to-face ($p=0.06$) and a person over phone or online chat ($p=0.065$). This means a motivated individual perceives himself looking for information online than to ask someone. People with such traits end up being 'Gurus' in workplaces or online forums, who everyone turns to when faced with questions that need answering. However, this relationship was insignificant for an objective measure of frequency. To further support the argument, learning orientation was found to have a significant negative effect on the percentage of time a face-to-face source is used, and the first use of a phone/chat source type. Thus, if at all learning orientation is significant, it is significant for online sources compared to interpersonal sources such as face-to-face or phone/chat.

A seeker's prior expertise or self efficacy in the task at hand was found to have no effect on the use of information sources. This might be explained by the fact that employees in organizations are constantly being forced to look for new information.

Even if they are experts in their areas, there are new demands based on market or client needs, to which the company (and subsequently, its employees) need to respond. This requires looking for new answers even if you know a lot about the area and could have been in the company/field for many years. Only in the first use of face-to-face sources, task self efficacy was found to have a negative effect. This is logical, because if a person thinks s/he knows about a task, s/he won't go about asking someone else right at the outset.

During post-hoc analysis, gender was found to have a strong effect on the perceived frequency of phone/chat and online source use, whereby females saw themselves as using these more compared to males. Perhaps females feel more comfortable talking or chatting as compared to men (especially in the Singapore work context where the survey was administered). The findings suggest that females see themselves as turning to online information when they can't find what they are looking for using phone or online chat. However, looking at the objective measure of frequency of use, only phone/chat was found to show a significant effect for females, and not online information. Thus, even though females see themselves as using online information more often than males do, it is only phone and chat where they surpass males in the frequency of use (both perceptually and behaviorally).

When individual source types were not considered, there was no significant relationship between age and source use. During post-hoc analysis however, age was shown to have a positive effect on the frequency of use (both perceived and behavioral measures) of books/manuals and email/forum. This finding suggests that older people in an organization may not be looking for immediate answers from synchronous sources such as face-to-face, phone/chat or online. Age was also seen to

have a positive effect on the amount of time email was used, and the first choice of email as a source, as compared to other source types. Age was found to have a negative effect on the first use of face-to-face. This implies that older employees prefer email the person first, as compared to using face-to-face as a first option.

Lower level of education was seen to have a negative relationship with perceived frequency of source use (irrespective of source type), but insignificant effects with behavioral aspects of use. This implies that people perceive educated people to be turning to an information source more often. This can be explained by the fact the more you learn, the more you realize how much you do not know and the more you want to learn. The regression analysis between education and perceived frequency of source use suggests that the more educated a person, the more s/he perceives as turning to books/manuals, email/forum and phone/chat for information. However, in the behavioral measures of use, these relationships do not hold.

The amount of time an employee has been in a particular role in a company (studied by Gray and Meister 2004) was found to have no relationship to the use of information sources. Thus, role tenure is not a factor in the use of a particular information source. That is because the need for information stems from the task at hand, and might not be related to how long the person has been in a particular position in a company.

Environment. While the respondents perceived their learning environment to positively affect perceived frequency of use, there was no effect on the behavioral measures of use. This could be because the mean values for learning environment were quite high (see Table 21), implying a perceived favorable learning environment. Since there was not much variation in the quality of learning environment experienced

by the respondents, it did not impact the actual behavior of using a particular information source. The post-hoc analysis showed that a learning environment negatively affected the first use of phone/chat, as compared to other source types. This implies that people might prefer to first seek information online, through books or asking someone face-to-face instead of first picking up the phone and calling. The other source types (e.g. online information or books or face-to-face) can be more easily associated with learning, as compared to phone or chat.

Team count was found to have no effect on source use (irrespective of source type). However, when source types were considered separately, team count was found to have a close to negative effect ($p<0.055$) on the perceived frequency of use of online sources, and a significant negative effect on the behavioral measure of frequency of use of online sources. This can be explained by the fact that for smaller teams, people are generally working on their own. The need to look for information online is high. As the team size increases, people work closely together and prefer getting information from each other (either face-to-face, through phone/chat or through emails) or through books/manuals.

Interaction Effects. For an important task, the quality of the source was found to matter for all aspects (both perceived and behavioral) of source use. For perceived frequency of use, it was found to matter more in the case of interpersonal sources (face-to-face and phone/chat), as compared to impersonal sources. The reputation of a person (for his/her knowledge) becomes a factor when the task at hand is important. This effect was especially more pronounced when getting information directly from a person face-to-face ($p<0.003$). The reason why the effect was not significant for impersonal sources such as online information or books and asynchronous sources

such as email or forum might be because when the task is important, you want to make sure you get the answers well. Verbal and non-verbal cues and immediacy of feedback provided by interpersonal sources help the person in better comprehension of information related to this important task at hand. However, for an objective measure of frequency of use, the quality was found to matter for book/manual, email and phone/chat. This might be because of the high usage of face-to-face and online sources in general, and thus, the person becoming pickier when it comes to the quality of other 3 source types, when faced with an important task. However, when faced with an important task, positive effects of the quality of email/forum, phone/chat and onlineInfo on the first choice of source to use were observed. Thus, the user is more sensitive to the quality of these source types, as compared to the quality of face-to-face or book/manual when choosing the first source type to use.

The interaction between task urgency and difficulty in accessing the source was found to have no effect on the use of any type of source. This could be because in the questionnaire in Appendix C, the respondents were asked to choose a typical source from each source type. It is possible that they implicitly chose a source accessible to them (Table 22 shows access difficulty to have low values in the range of 3.xxx in a scale of 1-7). Thus, given sufficient lack of variation in accessibility values, it is possible that the moderator effect is found to be insignificant as well.

For an urgent task, the difficulty in communicating with a source was found to negatively affect the frequency of use (objective measure) of that source. This is intuitive. The greater the difficulty in communicating with a source, the less frequently a seeker will want to use that particular source.

In post-hoc analysis, for an urgent task, the difficulty in communicating with a person over email/forum was found to negatively affect the perceived frequency of use and the amount of use of that source over email/forum. However, for an objective measure of frequency of use, these negative effects were observed for onlineInfo, book/manual and email/forum. These results are intuitive. For anything urgent, it becomes important that you understand the person you are talking to. Impersonal and asynchronous sources being found as impediments is understandable. This is because for urgent tasks, one would prefer getting information from interpersonal (face-to-face, phone/chat), synchronous means rather than using an asynchronous medium such as email/forum or impersonal sources such as onlineInfo and book/manual.

For a complex task, the difficulty in communicating with a person over phone was not found to be an impediment for frequency of use (both perceived and behavioral), as compared to other source types. This finding is counter-intuitive. It could be because a complex task requires a person to use more than one source for information. Also, for a complex task, the communication difficulty with an online source was not found to be an impediment for amount of usage. This could be because being an impersonal source, communication difficulty is not as readily applicable to online sources, as it would be for face-to-face or a source over phone or chat.

Effects of source types (with respect to face-to-face) on use. Based on the HLM analysis of Table 25, we arrive at the table below, where we rank the source types for each aspect of source use. An interesting distinction comes forth between the perceived and behavioral aspects of use. We find that for the perceived frequency of source use, the respondents rank the source types in the order of face-to-face, phone/chat, onlineInfo, email/forum and book/manual (from most used to least used).

However, all behavioral measures of use show the order to be onlineInfo, face2face, phone/chat, email/forum and book/manual (most used to least used). The behavioral measures are closer to reality, and considered more accurate than perceptual measures. Thus, we can conclude that with the increased availability of online data, people use online information sources the most, followed by face-to-face and phone. Books and manuals (because of the difficulty in accessing, searching, and lack of feedback/cues) are the least used. In Table 22, we had arrived at the ranking source types based on their perceived frequency of use. These ranking, derived from mean values, place the order as face-to-face, onlineInfo, phone/chat, email/forum and book/manual (most used to least used).

Table 26 Ranking of source types on different aspects of use

Rank	usePerceptual	useFrequency	useMost	useFirst	useBehavior
1	f	o	o	o#	o
2	p	f	f	f	f
3	o#	p#	p	p	P
4	e	e#	e	e	e
5	b	b	b	b	b

f=face2face; p=phone/chat; o=onlineInfo; e=email/forum; b=book/manual
# Relationship not significant with respect to face-to-face

6.2 Limitations and Future Research

It is important to note the limitations of this survey study. First, the study was based in Singapore where a large majority of the sample was highly educated. How source use behavior plays out in a setting where people have more diverse different educational levels might be interesting to note. Also, people in Singapore have easy access to high-speed internet (so online information becomes an important factor). Whether the findings would differ in settings where access to online information is limited would be important to consider. In the survey, the respondents had all the 5 source types listed before them. In a real-life setting, a person might not readily make

a choice keeping all the sources before him/her. The study can be repeated whereby the respondent is asked to select one or more type(s) of source(s) s/he typically uses and answer the questions in the survey based on that. The respondents were restricted to only one source per source-type. As they were asked to focus on the source that they would use for the task (a typical source from each type), it is possible that they chose sources (among the source types) with relative high quality (inflated effect of source quality) and relatively low access difficulty (limited effect of access difficulty, as what they choose would likely be those they have access to). See Table 22 for mean values. This could lead to lesser variation in the values across the sample (than would be in a real-life case). Future studies can look at ways to include more sources for each source type. The study can be made feasible by asking the respondent to choose any one type of source, and then choosing, say, 5 sources within each source type. E.g. for the 'online information' source type, it would be useful to design a study around different types of information channels/sources (search engines, blogs, social networking/folksonomy-based sites such as Facebook, Orkut, YouTube, etc., wikis, repositories or other advanced media, including upcoming technologies such as Google Wave and the Microsoft Bing decision engine). This will lend more of an IT artifact to the study. Also, many variables in the theoretical framework of elements of context (Figure 22) could not be incorporated in this research model. Future studies should investigate the effect of other contextual variables on source use. Another limitation was that the study included employees from different industries and work roles. Incorporating the physical context of the seeker (whether the participant is an office worker or a field worker) might shed light on the differing preference for source-type such as face-to-face versus online. However, it is extremely difficult to club different employees (from varied industries) into two groups; the access to

sources, the type of work role and sources used is highly variable, and may not be effectively put into two neat groups. Studies could also look at the task factors by examining different dimensions of 'importance', 'urgency' and 'complexity', as these factors could be multifaceted.

A questionnaire survey was used in this study because this method of data collection helps us get a large amount of information from people in a non-threatening manner - especially subjective information related to attitudes and opinions. Questionnaire surveys can be completed anonymously, are relatively inexpensive to administer, easy to compare and analyze, can be administered to many people, can help get lots of data and also have well-developed items for a large number of constructs that can be used across studies. However, there are also challenges and limitations of using a questionnaire survey for this kind of study. These include the risk of not getting careful feedback from respondents, the risk of the wording of items in the questionnaire biasing the responses, the impersonal nature of questionnaires and the lack of a full in-depth story as one could possibly get in a well-designed qualitative study. Moreover, in-person administration of questionnaire surveys (as this study was) can have limited geographic coverage (this study was limited to working people across Singapore) and there is the risk of a bias due to the presence of the survey administrator (care was taken to not disturb/stay away from the respondent while filling out the questionnaire). Future work should include more in-depth qualitative analysis to address the research questions and to see if the findings are different.

6.3 Implications

There are important theoretical implications of this study. First, our study resolves the conflicting findings of the relative importance of the cost and benefit components in the seeker's choice of an information source. In the presence of contextual variables, it was found that while source quality is clearly important in all cases, the effect of accessibility differs in the perceived and behavioral dimensions of source use. While the relationship between access difficulty and perceived frequency of use is insignificant, the negative relationship between access difficulty and the behavioral measure of frequency of use was found to be significant. The negative relationship between access difficulty and first choice of that source was also significant. What it implies is that seekers will not choose a source that is difficult to access (as their first choice), nor will they frequently use that source. However, they think that they do not really care for accessibility of the source (while in reality, they do). Thus, our study has disambiguated the conditions under which accessibility is important, and established source quality as always important, when contextual variables are incorporated in the study. The results are consistent with studies such as Morrison and Vancouver (2000), Vancouver and Morrison (1995), Swanson (1987), Ashford (1986) and Xu *et al.* (2006), which found quality to be more important. Results also support the studies by Gerstberger and Allan (1968), Chakrabarti *et al.* (1983), Culnan (1983), Anderson *et al.* (2001) and Yitzhaki and Hammershlag (2004) which found support for the least-effort principle, and said accessibility is more important. Xu *et al.* (2006), who had limited their study to personal sources, had posited that information science studies using both interpersonal and impersonal sources find accessibility to be more important. However, we defy this contention because we've considered both

impersonal and personal source types, and found both quality and accessibility to be important. The most important contribution beyond these studies is that we show that *both* quality and accessibility are important, and bring forth the circumstances under which accessibility becomes important.

Second, this study shows that a discernable pattern in the findings of various contextual variables can be obtained when we use hierarchical linear modeling. When every person provides responses corresponding to the same fixed number of source types, it is conventional to view the design as source types crossed by persons. But when the use of source types varies from person to person, we may view source types as nested within persons. We were able to make use of hierarchical data modeling to study source use across persons. On doing this, we found that source quality (and its interaction with task importance) is consistently important (also task complexity and comfort level with the source); source accessibility is important for behavioral aspects of use and insignificant for perceived frequency of use (same for the interaction between task urgency and communication difficulty); communication difficulty, learning environment and education were important for perceived frequency of use, but not significant for behavioral aspects of use; source types with respect to face-to-face were found to be important for both perceived and behavioral aspects of use (except for onlineInfo with respect to face-to-face, which was insignificant for perceived frequency of use).

Apart from the pattern outlined above, there was no discernable pattern in the findings of various contextual variables when we consider each source type separately. This is because context varies depending on the task at hand, the source being used and also because of the individual differences of the seeker. This implies that while we can

have a general set of contextual variables that hold irrespective of source type, having a fixed formula for information sourcing patterns is difficult to achieve when we consider the effect of contextual variables on a particular source type. Thus, context differs based on type of information source, and the dimension of use being studied. In this case, a general model incorporating the three competing views of the boundaries of context (as evidenced by the Contextual Identity Framework of Figure 18) still holds.

Table 27 shows a pattern of the relative importance of the different contextual variables based on their significance (for each dimension of use). Under each use dimension, the HLM results (indicated by 'H', and across source types) are shown, followed by the results for the 5 source types – onlineInfo (o), book/manual (b), email/forum (e), phone/chat (p) and face-to-face (f). Every significant co-efficient ($p<0.05$) is denoted by a '*'. The total no. of hits (number of times each variable was found significant) for all source types and HLM results for each dimension of use is denoted by a number (in superscript) denoting the number of times the particular variable was found significant. E.g. ACC^{6} implies that access difficulty was found significant during 6 instances of the HLM/regression analyses.

From the table, we can see that the relative importance of contextual variables (based on hit rate and hit ratio) is in the following order: Source quality$^{24\ (100\%)}$, age$^{7\ (29.17\%)}$, access difficulty$^{6\ (25\%)}$, task complexity$^{6\ (25\%)}$, education$^{4\ (16.67\%)}$, comfort level with the source$^{4\ (16.67\%)}$, task urgency$^{3\ (12.5\%)}$, learning orientation$^{3\ (12.5\%)}$, gender$^{3\ (12.5\%)}$, communication difficulty$^{2\ (8.33\%)}$, task importance$^{2\ (8.33\%)}$, environment$^{2\ (8.33\%)}$, task self efficacy$^{1\ (4.17\%)}$, team size$^{1\ (4.17\%)}$ and role tenure$^{0\ (0\%)}$. However, this is just an estimate. The number or percentage of hits doesn't necessarily imply that the

contextual variable is more important than the rest, because the source types and dimensions of use differ in each case.

Table 27 Relative importance of different contextual variables

contextual		Var.[hits]	frequency of use (perceived)						Frequency of use (behavioural)						% age of use (most used)						Order of use (first used)					
view	element		H	o	b	e	p	f	H	o	b	e	p	f	H	o	b	e	p	f	H	o	b	e	p	f
CS/ SC	Source	QUA[24]	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		CMM[2]	*							*																
	Source/ Channel	ACC[6]							*		*			*			*				*					*
PC, SC	Task	CMP[6]	*		*				*	*	*					*										
		IMP[2]			*								*													
		URG[3]					*						*											*		
PC	Seeker	ORT[3]		*																*					*	
		EFF[1]																								*
		Gdr[3]		*			*						*													
		Age[7]			*	*					*	*						*						*		*
		Edu[4]	*		*	*	*																			
PC, SC		RoleTen.																								
SC	Env.	ENV[2]	*																						*	
		Team Size[1]								*																
CS, SC	Seeker, Source	CFT[4]			*										*			*			*					

H=HLM results (irrespective of source type)
o=onlineInfo; b=book/manual; e=email/forum; p=phone/chat; f=face2face
PC=personal context; SC=shared context; CS=context stereotype

The pattern of contextual variables on different aspects of source use will contribute to the literature in terms of understanding how context, and which contextual variables contribute to which aspects of source use, and information seeking behavior as a whole.

Zimmer *at al.* (2008) found accessibility to have less effect on the use of interpersonal sources. No such distinct pattern was observed in this study. This is the first study of its kind making use of a large number of contextual variables. Zimmer *et al.* (2008)'s study was limited to the effect of quality and accessibility on source use. Also, they muddled the difference between 'source types' and 'sources', which is important to consider in a study of this kind.

While Pettigrew *et al.* (2001) suggested that information seeking is shaped by the social environment (social context), and while Xu *et al.* (2006) found the cognitive view to be more important to task important seeking (personal view of context), the lack of an easily discernable pattern across different source types suggests that multiple views of context come into play at the same time, and must be examined simultaneously to better understand a person's source use decisions.

The seeker-source relationship variable, 'lack of comfort with the source' showed significant effects on use. We had incorporated it as a control variable. Future studies should include relationship variables in their research model and arrive at hypotheses based on the effect of lack of comfort on source use.

An important theoretical contribution of this study has also been the breakdown of different aspects/dimension of source use into perceptual (perceived frequency of use) and behavioral (frequency of use, percentage of use or most used, order of use or first used) and an analysis of the data based on each of these dimensions.

Managers can leverage the understanding of different source types and the source use behavior to increase productivity in their work environments. For instance, looking at the significance of source quality to use, and the importance to accessibility that

employees exhibit in their use behavior, managers can ensure the access of high quality sources to their employees across all types of sources. The importance on quality placed by the respondents should assure many employers on the learning environment being created in their companies. However, the findings also show that access difficulty has a negative impact on the frequency of use, and the use of the source as the seeker's first choice. The finding about the effect of communication difficulty on perceived use (but not on behavioral aspects of use) shows that employees are not overly worried about communication difficulty when using a source. The findings also shed light on an intuitive assumption that a complex task will lead a person to seek information from a source frequently. Efforts should be made in organization to design and provide information sources that help in reducing the level of complexity of the task at hand. Also, when the task is important, the quality of the source becomes important. Again, managers and practitioners must ensure access to high quality sources, at least for employees who are asked to perform important tasks. Understanding the relative importance of different source types is also extremely useful for practitioners. The study shows that knowledge works use online information most often, followed by face-to-face, phone/chat, email/forum and finally books or manuals. The lower usage of books could also point to the lack of availability of new and relevant books for employees in a company. The findings about the role of gender, age, and other individual differences in the source use behavior can be leveraged in an organizational setting to better match employees to the right sources. This would lead to a more favorable learning environment and greater productivity subsequently. Also, managers should try and place people of related skills together, so that employees have easy access to good quality of sources. Also, effort should be made to improve the comfort level between peers and

employees at various levels so that they can easily ask each other for information. Learning about the role of context in search choice will be extremely useful for designers of the next generation of search and decision engines. 'The underlying hypothesis (and belief) is that by taking account of context, the next generation of retrieval engines dependent on models of context can be created, designed and developed delivering performance exceeding that of out-of-context engines.' (Ingwersen, Jarvelin and Belkin, 2005). The insight gained from the findings of the relative importance of different contextual variables will be valuable for designers.

If source types were to be linked to the dimensions of the source, we can get important insights into the design of source systems, leading to effective source use.

Table 28 Results of perceived frequency of use classified under dimensions of source

contextual		Var.	frequency of use (perceived)					
view	element		HLM	online Info	book/ manual	email/ forum	phone/ chat	face-to-face
Source Dimensions				Electronic impersonal	physical impersonal	Electronic asynchronous interpersonal	Electronic synchronous interpersonal	physical interpersonal synchronous
CS/ SC	Source	QUA	*	*	*	*	*	*
		CMM	*					
	Source/ Channel	ACC						
PC, SC	Task	CMP	*		*			
		IMP			*			
		URG					*	
PC	Seeker	ORT		*				
		EFF						
		Gdr		*			*	
		Age			*	*		
		Edu	*		*	*	*	
PC, SC		RoleTen.						
SC	Env.	ENV	*					
		Team Size						

CS, SC	Seeker, Source	CFT			*			

E.g. Table 28 shows the results of the relationship between contextual variables and perceived frequency of use of different dimensions of sources. Studying these relationships will have important implications on the design of sources along different dimensions. Similarly, the dimensions shown in this table could be mapped to the tables in Appendix I, and studied for each aspect of use. This should also contribute to research on Information and Communication Technologies and Computer Medicated Communication.

6.4 Summary of Empirical Survey Study

Most past studies in the disciplines of Information Science and Organizational behavior have largely employed the cost-benefit framework to analyze how seekers decide on choosing a particular information source. However, conflicting findings have been found with regard to the importance of the cost (source accessibility) or the benefit components (source quality) in the seeker's choice of information sources. Also, while the cost-benefit studies have focused on the effect of source quality and accessibility on seeker's choice of source, they have paid little attention to the different contingent variables (which would make up the 'context' of search) on the cost-benefit analysis. We proposed a theoretical framework incorporating different contingent variables used in past studies, which can help to address the cost-benefit debate in the seeker's choice of information source. Based on the contextual framework, we proposed a research model and conducted a survey study on 352 working professionals in Singapore. The study found that upon incorporating

contextual variables, quality (benefit) was certainly the important factor in the use of a source. Accessibility (cost) was perceived by the seeker to be unimportant but was also found important in use behavior.

CHAPTER 7 CONCLUSION AND FUTURE RESEARCH DIRECTIONS

In this thesis, we have presented three theoretical frameworks (one on 'information seeking' and two on 'context') and an empirical survey study.

The integrated framework integrated framework synthesizes a large number of models/frameworks from the person-centric field of information seeking (that looks at the information needs of the user, the process of seeking and the searcher context) and the system-centric field of information retrieval (concentrating on technology aspects such as search engines/interfaces/algorithms). The framework answers recent calls for collaboration between the two related fields. It contributes to theory development in the fast merging field of information searching and retrieval and would be useful to practitioners and designers of information systems for research. This process of synthesis could also serve as a methodological move, whereby the work of a particular theorist is taken and other theories and models mapped to it. This should help bring about synthesis and convergence in research in any field. Designed to serve

as one of the most comprehensive frameworks in the field of information behavior, it would help in understanding past studies in the wider context of the field, as well as in the design of new empirical studies. Our survey study provides one such design based on elements from this integrated framework. Researchers can use the example put forth in this study to synthesize models and theories in the field(s) they are working on. The exercise will also help them understand existing work better, and be useful in developing new ideas for research.

We also carry out a context-based investigation into source use by information seekers. An important question in information seeking behavior is where do people go for information and how do people decide on which information source to use when faced with an information-seeking task or need for information. Some studies have reported that seekers use the information source that is most easily accessible. Other studies have found that people go for the source with the highest quality. The survey study sought to address these conflicting findings by incorporating variables from the 'context' surrounding information seeking that impact a person's use of one or more information sources. However, this required facing difficult questions on what 'context' really means and what its boundaries are. This difficulty was resolved by proposing theoretical frameworks 1) to define the boundaries of context and 2) to list the variables that make up context. This was followed by an empirical survey study of 352 working professionals in Singapore to study the role of these contextual factors in determining a person's use of information source. When contextual variables were taken into account, source quality was found to be highly significant across all source types, while the impact of access difficulty on source use was found significant for behavioral aspects of use (but insignificant for perceived frequency of use). The study has important implications for theory and practice.

7.1 Future Research Directions

Future research will examine various sub-areas of the integrated framework of information seeking and information retrieval. More studies focused on information need and how need leads to seeking behavior will be conducted. Information seeking and source choice behavior in specific settings (e.g. healthcare) will also be investigated to see if findings differ from those in this study. Context versus the source types will also be examined based on the different dimensions of sources.

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APPENDIX A - ITEMS FOR CONSTRUCTS IN THE RESEARCH MODEL (SURVEY)

We first ask the respondent to specify a task/project/problem situation s/he is involved in currently, and that is expected to continue for at least a few months
(the items on IMP, CMP, URG, EFF, ORT and ENV are asked at this level, where EFF and ENV are control variables)

For the task/project/problem situation specified by the respondent, we ask him/her to recall a specific problem/part of the task where s/he had to (or would have to) look for information from one or more sources (e.g. asking a colleague face to face, through phone or on chat, referring to a book or a report or doing a search on the Internet).

To get information to solve the above specific problem/part of the task, we ask the respondent to specify a typical source of information for each of the 5 categories of sources i.e. a) online / electronic; b) book / manual / report; c) email or online forum queries; d) phone or online chat; e) face to face. We call these typical sources that the respondent specified as MyOnlineInfoSource, MyBook/Manual, MyEmail/ForumSource, MyPhone/ChatSource and MyFace2FaceSource respectively.

We then ask the respondent to compare his/her 5 typical sources against each other to solve the specific problem/part of their task. Thus, for items based on the constructs QUA, ACC, CMM, CFT and USE, [] is to be replaced with the typical source that the respondent has specified in each category. This implies that the respondent answers each of these questions for these constructs 5 times i.e. once for each source they've chosen in each category (CFT is a control variable).

Pertains to / Construct (Abbreviation)		**Items**	**Item wording**	**References**
Task	Importance – IMP	IMP1	The task is an important part of my duty.	Xu *et al.* (2006)
		IMP2	The task is important to my performance.	Xu *et al.* (2006)
		IMP3	The task means a lot to me.	Xu *et al.* (2006)
		IMP4	I give a lot of weightage to this task.	Self-developed
		IMP5	I really value this task.	Self-developed
	Complexity – CMP	CMP1	It has been a challenge for me to understand the task.	Adapted from Zander & Kogut (1995); Lord & Ranft (2000)
		CMP2	I spend a long time learning how to do the task.	Zander & Kogut (1995); Lord & Ranft (2000)
		CMP3	The task is so complex and difficult to understand.	Adapted from Zander & Kogut (1995); Lord & Ranft (2000)
		CMP4*	This task requires me to consider so many aspects.	Self-developed
		CMP5	The aspects of the task unclear to me are many.	Self-developed
	Urgency – URG	URG1	I have an approaching deadline to finish this task.	Self-developed
		URG2	The deadline for this task is really close.	Self-developed

		URG3	This is a very urgent task.	Self-developed
		URG4	I need to finish this task soon.	Self-developed
		URG5	There is a pressing need to get this task done soon.	Self-developed
Seeker	Task Self Efficacy – EFF (Control Variable)	EFF1	I consider myself an expert in doing this task.	Xu & Chen (2006); Xu *et al.* (2006)
		EFF2	I can tell a lot about how to do this task.	Adapted from Xu & Chen (2006); Xu *et al.* (2006)
		EFF3	I know this task very well.	Xu & Chen (2006); Xu *et al.* (2006)
		EFF4	I can logically analyze this task.	Xu *et al.* (2006)
		EFF5	I have good knowledge about this task.	Self-developed
	Learning Orientation – ORT	ORT1*	I always push myself to learn more.	Self-developed
		ORT2	I am willing to select a challenging work assignment that I can learn a lot from.	Gray & Meister (2004)
		ORT3	I often look for opportunities to develop new skills and knowledge.	Gray & Meister (2004)
		ORT4	I enjoy challenging and difficult tasks at work where I'll learn new skills.	Gray & Meister (2004)
		ORT5	I continuously work towards upgrading my knowledge and skills.	Self-developed
Environment	Learning Environment – ENV (Control Variable)	ENV1	In my organization, we always ask each other for work-related knowledge.	Self-developed
		ENV2	In my organization, everyone around me feels free to ask for information s/he needs.	Self-developed
		ENV3	In my organization, I am encouraged to ask for anything I do not know.	Self-developed
		ENV4	Most colleagues in my organization are ready to share their knowledge.	Self-developed
		ENV5	My organization has a learning culture.	Self-developed
Source	Quality – QUA	QUA1	[] has knowledge that is potentially applicable to the problem.	Xu & Chen (2006); Xu *et al.* (2006)
		QUA2	[] has knowledge that is relevant to the problem.	O'Reilly 1982; Xu *et al.* (2006)
		QUA3	[] has novel (new) knowledge related to the problem.	Adapted from Xu & Chen (2006); Xu *et al.* (2006)
		QUA4	[] has reliable knowledge relevant to the problem.	Self-developed
		QUA5	[] has broad/wide knowledge related to the problem.	Xu & Chen (2006); Xu *et al.* (2006)
		QUA6	[] has deep knowledge related to the problem.	Self-developed
	Access Difficulty – ACC	ACC1	I would have to spend a lot of time to gain access to [].	Self-developed
		ACC2	It would be very hard to get to [].	Self-developed
		ACC3	It would take a lot of effort to reach [].	Self-developed
		ACC4	It would take too long to get to [].	Self-developed

		ACC5	It would not be easy to approach [].	Adapted from Xu *et al.* (2006)
	Communication Difficulty – CMM	CMM1*	While using [] for my problem, the "conversation" with [] is painful.	Self-developed
		CMM2	While using [] for my problem, it is difficult to "converse" with [].	Self-developed
		CMM3	While using [] for my problem, it is difficult to explain to [].	Self-developed
		CMM4	While using [] for my problem, it is difficult to make [] understand most of the time.	Self-developed
		CMM5	While using [] for my problem, it is difficult to extract useful information from [].	Self-developed
Seeker	Inherent Lack of Comfort with Source – CFT (control variable)	CFT1	I would be nervous to use [] for information in solving this problem.	Adapted from Ashford (1986); Xu *et al.* (2006)
		CFT2	I would be embarrassed to use [] for information.	Adapted from Ashford (1986); Xu *et al.* (2006)
		CFT3	I might be thought as incompetent if I use [] for information.	Adapted from Ashford (1986); Xu *et al.* (2006)
		CFT4	I would not feel comfortable using [] for this problem.	Self-developed
		CFT5	Using [] will not be nice for my image (the way another person(s) sees me).	Self-developed
		CFT6	Using [] will not be nice for my self-image (the way I see myself).	Self-developed
Source	Use – USE (dependent variable)	USE1	Among all the sources of information available to me, I used [] a lot for problem-solving information.	Adapted from Xu *et al.* (2006)
		USE2	I used [] very often for problem-solving information.	Adapted from Jarvenpaa *et al.* (1999)
		USE3	How frequently did you use the following sources for this specific problem/part of the task? (very infrequently… …very frequently)	Adapted from Zimmer & Henry (2007)
		USE4+	I used [] (several times a day; about once a day; several times a week; about once a week; about once in 2-3 weeks; less than (once in 2-3 weeks); didn't use at all)	Adapted from Davis (1989)
		USE5	For this specific problem/part of the task, indicate the approximate percentage of time you used each source (the TOTAL must sum up to 100%)	Adapted from Zimmer & Henry (2007)
		USE6	For this specific problem/part of the task, indicate the order in which you used each source from 1st (fist used), 2nd, 3rd, 4th, 5th (last used) or NA (not used for this problem).	Self-developed

+ Item USE4 was found problematic after Exploratory Factor Analysis
* Items CMP4, ORT1, CMM1 and USE4 were dropped after Confirmatory Factor Analysis

APPENDIX B - CHANGES TO SURVEY ITEMS AFTER SORTING EXERCISES

Table 29 Changes to survey items after unstructured sorting

Construct	ItemCode	Item before unstructured sorting	Item after unstructured sorting
Access Difficulty	ACC2	It would be very **difficult** to get to [].	It would be very hard to get to [].
Learning Environment	ENV2	Everyone around me **is asking** for information s/he needs.	In my organization, everyone around me feels free to ask for information s/he needs.
Task Self Efficacy	EFF5	I have good knowledge about the task.	I have good knowledge about **this** task.
Task Complexity	CMP4	I need to consider so many factors to do this task.	This **task requires me** to consider so many factors.
Task Importance	IMP4*		I give a lot of **weightage** to this task.
Task Urgency	URG5	I have enough time to accomplish this task.	I **do not have** enough time to accomplish this task.
Source Quality	QUA3	[] has novel (new) knowledge which **can be used to solve** the problem.	[] has novel (new) knowledge related to the problem.
	QUA4	[] has reliable knowledge which **can be used to solve** the problem.	[] has reliable knowledge relevant to the problem.
Inherent Lack of Comfort	CFT2	**It is embarrassing** to use [] for information.	I would be embarrassed to use [] for information.
	CFT5	I do not have adequate knowledge about [].	Using [] will hurt my image (the way another person(s) sees me).
	CFT6*	-	Using [] will hurt **my self-image** (the way I see myself).
Communication Difficulty	CMM1*	-	It is difficult to reach a **common understanding** of the problem with [].
	CMM2	It is not easy to get immediate feedback from [].	It is difficult to communicate with [].
	CMM3*	-	It is difficult to **explain** my

dd

			problem to [].
	CMM4	It is difficult to **reach a common understanding** of the problem with [].	It is difficult to make [] understand my problem most of the time.
	CMM5	It is **not easy to** extract information from [].	It is difficult to extract useful information from [].
Source Use	USE1*	-	Among all the sources of information available to me, **I used** [] for problem-solving information.
	USE2	For information to solve this problem, I used [] very frequently.	I used [] very frequently for problem-solving information.

*Item added after unstructured sorting

Table 30 Changes to survey items after structured sorting

Construct	**ItemCode**	**Item before structured sorting**	**Item after structured sorting**
Task Complexity	CMP4	This task requires me to consider so many **factors**.	This task requires me to consider so many aspects.
Task Urgency	URG5	I **do not have enough time** to accomplish this task.	There is a pressing need to get this task done soon.
Learning Orientation	ORT5	I **believe** in life-long learning.	I continuously work towards upgrading my knowledge and skills.
Learning Environment	ENV1	My **organization encourages** me to seek knowledge.	In my organization, we always ask each other for work-related knowledge.
	ENV4	My **organization encourages** me to share knowledge.	Most colleagues in my organization are ready to share their knowledge.
Source Quality	QUA5	[] has **broad** knowledge related to the problem.	[] has broad/wide knowledge related to the problem.
	QUA6^{+}	-	[] has **deep** knowledge related to the problem.
Communication Difficulty	CMM1	It is difficult to **reach a common understanding** of the problem with [].	While using [] for my problem, the "conversation" with [] is painful.
	CMM2	It is difficult to **communicate** with [].	While using [] for my problem, it is difficult to

ee

			"converse" with [].
	CMM3	It is difficult to explain my problem to [].	**While using [] for my problem**, it is difficult to explain to [].
	CMM4	It is difficult to make [] understand my problem most of the time.	**While using [] for my problem**, it is difficult to make [] understand most of the time.
	CMM5	It is difficult to extract useful information from [].	**While using [] for my problem**, it is difficult to extract useful information from [].
Inherent Lack of Comfort	CFT5	Using [] **will hurt** my image (the way another person(s) sees me).	Using [] will not be nice for my image (the way another person(s) sees me).
	CFT6	Using [] **will hurt** my self-image (the way I see myself).	Using [] will not be nice for my self-image (the way I see myself).
Source Use	USE1	Among all the sources of information available to me, I used [] for problem-solving information.	Among all the sources of information available to me, I used [] **a lot** for problem-solving information.
	USE2	I used [] very **frequently** for problem-solving information.	I used [] very often for problem-solving information.
	USE3	How **often** did you use [each of] the following sources for this problem? (very infrequently.. …very frequently)	How frequently did you use the following sources for this **specific problem/part of the task**? (very infrequently… …very frequently)
	USE4	How **frequently** did you use the following sources for this problem? Tick the appropriate choice (only one) for each source (didn't use at all; used less than once each week; used about once each week; used several times a week; used about once each day; used several times a day).	I used [] (several times a day; about once a day; several times a week; about once a week; **about once in 2-3 weeks**; **less than (once in 2-3 weeks)**; didn't use at all)

[+]Item added after structured sorting

APPENDIX C – FINAL SURVEY QUESTIONNAIRE

RESEARCH SURVEY (Dept. of Information Systems, NUS School of Computing)

The **purpose** of this survey is to investigate who do you ask or where do you look for information when faced with your daily tasks in your job/workplace. This is purely an *academic research*. You will take about 15 minutes to complete the survey. **Kindly fill all parts of the questionnaire carefully. You'll receive S$10 as a token of thanks** for your participation. *Participation in this research is voluntary and completely up to you. You can also withdraw from the research at any time without giving any reasons, by informing the researcher and all your data collected will be discarded.*

Listed below are 5 **sources of information** that you might use to help you in your work task. Please note the terms. You may ask if in doubt:

Face2face	Meeting a person face to face (people, colleagues, friends)
Phone/OnlineChat	Calling a person using landline/mobile or reaching out to a person through online voice/video/chat/instant messaging (Skype, Yahoo/MSN messenger, Google talk, etc.)
Email/OnlineForums	Reaching out to a person through email, messaging in social networking websites (Friendster, Facebook, Orkut, etc.) or through online forums/blogs (posting queries in specialized forums).
Book/manual	Physically accessing books (from the library, company, etc.), magazines, hard copies of manuals, reports, journal/conference proceedings, printouts, etc.
OnlineInfo	Electronic/online sources of information such as web search engines (Google, Yahoo, Live search, etc.), online knowledge bases, professional websites (company websites, Wikipedia, etc.), electronic/soft copies of journals/conference proceedings/books/manuals/reports, finding answers in pre-posted entries in forums/blogs, etc.

Please answer the following with respect to the organization you work for:

Primary industry or line of business of your organization: _____

No. of employees in your organization: ☐ 1-19 ☐ 20-49 ☐ 50-100 ☐ 101-499 ☐ >500

No. of people in your work team: ☐ only me ☐ 2-5 ☐ 6-10 ☐ 11-20 ☐ 21-50 ☐ >50

Organization location in Singapore_____ No. of years in current organization _____

Your work role/position _____No. of months in current work role/position _____

A task/project/problem situation you're involved in currently, and that is expected to continue for at least a few weeks_____

Please circle the most appropriate answers keeping in mind the task/project/problem situation in your workplace that you specified above.

	1=strongly disagree						7=strongly agree
1. The task is an important part of my duty.	1	2	3	4	5	6	7
2. The task is important to my performance.	1	2	3	4	5	6	7
3. The task means a lot to me.	1	2	3	4	5	6	7
4. I give a lot of weightage to this task.	1	2	3	4	5	6	7
5. I really value this task.	1	2	3	4	5	6	7
6. It has been a challenge for me to understand the task.	1	2	3	4	5	6	7
7. I spend a long time learning how to do the task.	1	2	3	4	5	6	7
8. The task is so complex and difficult to understand.	1	2	3	4	5	6	7
9. This task requires me to consider so many aspects.	1	2	3	4	5	6	7
10. The aspects of the task unclear to me are many.	1	2	3	4	5	6	7
11. I have an approaching deadline to finish this task.	1	2	3	4	5	6	7
12. The deadline for this task is really close.	1	2	3	4	5	6	7
13. This is a very urgent task.	1	2	3	4	5	6	7
14. I need to finish this task soon.	1	2	3	4	5	6	7
15. There is a pressing need to get this task done soon.	1	2	3	4	5	6	7

gg

	1=strongly disagree						7=strongly agree
16. I consider myself an expert in doing this task.	1	2	3	4	5	6	7
17. I can tell a lot about how to do this task.	1	2	3	4	5	6	7
18. I know this task very well.	1	2	3	4	5	6	7
19. I can logically analyze this task.	1	2	3	4	5	6	7
20. I have good knowledge about this task.	1	2	3	4	5	6	7

Please circle the most appropriate answer.

	1=strongly disagree						7=strongly agree
21. I always push myself to learn more.	1	2	3	4	5	6	7
22. I am willing to select a challenging work assignment that I can learn a lot from.	1	2	3	4	5	6	7
23. I often look for opportunities to develop new skills and knowledge.	1	2	3	4	5	6	7
24. I enjoy challenging and difficult tasks at work where I'll learn new skills.	1	2	3	4	5	6	7
25. I continuously work towards upgrading my knowledge and skills.	1	2	3	4	5	6	7

	1=strongly disagree						7=strongly agree
26. In my organization, we always ask each other for work-related knowledge.	1	2	3	4	5	6	7
27. In my organization, everyone around me feels free to ask for information s/he needs.	1	2	3	4	5	6	7
28. In my organization, I am encouraged to ask for anything I do not know.	1	2	3	4	5	6	7
29. Most colleagues in my organization are ready to share their knowledge.	1	2	3	4	5	6	7
30. My organization has a learning culture.	1	2	3	4	5	6	7

For the task/project/problem situation that you specified, recall a **specific problem/part of the task** where you had to (or will have to) look for information from one or more sources (e.g. asking a colleague face to face, through phone or on chat, referring to a book or a report or doing a search on the Internet).

31. Information I was/am looking for (or 'will look for') _____

To get information to solve the above **specific problem/part of the task**, think of **a typical source of information** for each of the following types of sources. If you happen to choose the same person for Q37-39, think of the difference in meeting the person face-to-face, reaching through phone/chat and through email/forum/blog.

Type of source	Specify name or nickname
32. The person with whom you would typically (or could) discuss this problem **face to face** e.g. Mr. A	(MyFace2FaceSource)
33. The person with whom you would typically (or could) discuss this problem on **phone or online chat** e.g. Miss B (or Mr. A on phone)	(MyPhone/ChatSource)
34. Typical person to **email** or **post online queries** about the problem e.g. Mr. C (or Mr. A on email), or Mr. D in an online forum	(MyEmail/ForumSource)
35. Typical **book/manual/report** to help in the problem e.g. Book-A	(MyBook/Manual)
36. Typical **online/electronic** information source to help in the problem e.g. Google, company digital library, intranet, etc.	(MyOnlineInfoSource)

Compare your 5 sources to solve this **specific problem/part of the task** in each of the following questions. For each source, circle the most appropriate answer (where **1=strongly disagree** and **7=strongly agree**).

In the question, replace [] with your typical source in each category
E.g. read "[] has..." as "MyOnlineInfoSource has...", "MyBook/Manual has...", etc.

E.g. Ques. 1 2 3 4 (5) 6 7 | 1 2 3 4 (5) 6 7 | 1 2 (3) 4 5 6 7 | 1 2 3 (4) 5 6 7 | 1 2 3 4 5 6 (7)

hh

1=strongly disagree 7=strongly agree	MyOnlineInfo Source	MyBook/ Manual	MyEmail/Forum Source	MyPhone/Chat Source	MyFace2Face Source
37. [] has knowledge that is potentially applicable to the problem.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
38. [] has knowledge that is relevant to the problem.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
39. [] has novel (new) knowledge related to the problem.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
40. [] has reliable knowledge relevant to the problem.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
41. [] has broad/wide knowledge related to the problem.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
42. [] has deep knowledge related to the problem.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

To answer Q.48 to Q.52, assume **you have not yet reached []**.

43. I would have to spend a lot of time to gain access to [].	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
44. It would be very hard to get to [].	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
45. It would take a lot of effort to reach [].	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
46. It would take too long to get to [].	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
47. It would not be easy to approach [].	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

To answer Q.53 to Q.57, assume **you have already reached []** and are in the process of using it.

1=strongly disagree 7=strongly agree	MyOnlineInfo Source	MyBook/ Manual	MyEmail/ ForumSource	MyPhone/ ChatSource	MyFace2Face Source
48. While using [] for my problem, the "conversation" with [] is painful.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
49. While using [] for my problem, it is difficult to "converse" with [].	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
50. While using [] for my problem, it is difficult to explain to [].	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
51. While using [] for my problem, it is difficult to make [] understand most of the time.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
52. While using [] for my problem, it is difficult to extract useful information from [].	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

1=strongly disagree 7=strongly agree	MyOnlineInfo Source	MyBook/ Manual	MyEmail/Forum Source	MyPhone/Chat Source	MyFace2Face Source
53. I would be nervous to use [] for information in solving this problem.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
54. I would be embarrassed to use [] for information.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
55. I might be thought as incompetent if I use [] for information.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
56. I would not feel comfortable using [] for this problem.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
57. Using [] will not be nice for my image (the way another person(s) sees me).	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
58. Using [] will not be nice for my self image (the way I see myself).	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

Answer the following questions on how much you used each source for this **specific problem/part of the task**.

59. Among all the sources of information available to me, I used [] a lot for problem-solving information.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
60. I used [] very often for problem-solving information.	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

61. How frequently did you use the following sources for this **specific problem/part of the task**?

a)	1=very infrequently						7=very frequently
MyOnlineInfoSource	1	2	3	4	5	6	7
MyBook/Manual	1	2	3	4	5	6	7
MyEmail/ForumSource	1	2	3	4	5	6	7
MyPhone/ChatSource	1	2	3	4	5	6	7
MyFace2FaceSource	1	2	3	4	5	6	7

b) Select ONE for each source *I used []...*	Several times a day	About once a day	Several times a week	About once a week	About once in 2-3 weeks	Less than (once in 2-3 weeks)	Didn't use at all
MyOnlineInfoSource	☐	☐	☐	☐	☐	☐	☐
MyBook/Manual	☐	☐	☐	☐	☐	☐	☐
MyEmail/ForumSource	☐	☐	☐	☐	☐	☐	☐
MyPhone/ChatSource	☐	☐	☐	☐	☐	☐	☐
MyFace2FaceSource	☐	☐	☐	☐	☐	☐	☐

62. For this **specific problem/part of the task**, indicate the approximate percentage of the time you used each source (**the TOTAL must sum up to 100%**).

TOTAL 100%	MyOnlineInfoSource	MyBook/Manual	MyEmail/ForumSource	MyPhone/ChatSource	MyFace2FaceSrc
	%	%	%	%	%

63. For this **specific problem/part of the task**, indicate the order in which you used each source from 1st (first used), 2nd 3rd, 4th, 5th (last used) or NA (not used for this problem).

ORDER OF USING	MyOnlineInfo Source	MyBook/Manual	MyEmail/Forum Source	MyPhone/Chat Source	MyFace2Face Source

YOUR PERSONAL INFORMATION

Gender: Male ☐ Female ☐ Birth Year: 19 _____ Nationality: _____

Education: ☐ Postgraduate ☐ Graduate ☐ Diploma ☐ JC ☐ Polytechnic ☐ Others _____ (specify)

Primary language: _____ Email: _____

Mobile number (for follow-up survey – won't be used/circulated beyond this study):_____

Thank you for your participation!

jj

APPENDIX D – DEMOGRAPHIC DATA

Total respondents	352		
N (with valid response for at least 1 source type)	346 (onlineInfo=336; bookManual=322; emailForum=334; phoneChat=333; face2face=341)		
Invalid cases	6 invalid cases across all source types (onlineInfo=16; bookManual=30; emailForum=18; phoneChat=19; face2face=11)		
Industry	banking & finance	91	26.30%
	software	69	19.94%
	education	44	12.72%
	manufacturing	35	10.12%
	accounting	20	5.78%
	service	20	5.78%
	shipping/logistics	11	3.18%
	consulting	10	2.89%
	research	9	2.60%
	healthcare	7	2.02%
	law	5	1.45%
	energy	5	1.45%
	defense science	4	1.16%
	insurance	4	1.16%
	oil and gas	2	0.58%
	retail	2	0.58%
	electronics	2	0.58%
	real-estate	2	0.58%
	construction	2	0.58%
	printing	2	0.58%
Company size (# of employees)	1-19 employees	45	13.01%
	20-49 employees	32	9.25%
	50-100 employees	34	9.83%
	101-499 employees	57	16.47%
	>500 employees	178	51.45%
Team size (No. of team members)	1 person team	10	2.89%
	2-5 persons team	124	35.84%
	6-10 persons team	94	27.17%
	11-20 persons team	61	17.63%
	21-50 persons team	37	10.69%
	>50 persons team	20	5.78%
Company Location in	CBD[76]	159	45.95%

[76] Raffles Place, City Hall, Tanjong Pagar, Tiong Bahru, Bugis, Collyer Quay, Harbourfront

Singapore	WestSG[77]	74	21.39%
	Others[78]	31	8.96%
	EastSG[79]	24	6.94%
	SciencePark[80]	23	6.65%
	NorthSG[81]	15	4.34%
	NUS[82]	13	3.76%
	SouthCentralSG[83]	7	2.02%
Organizational Tenure	0 to 1 year	149	43.06%
	>1 to 2 years	76	21.97%
	>2 to 3 years	46	13.29%
	>3 to 5 years	28	8.09%
	>5 to 10 years	28	8.09%
	>10 to 20 years	11	3.18%
	>20 years	8	2.31%
	Minimum	1 month	
	Maximum	34 years	
	Mean	3.23 years	
	S.D.	4.924	
Role	Top Management	13	3.76%
	Middle Mgmt./Project Leader	100	28.90%
	Professional / Executive[84]	209	60.40%
	Admin/Support	19	5.49%
	Temp. staff / Intern	5	1.45%
Role Tenure	0 to 3 months	44	12.72%
	4 to 6 months	42	12.14%
	7 to 12 months	110	31.79%
	>1 to 2 years	81	23.41%
	>2 to 3 years	32	9.25%
	>3 to 5 years	13	3.76%
	>5 to 10 years	16	4.62%
	>10 years	8	2.31%
	Minimum	1 month	

[77] Jurong, Jurong East, Ayer Rajah Industrial Estate, Benoi Crescent, Buona Vista, Clementi, Dover, Biopolis, Fusionopolis, KentRidge, NTU, Queenstown, Tuas, Boon Lay

[78] locations not clearly specified; islandwide

[79] Kaki Bukit, Bedok, Changi Business Park, Eunos, Paya Lebar, Aljunied, Kallang

[80] Science Park I and II

[81] Ang Mo Kio, Serangoon, Toa Payoh, Bukit Timah, Woodlands

[82] Offices located within the National University of Singapore

[83] Balestier, Bendemeer, OutramPark, Newton, Novena

[84] Analyst, Auditor, Business Analyst, Business Consultant, Consultant, Engineer, Product Engineer, R&D Engineer, Sales Executive, Software Developer, Software Engineer, Systems Analyst, Trader, Banker

	Maximum	25 years		
	Mean	23.41 months		
	S.D.	35.768		
Gender	Male	253		73.12%
	Female	93		26.88%
Age	Ages <20	1		0.29%
	Ages 20-29	203		58.67%
	Ages 30-39	104		30.06%
	Ages 40-49	31		8.96%
	Ages 50-59	6		1.73%
	Ages >60	1		0.29%
	Minimum	19	years	
	Maximum	61	years	
	Mean	30.46	years	
	S.D.	7.232		
Nationality	Singaporean	172		49.71%
	Indian	71		20.52%
	Malaysian	30		8.67%
	PRC	20		5.78%
	Indonesian	11		3.18%
	Filipino	9		2.60%
	Italian	7		2.02%
	British	4		1.16%
	Burmese (Myanmar)	3		0.87%
	French	3		0.87%
	Vietnamese	3		0.87%
	Australian	2		0.58%
	Canadian	2		0.58%
	Sri Lankan	2		0.58%
	Swiss	2		0.58%
	American	1		0.29%
	Bangladeshi	1		0.29%
	Finnish	1		0.29%
	German	1		0.29%
	Pakistani	1		0.29%
Education	Postgraduate	112		32.37%
	Graduate	186		53.76%
	Diploma	32		9.25%
	Junior College	4		1.16%
	Polytechnic	3		0.87%
	O-Levels	7		2.02%
	Below O-Levels	2		0.58%
Primary Language	English	283		81.79%
	Chinese	34		9.83%

mm

	Tamil	8	2.31%
	Hindi	4	1.16%
	French	3	0.87%
	Indonesian	3	0.87%
	Burmese	2	0.58%
	Malayalam	2	0.58%
	German	2	0.58%
	Malay	1	0.29%
	Italian	1	0.29%
	Vietnamese	1	0.29%
	Finnish	1	0.29%
	Tagalog	1	0.29%

APPENDIX E – EXPLORATORY FACTOR ANALYSIS OF PILOT DATA

Table 31 Rotated Component Matrix for pilot data for onlineInfo (N=103)

	Component										
	1	2	3	4	5	6	7	8	9	10	11
IMP1	.484	-.028	-.114	.296	.186	-.102	-.086	.202	.070	**.608**	-.116
IMP2	.497	.037	-.142	.238	.137	-.165	.004	.190	.057	**.584**	-.028
IMP3	.198	.008	.006	.331	.163	-.162	-.008	.159	.137	**.781**	-.003
IMP4	.346	.005	-.074	.383	.271	-.091	-.016	.168	.055	**.683**	.055
IMP5	.205	.047	.029	.398	.317	-.137	.014	.186	.058	**.714**	.013
CMP1	.063	.118	.135	.207	-.042	.168	.041	-.024	**.724**	.147	-.014
CMP2	.061	-.040	.099	.086	.025	.031	.157	.169	**.848**	.118	-.021
CMP3	-.140	-.099	.163	.081	-.046	.042	.032	.013	**.841**	-.072	.048
CMP4	.283	-.149	-.103	.171	.215	-.141	.083	.043	**.553**	.143	.025
CMP5	.091	-.004	.232	.183	-.174	.115	.002	-.115	**.721**	-.052	.124
URG1	.263	.123	.121	**.742**	.108	-.234	.038	.117	.004	.132	-.006
URG2	.085	.129	.076	**.883**	.180	.007	.062	.121	.049	.054	.023
URG3	.069	.060	-.083	**.832**	.061	.016	-.058	.078	.182	.240	.001
URG4	.103	.051	-.054	**.869**	-.024	.018	.061	.025	.194	.200	.016
URG5	.117	-.012	-.100	**.858**	.085	-.026	.007	.017	.240	.174	.052
EFF1	.189	.058	-.060	.096	**.860**	-.023	.014	-.057	.028	.103	.013
EFF2	.223	.034	-.063	.134	**.856**	-.074	.013	.154	.089	.083	-.021
EFF3	.164	-.012	-.084	.079	**.894**	-.039	-.092	.107	-.037	.137	-.011
EFF4	.261	-.036	-.161	.032	**.685**	-.011	-.110	.314	-.111	.165	.103
EFF5	.180	.014	-.189	.066	**.855**	-.039	-.026	.144	-.126	.110	-.050
ORT1	**.762**	.128	-.109	.131	.289	-.215	-.015	.169	.122	.107	-.075
ORT2	**.832**	.017	-.172	.135	.247	-.107	-.040	.215	.079	.072	.170
ORT3	**.867**	-.021	-.194	.126	.178	-.115	.029	.111	.017	.083	.135
ORT4	**.810**	-.024	-.110	.100	.188	-.148	.025	.087	-.037	.208	.142
ORT5	**.787**	.153	-.062	.128	.191	-.114	-.026	.119	.034	.312	.018
ENV1	.387	.222	-.125	.116	.290	-.140	-.124	**.576**	.116	-.032	-.090
ENV2	.279	.278	-.236	.091	.186	-.082	.052	**.660**	.076	.082	-.087
ENV3	.251	.286	-.047	.110	.225	-.094	.004	**.756**	.005	.106	.118
ENV4	.063	.276	-.130	.053	.132	.092	.142	**.785**	-.051	.155	.110
ENV5	.103	.171	-.060	.115	.010	.072	.017	**.833**	.036	.222	.123
QUA1o	.079	**.843**	-.145	.177	.041	-.019	-.082	.154	-.125	-.077	.137
QUA2o	.143	**.826**	-.083	.130	.044	-.064	-.054	.115	-.021	-.141	.112
QUA3o	-.064	**.793**	-.038	.009	.054	-.187	.174	.058	.071	.043	.036
QUA4o	.119	**.837**	.043	.048	-.018	.000	-.146	.153	-.105	-.014	.119
QUA5o	-.034	**.810**	-.136	-.044	.048	.011	.013	.224	-.021	.122	.177
QUA6o	-.051	**.825**	-.009	.029	-.084	.147	-.105	.162	.040	.115	.155
ACC1o	-.090	.124	.182	.028	.066	**.755**	.023	.042	.043	-.065	.029

ACC2o	-.186	-.065	.252	-.014	-.073	**.860**	.141	-.014	-.026	-.049	-.015
ACC3o	-.099	-.028	.174	.039	-.009	**.818**	.209	-.004	.090	-.172	-.011
ACC4o	-.102	-.081	.230	-.101	-.166	**.847**	.178	-.047	-.005	-.019	-.072
ACC5o	-.157	-.096	.178	-.165	-.049	**.748**	.130	-.019	.162	-.067	.009
CMM1o	-.073	.005	.270	.046	.009	.114	**.691**	.123	.192	-.087	.084
CMM2o	-.041	-.051	.211	-.007	-.022	.201	**.823**	.106	.123	.043	.230
CMM3o	.089	-.023	.173	.056	-.124	.132	**.874**	-.054	-.025	-.050	-.071
CMM4o	.087	-.048	.186	.061	-.048	.107	**.898**	.016	.011	-.009	-.099
CMM5o	-.085	-.042	.136	-.045	.027	.092	**.828**	-.039	.032	.055	-.062
CFT1o	-.048	-.005	**.806**	.082	-.075	.047	.161	-.121	.090	-.115	.003
CFT2o	-.184	-.080	**.796**	.024	-.070	.279	.141	-.147	-.037	.029	-.040
CFT3o	-.081	-.057	**.802**	-.055	-.173	.246	.212	-.049	.135	.083	-.022
CFT4o	-.137	-.071	**.756**	-.129	-.122	.179	.235	-.008	.160	.003	-.109
CFT5o	-.146	-.111	**.811**	-.014	-.060	.272	.213	-.064	.146	-.060	.087
CFT6o	-.165	-.144	**.689**	-.025	-.137	.327	.255	-.143	.247	-.120	.059
USE1o	.142	.260	.015	.115	-.002	.098	-.057	.038	.009	-.169	**.839**
USE2o	.032	.220	-.054	.021	.054	-.003	.024	.075	.077	-.001	**.907**
USE3o	.144	.329	.023	-.075	-.078	-.188	.047	.100	.055	.195	**.663**
Eigenvalue	13.810	7.340	5.333	3.586	2.748	2.391	2.049	1.903	1.843	1.489	1.191
% of Variance	25.108	13.345	9.697	6.520	4.996	4.347	3.726	3.461	3.351	2.707	2.165
Cumulative %	25.108	38.453	48.150	54.670	59.665	64.012	67.738	71.198	74.549	77.256	79.422

Table 32 Rotated Component Matrix for pilot data for book/manual (N=98)

	Component										
	1	2	3	4	5	6	7	8	9	10	11
IMP1	.476	-.089	-.079	.204	.027	.264	.181	.079	**.619**	-.015	-.163
IMP2	.511	-.156	-.027	.156	.092	.175	.172	.050	**.646**	-.031	-.094
IMP3	.221	.008	.031	.164	-.026	.327	.170	.108	**.795**	.051	-.057
IMP4	.324	-.050	-.050	.273	-.013	.377	.199	.063	**.704**	.042	-.015
IMP5	.196	.031	-.033	.329	-.049	.406	.226	.048	**.705**	.071	-.056
CMP1	.040	.118	.216	-.048	.053	.201	.006	**.713**	.143	.050	.162
CMP2	.070	.118	.190	.063	.047	.049	.144	**.855**	.121	.063	.030
CMP3	-.119	.147	.048	-.064	-.038	.082	-.035	**.853**	-.062	.084	.075
CMP4	.319	-.052	-.046	.231	-.160	.196	.002	**.566**	.182	.250	-.042
CMP5	.097	.240	.067	-.211	.021	.239	-.089	**.695**	-.061	-.037	.106
URG1	.263	-.013	-.123	.140	.053	**.721**	.117	.029	.168	.104	-.103
URG2	.088	.003	.044	.185	-.010	**.898**	.136	.023	.071	.036	-.016
URG3	.063	-.089	.052	.056	-.046	**.833**	.115	.165	.235	-.069	-.111
URG4	.111	-.027	.005	-.007	.009	**.871**	.047	.172	.190	.049	-.130
URG5	.132	-.088	-.007	.092	-.031	**.861**	.017	.224	.159	.075	-.047
EFF1	.144	-.087	-.032	**.837**	.039	.130	.002	.018	.138	.052	.054
EFF2	.232	-.031	-.034	**.856**	.018	.155	.180	.075	.071	-.022	.001
EFF3	.173	-.149	-.031	**.884**	.026	.081	.091	-.027	.146	-.119	.009
EFF4	.297	-.095	-.076	**.703**	.097	.037	.248	-.107	.185	-.041	.051
EFF5	.198	-.156	-.029	**.850**	-.050	.070	.160	-.122	.113	-.075	-.033

ORT1	**.767**	-.125	-.105	.291	.058	.118	.234	.142	.121	-.017	-.157
ORT2	**.828**	-.159	.044	.254	.063	.154	.241	.076	.112	-.031	.066
ORT3	**.874**	-.192	-.035	.179	.016	.140	.133	.014	.103	.116	.061
ORT4	**.840**	-.079	-.036	.178	-.034	.118	.127	-.068	.205	.032	.131
ORT5	**.756**	-.098	.020	.188	.151	.144	.169	.049	.352	-.058	-.065
ENV1	.362	-.176	-.066	.297	.091	.095	**.641**	.131	-.027	-.012	-.066
ENV2	.247	-.219	.025	.199	.065	.072	**.769**	.063	.076	.005	-.027
ENV3	.262	-.133	.126	.217	.161	.114	**.776**	-.017	.125	-.045	-.028
ENV4	.070	-.109	.119	.116	.254	.088	**.792**	-.093	.172	.141	.024
ENV5	.119	-.043	.072	-.020	.155	.144	**.822**	-.010	.250	.077	.057
QUA1b	.090	-.103	.015	.188	**.761**	.040	.058	.012	-.016	.040	.139
QUA2b	-.020	-.032	.102	.016	**.833**	-.027	.152	.100	.045	.025	.268
QUA3b	-.061	.170	.058	-.204	**.775**	.063	-.050	.011	.049	.092	.101
QUA4b	.111	.003	-.033	.041	**.848**	-.083	.142	-.020	-.023	-.007	-.028
QUA5b	.001	.100	.022	-.019	**.869**	.043	.176	.011	-.050	-.063	.049
QUA6b	.055	.059	.094	.064	**.877**	-.062	.094	-.090	.025	-.075	.071
ACC1b	.089	.121	**.799**	.001	.153	-.009	.101	.117	-.024	.071	.029
ACC2b	.025	.195	**.840**	-.179	.024	.004	.081	.070	-.086	.159	-.058
ACC3b	-.029	.189	**.850**	-.059	.088	.015	.048	.133	-.028	.213	-.038
ACC4b	-.057	.133	**.886**	-.065	.011	-.090	-.019	.015	-.033	.182	-.013
ACC5b	-.135	.098	**.800**	.105	-.010	.006	.002	.049	.031	.140	.077
CMM1b	-.073	.353	.499	.007	-.021	.133	.042	.126	.152	.396	.117
CMM2b	-.007	.332	.465	-.083	-.032	-.010	.049	.119	.106	**.627**	-.047
CMM3b	.020	.179	.338	-.125	-.033	.099	.054	.053	.027	**.822**	-.121
CMM4b	.090	.252	.387	.026	.018	.028	.074	.096	-.071	**.725**	-.131
CMM5b	-.002	.321	.440	-.068	.069	.086	.031	.106	.039	**.701**	-.133
CFT1b	-.119	**.745**	.106	-.040	.035	-.001	-.076	.046	-.005	.323	.076
CFT2b	-.176	**.851**	.199	-.065	.083	-.037	-.075	.051	.042	.113	-.093
CFT3b	.049	**.837**	.104	-.217	.010	.008	-.150	.011	-.022	.105	.053
CFT4b	-.230	**.808**	.155	-.026	.103	-.119	.013	.136	-.067	.147	.016
CFT5b	-.199	**.811**	.255	-.041	.030	-.082	-.160	.226	-.004	.070	-.022
CFT6b	-.044	**.787**	.206	-.173	-.041	-.034	-.205	.175	-.141	.033	.028
USE1b	.017	.017	.022	-.042	.168	-.126	.041	.088	.020	-.001	**.909**
USE2b	.013	.057	.013	.059	.212	-.110	.026	.027	-.148	-.122	**.869**
USE3b	-.007	-.032	-.042	.062	.216	-.146	-.107	.281	-.079	-.184	**.620**
Eigenvalue	12.751	8.855	5.352	3.557	2.878	2.550	2.157	1.684	1.482	1.261	1.165
% of Variance	23.184	16.100	9.731	6.466	5.233	4.637	3.922	3.061	2.694	2.292	2.119
Cumulative %	23.184	39.284	49.015	55.481	60.714	65.351	69.273	72.334	75.028	77.320	79.439

Table 33 Rotated Component Matrix for pilot data for email/forum (N=101)

	Component										
	1	2	3	4	5	6	7	8	9	10	11
IMP1	.474	-.035	.270	.211	.201	-.181	.197	-.137	.065	**.592**	-.017
IMP2	.488	-.052	.197	.177	.161	-.098	.216	-.085	.045	**.626**	-.148
IMP3	.215	-.101	.295	.150	.179	-.045	.156	.113	.143	**.775**	.107

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IMP4	.372	-.114	.368	.262	.163	-.012	.175	.049	.069	**.653**	.142
IMP5	.231	-.109	.393	.318	.165	-.019	.190	.168	.063	**.657**	.117
CMP1	.022	.132	.146	-.017	-.153	.001	.066	.136	**.743**	.162	.088
CMP2	.057	.095	.015	.056	.015	.058	.174	.114	**.880**	.104	.062
CMP3	-.133	.171	.109	-.066	-.018	.112	-.065	.022	**.835**	-.025	-.009
CMP4	.363	-.087	.198	.215	.023	-.029	-.028	.144	**.529**	.108	.014
CMP5	.118	.136	.205	-.232	.060	.146	-.156	-.037	**.719**	-.117	-.007
URG1	.269	.003	**.729**	.132	-.003	-.021	.144	.073	-.008	.130	-.107
URG2	.094	-.013	**.878**	.194	-.037	.032	.133	.103	.012	.023	.082
URG3	.074	-.060	**.821**	.049	.110	-.006	.108	.024	.175	.214	.019
URG4	.093	-.001	**.886**	.005	.031	-.050	.057	.067	.167	.163	-.022
URG5	.137	-.054	**.875**	.083	.022	-.008	.017	.085	.212	.124	.057
EFF1	.169	-.071	.121	**.842**	-.058	.016	.009	-.032	.012	.127	.012
EFF2	.198	-.080	.147	**.857**	-.021	-.027	.197	-.036	.089	.087	-.001
EFF3	.180	-.165	.083	**.876**	-.007	-.019	.117	-.048	-.032	.119	-.054
EFF4	.306	-.066	.050	**.691**	.211	.049	.236	-.173	-.113	.124	.026
EFF5	.177	-.199	.082	**.856**	.118	-.022	.144	-.035	-.119	.081	.003
ORT1	**.755**	-.066	.135	.296	.101	-.235	.249	-.023	.134	.081	-.023
ORT2	**.846**	-.086	.177	.219	.055	-.030	.234	-.106	.060	.075	.003
ORT3	**.875**	-.131	.147	.170	.150	-.109	.109	-.094	.022	.062	.027
ORT4	**.822**	-.063	.105	.177	.095	-.046	.105	-.052	-.043	.210	.058
ORT5	**.796**	-.121	.111	.160	.092	-.062	.216	-.017	.030	.262	-.030
ENV1	.301	-.136	.115	.318	.055	-.218	**.651**	-.016	.115	-.026	-.019
ENV2	.256	-.173	.085	.182	.087	-.044	**.788**	.023	.061	.030	.014
ENV3	.236	-.046	.098	.204	.164	-.064	**.808**	.031	-.017	.113	-.063
ENV4	.064	.051	.123	.112	.223	.106	**.816**	-.004	-.088	.156	.068
ENV5	.133	.050	.126	-.030	.231	.044	**.810**	.070	.002	.204	.126
QUA1e	.014	-.094	-.114	.221	**.736**	-.001	.305	.025	.157	.115	.041
QUA2e	.252	-.080	-.075	.161	**.727**	.022	.268	-.003	-.009	.245	.129
QUA3e	-.054	.147	.066	.007	**.728**	.057	.003	.153	-.006	.180	-.100
QUA4e	.156	-.146	.094	.040	**.809**	-.071	.084	.027	-.084	-.003	.112
QUA5e	.074	-.082	.036	-.033	**.868**	-.064	.143	.018	-.036	.049	.082
QUA6e	.151	.034	.077	-.112	**.799**	-.200	.058	.059	-.078	-.049	.189
ACC1e	-.087	.189	.146	-.049	.085	**.772**	-.098	.107	.081	.024	.110
ACC2e	.001	.117	-.074	.001	-.038	**.874**	-.019	.259	.043	-.066	-.021
ACC3e	-.067	.112	-.059	.031	-.024	**.894**	.013	.266	-.069	-.074	.017
ACC4e	-.065	.078	-.038	-.005	-.175	**.878**	.025	.160	.042	-.040	-.009
ACC5e	-.197	.205	-.035	-.005	-.103	**.754**	-.003	.073	.210	-.003	-.028
CMM1e	-.139	.419	.139	-.022	.074	.119	.071	**.733**	.102	.131	-.031
CMM2e	-.169	.316	.169	-.055	.107	.270	-.027	**.752**	.092	.112	-.072
CMM3e	.015	.163	.057	-.154	.002	.203	.044	**.833**	.085	-.150	-.004
CMM4e	.056	.236	.025	.003	.077	.218	.012	**.835**	.097	.006	-.021
CMM5e	-.127	.279	.095	-.050	.102	.225	.010	**.804**	.022	.092	-.036
CFT1e	-.070	**.765**	-.153	-.060	.002	.185	-.002	.272	.076	.023	.065
CFT2e	-.119	**.844**	-.067	-.140	-.065	.126	-.023	.067	.041	.061	.070
CFT3e	-.039	**.856**	-.037	-.054	.039	.035	.086	.223	.104	-.069	-.058
CFT4e	-.177	**.754**	.070	-.066	-.068	.151	-.002	.257	.146	-.113	-.086
CFT5e	.036	**.843**	-.010	-.126	-.062	.183	-.118	.158	.008	-.082	-.055

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CFT6e	-.107	**.804**	.022	-.163	-.083	.069	-.206	.192	.155	-.115	.004
USE1e	.086	-.007	-.008	.037	.063	.121	.007	-.155	.076	-.018	**.900**
USE2e	-.040	.033	-.031	.014	.116	-.010	-.005	-.052	.020	.018	**.901**
USE3e	-.045	-.114	.138	-.109	.271	-.078	.175	.168	.048	.183	**.541**
Eigenvalue	13.339	8.172	4.278	3.626	2.850	2.577	2.069	1.970	1.878	1.488	1.359
% of Variance	24.252	14.858	7.779	6.592	5.182	4.685	3.763	3.582	3.415	2.706	2.471
Cumulative %	24.252	39.110	46.889	53.481	58.663	63.348	67.111	70.693	74.107	76.813	79.284

Table 34 Rotated Component Matrix for pilot data for phone/chat (N=101)

	Component										
	1	2	3	4	5	6	7	8	9	10	11
IMP1	.508	.224	-.011	.237	.235	-.134	-.001	.178	.037	**.586**	.001
IMP2	.523	.126	-.004	.159	.192	-.130	.003	.206	.032	**.614**	.008
IMP3	.252	.172	-.042	.267	.169	.017	-.010	.161	.121	**.769**	.194
IMP4	.389	.145	-.149	.311	.260	.028	.040	.183	.054	**.674**	.122
IMP5	.249	.177	-.110	.340	.312	.092	.011	.196	.046	**.698**	.117
CMP1	.022	-.005	.120	.148	-.024	.010	.017	.062	**.764**	.108	.139
CMP2	.116	.008	.097	.047	.032	.157	-.013	.153	**.865**	.049	.085
CMP3	-.166	-.069	.105	.104	-.051	.042	.065	-.037	**.860**	-.010	-.101
CMP4	.389	.078	-.063	.187	.196	.162	.019	-.043	**.517**	.113	-.045
CMP5	.035	-.012	.051	.201	-.197	-.011	.145	-.136	**.751**	-.058	-.063
URG1	.242	.166	.009	**.746**	.118	.028	.111	.086	.029	.127	-.173
URG2	.081	.008	.018	**.891**	.168	.107	.035	.137	.052	.032	.005
URG3	.110	-.045	-.022	**.853**	.046	.068	.070	.111	.152	.182	.103
URG4	.108	.060	.010	**.891**	-.013	.010	.041	.034	.184	.140	.098
URG5	.136	-.028	-.076	**.876**	.054	.095	.071	-.003	.221	.165	.009
EFF1	.187	-.007	.012	.121	**.851**	-.036	-.019	-.003	.020	.075	.133
EFF2	.248	-.017	-.071	.121	**.846**	.058	-.041	.163	.070	.087	.039
EFF3	.172	.005	-.094	.052	**.896**	.021	-.062	.114	-.039	.138	-.024
EFF4	.274	.050	-.100	.011	**.714**	-.041	-.029	.259	-.109	.183	-.097
EFF5	.189	.019	-.181	.050	**.854**	.046	-.012	.157	-.136	.123	-.004
ORT1	**.780**	.175	-.067	.137	.296	-.100	-.078	.204	.106	.089	-.028
ORT2	**.835**	.008	-.125	.151	.240	-.151	-.022	.209	.053	.098	-.058
ORT3	**.861**	.116	-.136	.142	.180	-.127	-.091	.094	-.001	.090	-.047
ORT4	**.810**	.061	-.042	.098	.181	-.142	-.052	.091	-.057	.229	.011
ORT5	**.805**	.107	-.145	.105	.165	-.096	-.015	.187	.016	.245	-.017
ENV1	.398	.188	-.145	.123	.310	.040	-.094	**.574**	.076	-.090	.065
ENV2	.318	.078	-.183	.086	.195	-.032	.014	**.729**	.045	.018	.053
ENV3	.265	.127	-.070	.093	.228	.032	.063	**.816**	-.024	.059	-.011
ENV4	.016	.098	.044	.071	.141	-.068	-.081	**.859**	-.047	.182	-.014
ENV5	.097	.102	-.110	.066	-.017	.075	-.010	**.850**	.031	.240	.002
QUA1p	.145	**.821**	-.028	.083	.054	-.078	-.030	.093	.060	.008	.099
QUA2p	.159	**.872**	.039	.004	.056	.002	-.101	.086	-.007	.056	.134
QUA3p	.028	**.794**	.026	.019	-.008	.001	-.048	.050	-.001	.229	-.106
QUA4p	.006	**.836**	-.135	.015	.033	-.077	-.079	.119	.059	.114	.058

QUA5p	.099	**.810**	-.078	-.022	-.077	.076	-.127	.070	-.121	-.122	.146
QUA6p	.036	**.854**	-.044	.016	.010	.016	-.026	.061	-.053	.097	.092
ACC1p	-.082	-.031	.200	.097	.028	.170	**.808**	-.002	.041	.075	.012
ACC2p	-.130	-.032	.166	.041	.029	.159	**.862**	-.046	-.012	.011	.032
ACC3p	-.036	-.121	.159	.091	-.075	.156	**.879**	-.059	.023	.049	-.070
ACC4p	.015	-.093	.191	.100	-.077	.193	**.807**	.054	.083	-.063	.077
ACC5p	.060	-.191	.170	-.041	-.079	.253	**.698**	-.010	.101	-.077	.140
CMM1p	-.107	.049	.298	.105	-.039	**.792**	.254	-.016	.112	.057	-.044
CMM2p	-.129	-.013	.262	.126	-.006	**.765**	.361	-.070	.116	.009	.005
CMM3p	-.130	-.062	.224	-.024	.083	**.836**	.236	.007	.078	-.045	.081
CMM4p	-.182	-.027	.271	.114	.029	**.782**	.191	.008	.097	.009	.039
CMM5p	-.061	.008	.223	.057	-.005	**.865**	.097	.069	-.038	-.042	.012
CFT1p	.039	-.083	**.744**	-.118	-.044	.264	.202	.050	-.060	-.113	-.130
CFT2p	-.181	.009	**.818**	.123	-.133	.176	.231	-.016	-.015	-.078	.003
CFT3p	.015	.075	**.826**	-.021	-.107	.198	.156	-.106	.039	-.079	-.136
CFT4p	-.096	-.138	**.788**	-.045	-.139	.190	.235	-.115	.198	.073	-.111
CFT5p	-.133	-.066	**.854**	-.052	-.056	.226	.115	-.115	.115	.025	-.014
CFT6p	-.195	-.122	**.810**	.014	-.008	.212	.117	-.108	.178	-.038	.064
USE1p	-.041	.136	-.054	-.077	.060	.075	.071	.040	-.039	.070	**.887**
USE2p	-.079	.165	-.103	.063	.006	-.024	.106	.031	.063	.074	**.858**
USE3p	.060	.410	-.188	.228	-.009	.053	-.085	-.096	.047	.191	**.488**
Eigenvalue	13.038	8.354	4.491	3.765	2.851	2.401	2.290	2.148	1.656	1.443	1.230
% of Variance	23.705	15.190	8.165	6.846	5.184	4.365	4.164	3.905	3.011	2.623	2.237
Cumulative %	23.705	38.894	47.060	53.906	59.090	63.455	67.619	71.524	74.535	77.159	79.396

Table 35 Rotated Component Matrix for pilot data for face-to-face (N=106)

	Component										
	1	2	3	4	5	6	7	8	9	10	11
IMP1	.481	-.029	.208	.248	.280	-.043	-.079	.203	.019	**.569**	.040
IMP2	.482	-.002	.158	.205	.209	-.101	.007	.232	.035	**.576**	.106
IMP3	.229	-.086	.147	.237	.151	.059	-.015	.169	.118	**.809**	.122
IMP4	.369	-.190	.272	.299	.122	.024	.091	.178	.043	**.681**	.080
IMP5	.239	-.140	.306	.320	.110	.067	.044	.195	.041	**.721**	.084
CMP1	.049	.098	-.064	.177	-.038	.089	.070	.057	**.734**	.118	.130
CMP2	.084	.027	.016	.099	-.010	.165	.041	.156	**.842**	.057	-.001
CMP3	-.167	.064	-.037	.084	-.073	.072	.039	-.039	**.870**	-.018	-.049
CMP4	.338	-.010	.258	.190	.154	.148	-.036	-.015	**.496**	.088	-.082
CMP5	.075	.055	-.215	.167	-.033	-.031	.089	-.136	**.751**	-.047	.040
URG1	.200	.051	.099	**.782**	.167	.005	.085	.116	.024	.097	-.059
URG2	.052	-.030	.168	**.888**	-.039	.084	.074	.124	.050	.032	.022
URG3	.077	-.064	.034	**.829**	-.067	-.001	-.002	.080	.175	.249	-.023
URG4	.082	-.035	-.040	**.889**	.082	.010	.011	.035	.191	.133	.127
URG5	.114	-.079	.080	**.878**	-.020	.000	.039	-.010	.227	.154	-.002
EFF1	.176	-.020	**.837**	.089	.015	-.014	-.009	-.011	.009	.133	.128
EFF2	.248	-.034	**.853**	.119	.019	.056	-.046	.176	.047	.071	.065

EFF3	.149	-.081	**.897**	.046	.053	-.038	-.007	.112	-.049	.145	.014
EFF4	.249	-.012	**.716**	.029	.107	-.165	.056	.303	-.109	.129	-.020
EFF5	.160	-.145	**.863**	.060	.093	-.018	.034	.157	-.148	.100	.002
ORT1	**.759**	-.058	.286	.133	.188	-.039	-.150	.218	.085	.118	-.011
ORT2	**.821**	-.106	.241	.127	.081	-.173	.018	.229	.076	.085	-.057
ORT3	**.855**	-.126	.177	.114	.142	-.127	-.061	.125	.014	.099	-.075
ORT4	**.809**	-.068	.177	.064	.041	-.167	.004	.111	-.029	.240	-.041
ORT5	**.779**	-.161	.165	.097	.160	-.093	-.005	.180	.020	.266	.001
ENV1	.381	-.124	.308	.141	.105	.096	-.150	**.623**	.073	-.088	.051
ENV2	.293	-.175	.182	.099	.071	-.021	.009	**.726**	.042	.027	.088
ENV3	.242	-.051	.201	.100	.079	-.045	.071	**.834**	-.002	.076	.019
ENV4	.022	-.037	.131	.043	-.025	-.048	.054	**.849**	-.045	.206	-.067
ENV5	.104	-.194	-.006	.049	-.037	.040	.032	**.834**	.022	.239	-.008
QUA1f	.139	-.155	.001	.156	**.824**	-.030	-.019	.024	.009	-.034	.112
QUA2f	.015	-.065	.050	.014	**.825**	-.082	-.093	.007	.066	.160	.128
QUA3f	-.103	-.003	.073	-.070	**.738**	-.046	-.070	.009	.112	.136	-.086
QUA4f	.191	-.236	.059	-.017	**.811**	-.153	-.017	.090	-.077	.092	.116
QUA5f	.306	-.011	-.043	.017	**.739**	-.118	-.060	-.037	-.259	-.008	.198
QUA6f	.218	.032	.132	.043	**.771**	-.114	.019	.056	-.082	.065	.179
ACC1f	.039	.054	-.093	.105	.074	.077	**.840**	.038	.026	-.001	-.035
ACC2f	-.124	.155	.007	.006	-.071	.185	**.865**	-.030	-.043	.077	-.001
ACC3f	-.052	.162	-.050	.053	-.086	.230	**.891**	-.058	.029	-.005	-.034
ACC4f	.006	.132	.078	.026	-.164	.337	**.761**	.074	.097	-.028	-.050
ACC5f	-.021	.224	.124	.003	-.029	.300	**.700**	.094	.180	-.025	.034
CMM1f	-.122	.315	-.004	.093	.017	**.711**	.306	.015	.205	.063	.046
CMM2f	-.187	.243	-.174	.090	-.130	**.769**	.281	-.099	.089	.015	-.029
CMM3f	-.120	.199	.005	-.072	-.092	**.826**	.284	.023	.124	-.023	-.094
CMM4f	-.189	.172	-.054	.093	-.170	**.812**	.263	-.040	.099	-.004	-.055
CMM5f	-.013	.208	.031	-.034	-.179	**.857**	.150	.030	-.001	.006	-.020
CFT1f	.051	**.761**	-.042	-.121	-.074	.193	.153	.012	.001	-.229	-.071
CFT2f	-.150	**.806**	-.074	.066	-.125	.104	.167	-.065	-.114	-.027	-.033
CFT3f	.095	**.838**	-.092	.053	.011	.148	.062	-.140	.024	-.161	-.043
CFT4f	-.093	**.839**	-.091	-.037	-.060	.202	.112	-.131	.123	.049	-.073
CFT5f	-.216	**.825**	-.003	-.057	-.088	.190	.163	-.030	.114	-.018	-.133
CFT6f	-.235	**.758**	-.020	-.134	-.115	.161	.097	-.228	.178	.076	-.005
USE1f	-.119	-.037	.230	-.010	.165	-.117	.073	.087	.027	-.066	**.841**
USE2f	-.148	-.109	.001	.066	.201	-.091	.006	-.053	.101	.126	**.835**
USE3f	.148	-.181	-.032	.004	.183	.090	-.190	.001	-.051	.194	**.776**
Eigenvalue	13.243	7.864	4.096	3.724	2.956	2.495	2.373	1.945	1.769	1.623	1.346
% of Variance	24.079	14.298	7.448	6.772	5.374	4.537	4.315	3.537	3.217	2.950	2.447
Cumulative %	24.079	38.376	45.824	52.596	57.970	62.506	66.821	70.357	73.575	76.525	78.972

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APPENDIX F – DESCRIPTIVE STATISTICS AND RELIABILITY ANALYSIS

All records N=352					
Property of	**Construct**	**No. of Items+**	**Mean (1-7 scale)**	**Standard Deviation**	**Reliability (Cronbach's α)**
Task / Problem Situation	IMP	5	5.837	1.223	0.923
	CMP	4	4.241	1.631	0.824
	URG	5	5.008	1.618	0.93
Seeker / Actor	ORT	4	6	1.105	0.941
	EFF*	5	5.029	1.258	0.935
Environment	ENV*	5	5.573	1.293	0.911

Online Information N=336					
Property of	**Construct**	**No. of Items+**	**Mean (1-7 scale)**	**Standard Deviation**	**Reliability (Cronbach's α)**
Task / Problem Situation	IMP	5	5.822	1.232	0.925
	CMP	4	4.232	1.622	0.822
	URG	5	4.993	1.604	0.928
Seeker / Actor	ORT	4	5.986	1.110	0.944
	EFF*	5	5.011	1.268	0.935
Environment	ENV*	5	5.538	1.302	0.909
Source (online information)	QUAo	6	4.73	1.712	0.92
	ACCo	5	3.042	1.951	0.909
	CMMo	4	3.607	2.001	0.908
	USEo	3	4.752	2.052	0.864
Seeker/Source relationship	CFTo*	6	2.449	1.819	0.941

Book/Manual N=322					
Property of	**Construct**	**No. of Items+**	**Mean (1-7 scale)**	**Standard Deviation**	**Reliability (Cronbach's α)**
Task / Problem Situation	IMP	5	5.843	1.226	0.924
	CMP	4	4.251	1.613	0.822
	URG	5	5.031	1.586	0.927
Seeker / Actor	ORT	4	5.991	1.108	0.943
	EFF*	5	5.033	1.274	0.938
Environment	ENV*	5	5.559	1.292	0.912
Source (book/ manual)	QUAb	6	4.159	1.740	0.919
	ACCb	5	3.613	1.880	0.926
	CMMb	4	3.78	1.917	0.907
	USEb	3	3.873	1.866	0.848
Seeker/Source relationship	CFTb*	6	2.554	1.779	0.936

Email/Forum N=334					
Property of	**Construct**	**No. of Items+**	**Mean (1-7 scale)**	**Standard Deviation**	**Reliability (Cronbach's α)**
Task / Problem Situation	IMP	5	5.837	1.233	0.924
	CMP	4	4.249	1.625	0.821
	URG	5	5.023	1.603	0.929
Seeker / Actor	ORT	4	5.982	1.107	0.944
	EFF*	5	5.02	1.267	0.936
Environment	ENV*	5	5.57	1.295	0.912
Source (email/ forum)	QUAe	6	4.611	1.474	0.906
	ACCe	5	3.619	1.742	0.916
	CMMe	4	3.565	1.689	0.898
	USEe	3	4.4	1.627	0.769
Seeker/Source relationship	CFTe*	6	2.846	1.824	0.934

Phone/Chat N=333					
Property of	**Construct**	**No. of Items+**	**Mean (1-7 scale)**	**Standard Deviation**	**Reliability (Cronbach's α)**
Task / Problem Situation	IMP	5	5.83	1.234	0.924
	CMP	4	4.239	1.630	0.822
	URG	5	5.02	1.612	0.932
Seeker / Actor	ORT	4	5.988	1.106	0.944
	EFF*	5	5.026	1.266	0.936
Environment	ENV*	5	5.562	1.301	0.91
Source (phone/chat)	QUAp	6	4.703	1.668	0.915
	ACCp	5	3.599	1.784	0.914
	CMMp	4	3.373	1.743	0.922
	USEp	3	4.67	1.722	0.836
Seeker/Source relationship	CFTp*	6	3.035	1.869	0.936

Face to Face N=341					
Property of	**Construct**	**No. of Items+**	**Mean (1-7 scale)**	**Standard Deviation**	**Reliability (Cronbach's α)**
Task / Problem Situation	IMP	5	5.844	1.224	0.924
	CMP	4	4.233	1.623	0.82
	URG	5	5.001	1.613	0.93
Seeker / Actor	ORT	4	5.988	1.108	0.941
	EFF*	5	5.017	1.259	0.935
Environment	ENV*	5	5.565	1.299	0.91
Source (face-to-face)	QUAf	6	5.196	1.569	0.926
	ACCf	5	3.55	1.935	0.913
	CMMf	4	3.133	1.850	0.922
	USEf	3	5.166	1.733	0.854
Seeker/Source relationship	CFTf*	6	2.927	1.904	0.938

* Control variables
+ Final number of items arrived at after Confirmatory Factor Analysis

APPENDIX G – CONVERGENT VALIDITY ANALYSIS

Table 36 Convergent Validity Analysis for OnlineInfo (N=336)

Property of	Construct	Item	T-value	Loading	Smallest T-value	Smallest Standard Loading	AVE	Cronbach's alpha	CFR
Task/Problem Situation	Importance	IMP1	17.27	0.8	17.08	0.79	0.714	0.925	0.926
		IMP2	17.08	0.79					
		IMP3	18.62	0.84					
		IMP4	20.97	0.9					
		IMP5	20.54	0.89					
	Complexity	CMP1	14.2	0.72	11.63	0.62	0.546	0.822	0.826
		CMP2	16.49	0.81					
		CMP3	15.95	0.79					
		CMP5	11.63	0.62					
	Urgency	URG1	14.24	0.69	14.24	0.69	0.726	0.928	0.929
		URG2	18.84	0.84					
		URG3	21.02	0.9					
		URG4	22.25	0.93					
		URG5	20.18	0.88					
Seeker/ Actor	Task Self Efficacy	EFF1	18.31	0.83	16.74	0.78	0.753	0.935	0.938
		EFF2	20.39	0.88					
		EFF3	22.09	0.93					
		EFF4	16.74	0.78					
		EFF5	21.43	0.91					
	Learning Orientation	ORT2	20.17	0.88	19.96	0.87	0.811	0.944	0.945
		ORT3	22.74	0.94					
		ORT4	21.57	0.91					
		ORT5	19.96	0.87					
Environment	Learning Environment	ENV1	15.32	0.74	15.32	0.74	0.671	0.909	0.911
		ENV2	18.09	0.83					
		ENV3	19.36	0.86					
		ENV4	19.63	0.87					
		ENV5	16.92	0.79					
Source (online Info)	Quality	QUA1o	18.25	0.83	15.41	0.74	0.663	0.920	0.922
		QUA2o	18.6	0.84					
		QUA3o	15.41	0.74					
		QUA4o	17.87	0.82					
		QUA5o	18.33	0.83					
		QUA6o	17.84	0.82					
	Access Difficulty	ACC1o	13.11	0.65	13.11	0.65	0.673	0.909	0.911
		ACC2o	18.68	0.84					
		ACC3o	19.87	0.87					
		ACC4o	20.74	0.9					
		ACC5o	17.99	0.82					

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	Communication Difficulty	CMM2o	17.71	0.81	17.01	0.79	0.712	0.908	0.908
		CMM3o	19.58	0.87					
		CMM4o	20.75	0.9					
		CMM5o	17.01	0.79					
	Usage	USE1o	21.14	0.92	13.34	0.67	0.702	0.864	0.874
		USE2o	20.26	0.9					
		USE3o	13.34	0.67					
Seeker-Source	Inherent Lack of Comfort	CFT1o	17.11	0.79	17.11	0.79	0.729	0.941	0.942
		CFT2o	19.12	0.85					
		CFT3o	19.94	0.87					
		CFT4o	18.87	0.84					
		CFT5o	20.56	0.89					
		CFT6o	20.11	0.88					

Table 37 Convergent Validity Analysis for Book/Manual (N=322)

Property of	**Construct**	**Item**	**T-value**	**Loading**	**Smallest T-value**	**Smallest Standard Loading**	**AVE**	**Cronbach's alpha**	**CFR**
Task/Problem Situation	Importance	IMP1	16.83	0.79	16.66	0.79	0.711	0.924	0.925
		IMP2	16.66	0.79					
		IMP3	18.2	0.84					
		IMP4	20.52	0.9					
		IMP5	20.07	0.89					
	Complexity	CMP1	13.76	0.72	11.48	0.62	0.546	0.822	0.826
		CMP2	16.23	0.81					
		CMP3	15.78	0.79					
		CMP5	11.48	0.62					
	Urgency	URG1	13.91	0.69	13.91	0.69	0.723	0.927	0.928
		URG2	18.55	0.84					
		URG3	20.56	0.9					
		URG4	21.66	0.93					
		URG5	19.6	0.87					
Seeker/ Actor	Task Self Efficacy	EFF1	17.97	0.83	16.82	0.79	0.756	0.938	0.939
		EFF2	20.04	0.88					
		EFF3	21.74	0.93					
		EFF4	16.82	0.79					
		EFF5	21.02	0.91					
	Learning Orientation	ORT2	19.54	0.87	19.35	0.87	0.811	0.943	0.945
		ORT3	22.2	0.94					
		ORT4	21.4	0.92					
		ORT5	19.35	0.87					
Environment	Learning Environment	ENV1	14.9	0.73	14.9	0.73	0.679	0.912	0.913
		ENV2	17.8	0.83					
		ENV3	19.28	0.87					
		ENV4	19.52	0.88					
		ENV5	17.04	0.8					
Source (online Info)	Quality	QUA1b	14.84	0.73	14.84	0.73	0.674	0.919	0.925
		QUA2b	17.35	0.81					
		QUA3b	15.11	0.74					

		QUA4b	19.4	0.87					
		QUA5b	19.85	0.88					
		QUA6b	19.59	0.88					
	Access Difficulty	ACC1b	15.27	0.74	15.27	0.74	0.716	0.926	0.926
		ACC2b	19.18	0.86					
		ACC3b	20.58	0.9					
		ACC4b	20.45	0.9					
		ACC5b	17.76	0.82					
	Communication Difficulty	CMM2b	17.95	0.83	17.54	0.82	0.710	0.907	0.907
		CMM3b	19.36	0.88					
		CMM4b	18.12	0.84					
		CMM5b	17.54	0.82					
	Usage	USE1b	19.03	0.88	11.7	0.61	0.683	0.848	0.862
		USE2b	21.28	0.95					
		USE3b	11.7	0.61					
Seeker-Source	Inherent Lack of Comfort	CFT1b	16.32	0.78	16.32	0.78	0.713	0.936	0.937
		CFT2b	18.77	0.85					
		CFT3b	17.98	0.83					
		CFT4b	18.01	0.83					
		CFT5b	20.03	0.89					
		CFT6b	19.92	0.88					

Table 38 Convergent Validity Analysis for Email/Forum (N=334)

Property of	**Construct**	**Item**	**T-value**	**Loading**	**Smallest T-value**	**Smallest Standard Loading**	**AVE**	**Cronbach's alpha**	**CFR**
Task/Problem Situation	Importance	IMP1	17.14	0.79	16.8	0.78	0.705	0.924	0.922
		IMP2	16.8	0.78					
		IMP3	18.62	0.84					
		IMP4	20.99	0.9					
		IMP5	20.3	0.88					
	Complexity	CMP1	13.81	0.71	11.79	0.63	0.545	0.821	0.826
		CMP2	16.06	0.79					
		CMP3	16.4	0.81					
		CMP5	11.79	0.63					
	Urgency	URG1	14.16	0.69	14.16	0.69	0.726	0.929	0.929
		URG2	18.71	0.84					
		URG3	21.11	0.9					
		URG4	22.34	0.93					
		URG5	20.37	0.88					
Seeker/ Actor	Task Self Efficacy	EFF1	18.38	0.83	16.62	0.78	0.753	0.936	0.938
		EFF2	20.49	0.89					
		EFF3	22.01	0.92					
		EFF4	16.62	0.78					
		EFF5	21.38	0.91					
	Learning Orientation	ORT2	19.73	0.87	19.73	0.87	0.811	0.944	0.945
		ORT3	22.77	0.94					
		ORT4	21.35	0.91					
		ORT5	20.41	0.88					

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Environment	Learning Environment	ENV1	15.31	0.74	15.31	0.74	0.681	0.912	0.914
		ENV2	18.66	0.84					
		ENV3	19.25	0.86					
		ENV4	19.79	0.88					
		ENV5	17.16	0.8					
Source (online Info)	Quality	QUA1e	15.77	0.76	13.82	0.69	0.622	0.906	0.908
		QUA2e	16.17	0.77					
		QUA3e	13.82	0.69					
		QUA4e	18.96	0.85					
		QUA5e	18.36	0.84					
		QUA6e	17.47	0.81					
	Access Difficulty	ACC1e	14.81	0.72	14.81	0.72	0.693	0.916	0.918
		ACC2e	19.57	0.87					
		ACC3e	20.11	0.88					
		ACC4e	19.96	0.88					
		ACC5e	17.23	0.8					
	Communication Difficulty	CMM2e	17.78	0.82	17.52	0.81	0.685	0.898	0.897
		CMM3e	18.34	0.84					
		CMM4e	18.44	0.84					
		CMM5e	17.52	0.81					
	Usage	USE1e	15.65	0.82	8.98	0.49	0.568	0.769	0.789
		USE2e	17.14	0.89					
		USE3e	8.98	0.49					
Seeker-Source	Inherent Lack of Comfort	CFT1e	16.93	0.79	16.93	0.79	0.707	0.934	0.935
		CFT2e	18.35	0.83					
		CFT3e	19.27	0.86					
		CFT4e	17.52	0.81					
		CFT5e	19.63	0.87					
		CFT6e	20.24	0.88					

Table 39 Convergent Validity Analysis for Phone/Chat (N=333)

Property of	**Construct**	**Item**	**T-value**	**Loading**	**Smallest T-value**	**Smallest Standard Loading**	**AVE**	**Cronbach's alpha**	**CFR**
Task/Problem Situation	Importance	IMP1	17.1	0.79	16.83	0.79	0.708	0.924	0.923
		IMP2	16.83	0.79					
		IMP3	18.6	0.84					
		IMP4	20.95	0.9					
		IMP5	20.24	0.88					
	Complexity	CMP1	13.74	0.71	11.8	0.63	0.549	0.822	0.828
		CMP2	16.15	0.8					
		CMP3	16.3	0.81					
		CMP5	11.8	0.63					
	Urgency	URG1	14.42	0.7	14.42	0.7	0.736	0.932	0.933
		URG2	18.71	0.84					
		URG3	21.28	0.91					
		URG4	22.35	0.93					
		URG5	20.58	0.89					
Seeker/	Task Self	EFF1	18.26	0.83	16.75	0.78	0.756	0.936	0.939

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Actor	Efficacy	EFF2	20.4	0.89					
		EFF3	22.07	0.93					
		EFF4	16.75	0.78					
		EFF5	21.3	0.91					
	Learning Orientation	ORT2	19.68	0.87	19.68	0.87	0.811	0.944	0.945
		ORT3	22.73	0.94					
		ORT4	21.3	0.91					
		ORT5	20.35	0.88					
Environment	Learning Environment	ENV1	15.53	0.75	15.53	0.75	0.674	0.910	0.912
		ENV2	18.3	0.83					
		ENV3	19.23	0.86					
		ENV4	19.49	0.87					
		ENV5	16.85	0.79					
Source (online Info)	Quality	QUA1p	17.77	0.81	14.9	0.72	0.686	0.915	0.929
		QUA2p	19.17	0.85					
		QUA3p	14.9	0.72					
		QUA4p	19.29	0.86					
		QUA5p	19.35	0.86					
		QUA6p	19.25	0.86					
	Access Difficulty	ACC1p	15.48	0.74	15.48	0.74	0.686	0.914	0.916
		ACC2p	18.6	0.84					
		ACC3p	20.65	0.9					
		ACC4p	19.56	0.87					
		ACC5p	16.54	0.78					
	Communication Difficulty	CMM2p	20.64	0.9	18.03	0.82	0.745	0.922	0.921
		CMM3p	19.7	0.87					
		CMM4p	19.43	0.86					
		CMM5p	18.03	0.82					
	Usage	USE1p	18.27	0.86	12.3	0.63	0.661	0.836	0.851
		USE2p	20.09	0.92					
		USE3p	12.3	0.63					
Seeker-Source	Inherent Lack of Comfort	CFT1p	16.02	0.76	16.02	0.76	0.713	0.936	0.937
		CFT2p	19.32	0.86					
		CFT3p	19.75	0.87					
		CFT4p	19.09	0.85					
		CFT5p	19.73	0.87					
		CFT6p	18.93	0.85					

Table 40 Convergent Validity Analysis for Face-to-face (N=341)

Property of	**Construct**	**Item**	**T-value**	**Loading**	**Smallest T-value**	**Smallest Standard Loading**	**AVE**	**Cronbach's alpha**	**CFR**
Task/Problem Situation	Importance	IMP1	17.14	0.79	16.75	0.78	0.712	0.924	0.925
		IMP2	16.75	0.78					
		IMP3	18.85	0.84					
		IMP4	21.31	0.9					
		IMP5	20.92	0.9					
	Complexity	CMP1	13.95	0.71	11.78	0.62	0.542	0.820	0.824
		CMP2	16.31	0.8					

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		CMP3	16.26	0.8					
		CMP5	11.78	0.62					
	Urgency	URG1	14.56	0.7	14.56	0.7	0.733	0.930	0.931
		URG2	18.78	0.84					
		URG3	21.18	0.9					
		URG4	22.51	0.93					
		URG5	20.76	0.89					
Seeker/ Actor	Task Self Efficacy	EFF1	18.47	0.83	16.79	0.78	0.753	0.935	0.938
		EFF2	20.59	0.88					
		EFF3	22.29	0.93					
		EFF4	16.79	0.78					
		EFF5	21.57	0.91					
	Learning Orientation	ORT2	20.31	0.88	20.04	0.87	0.801	0.941	0.942
		ORT3	22.07	0.92					
		ORT4	21.66	0.91					
		ORT5	20.04	0.87					
Environment	Learning Environment	ENV1	15.61	0.74	15.61	0.74	0.671	0.910	0.911
		ENV2	18.35	0.83					
		ENV3	19.58	0.86					
		ENV4	19.8	0.87					
		ENV5	17.12	0.79					
Source (online Info)	Quality	QUA1f	19.67	0.86	13.91	0.68	0.679	0.926	0.927
		QUA2f	18.9	0.84					
		QUA3f	13.91	0.68					
		QUA4f	20.13	0.87					
		QUA5f	18.84	0.84					
		QUA6f	19	0.84					
	Access Difficulty	ACC1f	15.12	0.72	15.12	0.72	0.683	0.913	0.915
		ACC2f	18.9	0.84					
		ACC3f	20.87	0.9					
		ACC4f	19.84	0.87					
		ACC5f	17.12	0.79					
	Communication Difficulty	CMM2f	19.86	0.87	19.01	0.85	0.748	0.922	0.922
		CMM3f	19.83	0.87					
		CMM4f	19.79	0.87					
		CMM5f	19.01	0.85					
	Usage	USE1f	19.16	0.88	13.54	0.68	0.682	0.854	0.864
		USE2f	20.01	0.9					
		USE3f	13.54	0.68					
Seeker-Source	Inherent Lack of Comfort	CFT1f	16.7	0.77	16.7	0.77	0.718	0.938	0.939
		CFT2f	18.93	0.84					
		CFT3f	19.85	0.87					
		CFT4f	19.39	0.85					
		CFT5f	20.81	0.89					
		CFT6f	19.62	0.86					

ddd

APPENDIX H – DISCRIMINANT VALIDITY ANALYSIS

onlineInfo (N=336)

	Mean	S.D.	IMP	URG	CMP	EFF	ORT	ENV	QUAo	ACCo	CMMo	CFTo	USEo
IMP	5.822	1.232	**0.845**										
URG	4.993	1.604	0.38***	**0.852**									
CMP	4.232	1.622	0.19**	0.3***	**0.739**								
EFF	5.011	1.268	0.41***	0.18**	-0.17**	**0.868**							
ORT	5.986	1.11	0.58***	0.23***	0.010	0.44***	**0.900**						
ENV	5.538	1.302	0.5***	0.18**	0.070	0.34***	0.46***	**0.819**					
QUAo	4.73	1.712	0.110	0.060	0.010	0.17**	0.18**	0.27***	**0.814**				
ACCo	3.042	1.951	-0.090	0.16**	0.22***	-0.050	-0.090	0.010	-0.080	**0.821**			
CMMo	3.607	2.001	-0.040	0.060	0.13*	-0.020	-0.060	-0.030	-0.2***	0.38***	**0.844**		
CFTo	2.449	1.819	-0.17**	0.070	0.22***	-0.110	-0.2***	-0.18**	-0.14*	0.51***	0.5***	**0.854**	
USEo	4.752	2.052	0.05	0.01	0.04	0.07	0.2***	0.17**	0.62***	0.000	-0.13*	-0.13*	**0.838**

book/manual (N=322)

	Mean	S.D.	IMP	URG	CMP	EFF	ORT	ENV	QUAb	ACCb	CMMb	CFTb	USEb
IMP	5.843	1.226	**0.843**										
URG	5.031	1.586	0.39***	**0.85**									
CMP	4.251	1.613	0.17**	0.29***	**0.739**								
EFF	5.033	1.274	0.42***	0.17**	-0.19**	**0.87**							
ORT	5.991	1.108	0.58***	0.24***	0.02	0.45***	**0.901**						
ENV	5.559	1.292	0.49***	0.19**	0.04	0.34***	0.46***	**0.824**					
QUAb	4.159	1.74	-0.08	-0.09	0	0.06	0.04	0.13*	**0.821**				
ACCb	3.613	1.88	-0.05	0.16**	0.24***	-0.03	0.03	0.04	0.04	**0.846**			
CMMb	3.78	1.917	0.07	0.21***	0.2**	-0.03	0.07	0.08	0.06	0.57***	**0.843**		
CFTb	2.554	1.779	-0.21***	0.06	0.23***	-0.14*	-0.21***	-0.15*	0.15*	0.42***	0.38***	**0.844**	
USEb	3.873	1.866	-0.17**	-0.16**	0.04	0.07	-0.02	0.04	0.56***	-0.01	-0.09	0.21***	**0.826**

email/forum (N=334)

	Mean	S.D.	IMP	URG	CMP	EFF	ORT	ENV	QUAe	ACCe	CMMe	CFTe	USEe
IMP	5.837	1.233	**0.839**										
URG	5.023	1.603	.35***	**0.852**									
CMP	4.249	1.625	.16**	.3***	**0.738**								
EFF	5.02	1.267	.42***	.2***	-0.17**	**0.868**							
ORT	5.982	1.107	.59***	.23***	0	.43***	**0.9**						
ENV	5.57	1.295	.51***	.2***	0.05	.34***	.44***	**0.825**					

eee

QUAe	4.611	1.474	.23***	0.04	0.01	.21***	.19**	.27***	**0.789**				
ACCe	3.619	1.742	-0.06	.12*	.22***	0.07	-0.02	0	-0.11	**0.832**			
CMMe	3.565	1.689	0.03	.15**	.18**	-0.05	-0.02	0.02	-0.08	.57***	**0.828**		
CFTe	2.846	1.824	-0.17**	0.08	.24***	-0.06	-.16**	-0.11	-0.1	.42***	.55***	**0.841**	
USEe	4.4	1.627	0.11	0.04	0.1	0.1	0.06	0.15*	.38***	-0.01	-0.01	0.03	**0.754**

phone/chat (N=333)

	Mean	**S.D.**	**IMP**	**URG**	**CMP**	**EFF**	**ORT**	**ENV**	**QUAp**	**ACCp**	**CMMp**	**CFTp**	**USEp**
IMP	5.83	1.234	**0.841**										
URG	5.02	1.612	.34***	**0.858**									
CMP	4.239	1.63	.15*	.31***	**0.741**								
EFF	5.026	1.266	.42***	.18**	-0.17**	**0.87**							
ORT	5.988	1.106	.59***	.23***	0	.43***	**0.9**						
ENV	5.562	1.301	.5***	.19**	0.04	.035***	.045***	**0.821**					
QUAp	4.703	1.668	.19***	0.02	0.03	.12*	.18**	.22***	**0.828**				
ACCp	3.599	1.784	0.03	.12*	.13*	0.06	0.03	0.04	-0.1	**0.828**			
CMMp	3.373	1.743	0.03	.13*	.15*	0.09	-0.03	-0.03	-0.19***	.56***	**0.863**		
CFTp	3.035	1.869	-0.12*	0.08	.18**	-0.02	-0.16**	-0.14*	-0.09	.41***	.53***	**0.844**	
USEp	4.67	1.722	0.11	0.11	0.03	.12*	0.02	.15*	.54***	0.04	-0.11	-0.02	**0.813**

face-to-face (N=341)

	Mean	**S.D.**	**IMP**	**URG**	**CMP**	**EFF**	**ORT**	**ENV**	**QUAf**	**ACCf**	**CMMf**	**CFTf**	**USEf**
IMP	5.844	1.224	**0.844**										
URG	5.001	1.613	.35***	**0.856**									
CMP	4.233	1.623	.16**	.3***	**0.736**								
EFF	5.017	1.259	.42***	.18**	-.18**	**0.868**							
ORT	5.988	1.108	.58***	.23***	0.01	.44***	**0.895**						
ENV	5.565	1.299	.51***	.17**	0.04	.34***	.46***	**0.819**					
QUAf	5.196	1.569	.31***	0.1	-0.01	.18**	.32***	.27***	**0.824**				
ACCf	3.55	1.935	0.06	.14*	.15*	.11*	0.1	0.01	-0.07	**0.826**			
CMMf	3.133	1.85	-0.04	0.06	.17**	0.05	-0.08	-0.08	-.28***	.57***	**0.865**		
CFTf	2.927	1.904	-.21***	0	.14*	-0.08	-0.19***	-0.21***	-.15**	.37***	.5***	**0.848**	
USEf	5.166	1.733	.22***	0.1	0.07	0.09	0.08	.2***	.53***	-0.07	-.18**	-.15**	**0.826**

***Correlation is significant at the 0.001 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

fff

APPENDIX I – POST-HOC ANALYSIS

Table 41 HLM Results for perceptual & behavioral (average of useFreq, useMost & useFirst) aspects of use

Final estimation of fixed effects (with robust standard errors)

		usePerceptual		useBehavioral	
Hypothesis	Ind. Variable	Std. Coefficient	P-value	Std. Coefficient	P-value
Control	Gender	0.198	0.083	0.009	0.897
Control	Age	0.011	0.178	0.006	0.238
Control	Role Tenure	-0.001	0.281	-0.001	0.536
Control	Team Count	0.041	0.299	0.022	0.384
Control	Education(R)	**-0.118***	0.048	0.043	0.182
Control	ENV	**0.185*****	0.000	0.035	0.257
Control	CFT	-0.115+	0.058	**-0.155***	0.015
Control	EFF	0.090	0.078	0.039	0.225
Dummy	onlineInfo	-0.163	0.117	**0.491****	0.001
Dummy	book/manual	**-0.620*****	0.000	**-0.991*****	0.000
Dummy	email/forum	**-0.392*****	0.000	**-0.551*****	0.000
Dummy	phone/chat	**-0.155***	0.037	**-0.385*****	0.000
	IMP	-0.057	0.349	-0.015	0.686
	URG	-0.018	0.621	0.002	0.936
1	QUA	**0.622*****	0.000	**0.616*****	0.000
2	ACC	-0.054	0.187	**-0.153****	0.001
3	CMM	**-0.079***	0.044	-0.073	0.085
7	CMP	**0.094***	0.020	**0.065****	0.009
9	ORT	0.036	0.488	-0.017	0.662
4	IMP * QUA	**0.074***	0.042	**0.121****	0.009
5	URG * ACC	0.001	0.978	0.031	0.326
6	URG * CMM	-0.003	0.912	-0.032	0.236
8	CMP * CMM	0.021	0.421	0.032	0.266
Final estimation of variance components					
S.D.		0.676		0.040	
Variance component		0.457		0.002	
df		334		323	
chi-square		868.340		260.857	
P-value		0.000		>.500	
level-1 S.D.		1.172		1.406	
level-1 variance component		1.374		1.977	
				QUA S.D.	0.273
				QUA Variance component	0.075

ggg

QUA df	333
QUA chi-square	459.489
QUA P-value	0.000

+ p<0.06 * p<0.05 **p<.01 ***p<.0001

Table 42 Regression (for different source types) & HLM results for perceived frequency of use

UsePerceptual (USE1, USE2, USE3)

		OnlineInfo (N=336)	Book/Manual (N=322)	Email/Forum (N=334)	Phone/Chat (N=333)	Face2Face (N=341)	**HLM**
Hypothesis	Ind. Variable	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Std. Coefficient (P-value)
Control	Gender	**0.097*** (.037)	.002 (.959)	.023 (.671)	**0.169**** (.001)	-.007 (.884)	0.198 (.083)
Control	Age	.018 (.738)	**0.144**** (.010)	**0.153*** (.014)	.085 (.129)	.015 (.794)	0.011 (.178)
Control	Role Tenure	-.052 (.328)	.021 (.699)	-.036 (.552)	-.057 (.301)	-.057 (.317)	-0.001 (.281)
Control	Team Count	-0.088+ (.055)	.003 (.951)	.044 (.400)	.057 (.231)	.016 (.745)	0.041 (.299)
Control	Education (R)	-.065 (.158)	**-0.113*** (.017)	**-0.107*** (.044)	**-0.103*** (.032)	-.046 (.353)	**-0.118*** (.048)
Control	ENV	.004 (.940)	.044 (.422)	.078 (.196)	.026 (.628)	.085 (.133)	**0.185***** (.000)
Control	CFT	-.067 (.236)	**0.128*** (.017)	.047 (.464)	.024 (.666)	-.060 (.291)	-0.115+ (.058)
Control	EFF	-.049 (.352)	.072 (.186)	.013 (.840)	.072 (.187)	.016 (.778)	0.090 (.078)
	IMP	-.076 (.211)	**-0.134*** (.032)	-.011 (.873)	.055 (.378)	.107 (.108)	-0.057 (.349)
	URG	-.042 (.420)	-0.094 (.069)	.025 (.667)	**0.114*** (.028)	.064 (.234)	-0.018 (.621)
1	QUA	**0.589***** (.000)	**0.524***** (.000)	**0.377***** (.000)	**0.522***** (.000)	**0.451***** (.000)	**0.622***** (.000)
2	ACC	.055 (.295)	-.077 (.171)	-.017 (.787)	.090 (.099)	-.001 (.983)	-0.054 (.187)
3	CMM	.022 (.673)	-0.099 (.073)	.004 (.954)	-.058 (.324)	-.051 (.407)	**-0.079*** (.044)
7	CMP	.057 (.248)	**0.115*** (.022)	.101 (.077)	-.008 (.866)	.047 (.364)	**0.094*** (.020)
9	ORT	**0.169**** (.004)	.057 (.335)	-.004 (.946)	-0.11 (.065)	-0.122+ (.060)	0.036 (.488)
4	IMP * QUA	.039 (.437)	.072 (.134)	.052 (.354)	**0.112*** (.019)	**0.179**** (.003)	**0.074*** (.042)
5	URG * ACC	.068 (.169)	-.066 (.242)	-.005 (.936)	.006 (.914)	-.016 (.792)	0.001 (.978)
6	URG * CMM	-.054 (.317)	.046 (.419)	-0.125+ (.052)	-.041 (.486)	.117 (.063)	-0.003 (.912)
8	CMP * CMM	.023 (.629)	.007 (.875)	.044 (.418)	**0.098*** (.045)	-.014 (.792)	0.021 (.421)
R-Square		0.399	0.401	0.21	0.361	0.307	
Adj. R-Square		0.363	0.363	0.16	0.322	0.266	

+ p<0.06 * p<0.05 **p<.01 ***p<.0001

hhh

Table 43 Regression (for different source types) & HLM results for objective measure of use frequency

UseFrequency (USE4)

		OnlineInfo (N=336)	Book/Manual (N=322)	Email/Forum (N=334)	Phone/Chat (N=333)	Face2Face (N=341)	**HLM**
Hypothesis	Ind. Variable	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Std. Coefficient (P-value)
Control	Gender	0.013 (.811)	0.020 (.707)	0.075 (.177)	**0.143**** (.006)	0.037 (.497)	0.160 (.242)
Control	Age	0.027 (.669)	**0.123*** (.048)	**0.176**** (.007)	0.100 (.096)	-0.066 (.314)	0.017 (.098)
Control	Role Tenure	-0.038 (.534)	0.002 (.969)	-0.068 (.282)	-0.041 (.484)	0.031 (.621)	-0.001 (.500)
Control	Team Count	**-0.124*** (.019)	-0.016 (.760)	0.020 (.709)	0.083 (.105)	0.037 (.492)	0.025 (.598)
Control	Education (R)	-0.003 (.959)	-0.098 (.065)	0.013 (.818)	0.062 (.233)	0.033 (.544)	0.020 (.740)
Control	ENV	-0.056 (.370)	-0.013 (.830)	-0.015 (.816)	-0.052 (.371)	0.052 (.414)	0.049 (.434)
Control	CFT	0.042 (.512)	0.062 (.307)	0.052 (.427)	0.053 (.379)	-0.045 (.475)	-0.094 (.158)
Control	EFF	-0.036 (.553)	0.007 (.907)	-0.013 (.844)	0.017 (.771)	-0.046 (.468)	0.038 (.524)
	IMP	-0.046 (.506)	-0.059 (.393)	-0.001 (.992)	**0.138*** (.042)	0.041 (.585)	-0.027 (.705)
	URG	-0.052 (.378)	-0.077 (.182)	0.087 (.150)	**0.129*** (.020)	0.019 (.747)	0.006 (.887)
1	QUA	**0.374***** (.000)	**0.365***** (.000)	**0.235***** (.000)	**0.365***** (.000)	**0.289***** (.000)	**0.467***** (.000)
2	ACC	0.060 (.323)	**-0.180**** (.004)	0.000 (.998)	-0.096 (.099)	**-0.184**** (.004)	**-0.218***** (.000)
3	CMM	**-0.126*** (.036)	-0.022 (.725)	-0.004 (.953)	0.076 (.227)	0.127 (.065)	-0.007 (.868)
7	CMP	**0.154**** (.006)	**0.112*** (.045)	0.067 (.254)	-0.037 (.488)	0.024 (.675)	**0.110**** (.010)
9	ORT	0.081 (.219)	0.094 (.153)	0.081 (.238)	-0.067 (.294)	-0.093 (.198)	0.018 (.821)
4	IMP * QUA	0.028 (.627)	**0.164**** (.002)	**0.154**** (.008)	**0.215***** (.000)	0.062 (.353)	**0.112*** (.018)
5	URG * ACC	0.064 (.264)	0.003 (.960)	-0.033 (.623)	-0.037 (.540)	0.081 (.221)	0.029 (.331)
6	URG * CMM	**-0.180**** (.004)	**-0.139*** (.031)	**-0.144*** (.031)	-0.072 (.252)	-0.004 (.949)	**-0.069*** (.012)
8	CMP * CMM	0.086 (.118)	0.063 (.241)	0.051 (.365)	**0.136**** (.010)	-0.026 (.649)	0.021 (.451)
R-Square		0.212	0.249	0.151	0.265	0.138	
Adj. R-Square		0.165	0.201	0.1	0.221	0.087	

+ p<0.06 * p<0.05 **p<.01 ***p<.0001

Table 44 Regression (for different source types) & HLM results for percentage of use

UseMost (adapted from USE5)

		OnlineInfo (N=336)	Book/Manual (N=322)	Email/Forum (N=334)	Phone/Chat (N=333)	Face2Face (N=341)	**HLM**
Hypothesis	Ind. Variable	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Std. Coefficient (P-value)
Control	Gender	-0.027 (.596)	-0.092 (.103)	-0.047 (.394)	0.058 (.299)	0.013 (.810)	-0.077 (.586)
Control	Age	0.027 (.651)	-0.012 (.861)	**0.227*** ** (.000)	0.021 (.752)	-0.024 (.705)	0.006 (.583)
Control	Role Tenure	-0.018 (.758)	0.060 (.356)	-0.045 (.471)	-0.030 (.637)	-0.069 (.270)	-0.001 (.671)
Control	Team Count	-0.079 (.113)	0.016 (.770)	0.000 (1.000)	0.015 (.785)	0.016 (.772)	0.025 (.603)
Control	Education (R)	0.036 (.477)	-0.013 (.810)	0.042 (.449)	0.095 (.091)	0.009 (.865)	0.098 (.115)
Control	ENV	-0.090 (.131)	-0.056 (.386)	-0.047 (.449)	-0.079 (.211)	0.058 (.356)	0.027 (.654)
Control	CFT	0.044 (.472)	0.076 (.232)	**0.142*** (.032)	0.002 (.979)	-0.007 (.910)	**-0.179*** (.018)
Control	EFF	-0.035 (.539)	0.078 (.223)	-0.057 (.380)	0.047 (.462)	0.020 (.749)	0.079 (.224)
	IMP	-0.046 (.492)	-0.031 (.674)	-0.013 (.859)	0.065 (.373)	0.006 (.937)	-0.024 (.765)
	URG	-0.033 (.563)	-0.021 (.736)	0.044 (.469)	0.080 (.185)	0.094 (.115)	0.016 (.734)
1	QUA	**0.505*** ** (.000)	**0.313*** ** (.000)	**0.286*** ** (.000)	**0.301*** ** (.000)	**0.315*** ** (.000)	**0.655*** ** (.000)
2	ACC	0.023 (.691)	**-0.163*** (.015)	0.013 (.843)	0.037 (.560)	-0.082 (.199)	-0.103 (.074)
3	CMM	-0.086 (.131)	0.038 (.562)	-0.029 (.667)	-0.039 (.567)	-0.004 (.958)	-0.070 (.205)
7	CMP	**0.106*** (.048)	0.057 (.335)	-0.047 (.429)	-0.009 (.873)	0.032 (.570)	0.075 (.106)
9	ORT	0.101 (.108)	0.005 (.942)	-0.025 (.713)	-0.094 (.173)	**-0.195**** (.007)	-0.068 (.352)
4	IMP * QUA	0.066 (.229)	0.046 (.419)	0.103 (.075)	0.075 (.174)	0.024 (.721)	**0.105*** (.034)
5	URG * ACC	0.010 (.855)	-0.017 (.800)	0.048 (.468)	0.047 (.476)	0.053 (.418)	0.014 (.733)
6	URG * CMM	-0.093 (.112)	-0.051 (.457)	**-0.173**** (.010)	0.020 (.769)	0.094 (.174)	-0.061 (.127)
8	CMP * CMM	**0.124*** (.018)	0.030 (.593)	-0.023 (.689)	0.058 (.305)	-0.099 (.081)	0.009 (.817)
R-Square		0.288	0.152	0.157	0.132	0.156	
Adj. R-Square		0.245	0.098	0.106	0.079	0.106	

+ p<0.06 * p<0.05 **p<.01 ***p<.0001

Table 45 Regression (for different source types) & HLM results for first use of source

UseFirst (adapted from USE6)

		OnlineInfo (N=336)	Book/Manual (N=322)	Email/Forum (N=334)	Phone/Chat (N=333)	Face2Face (N=341)	**HLM**
Hypothesis	Ind. Variable	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Std. Coefficient (P-value)
Control	Gender	-0.058 (.272)	-0.092 (.089)	-0.004 (.944)	0.054 (.312)	0.005 (.929)	-0.060 (.168)
Control	Age	0.006 (.919)	0.086 (.174)	**0.196**** (.002)	-0.046 (.463)	**-0.139*** (.025)	-0.001 (.820)
Control	Role Tenure	-0.038 (.541)	0.007 (.908)	-0.055 (.373)	0.023 (.704)	-0.006 (.922)	0.000 (.293)
Control	Team Count	-0.059 (.270)	-0.040 (.454)	0.003 (.958)	0.053 (.316)	-0.024 (.649)	0.011 (.572)
Control	Education (R)	0.045 (.394)	-0.014 (.793)	0.024 (.653)	0.020 (.710)	-0.067 (.203)	0.010 (.599)
Control	ENV	-0.008 (.903)	-0.076 (.222)	-0.051 (.405)	**-0.125*** (.040)	0.004 (.948)	0.030 (.128)
Control	CFT	-0.014 (.826)	-0.096 (.119)	0.030 (.645)	-0.057 (.360)	-0.037 (.542)	**-0.185*** (.018)
Control	EFF	-0.018 (.764)	0.043 (.483)	-0.022 (.728)	-0.006 (.921)	**-0.128*** (.033)	-0.003 (.860)
	IMP	-0.128 (.070)	-0.037 (.603)	-0.032 (.664)	0.118 (.090)	0.100 (.155)	0.001 (.960)
	URG	0.041 (.490)	-0.105 (.076)	**0.137*** (.022)	0.089 (.120)	-0.008 (.885)	-0.021 (.140)
1	QUA	**0.376***** (.000)	**0.399***** (.000)	**0.309***** (.000)	**0.368***** (.000)	**0.342***** (.000)	**0.670***** (.000)
2	ACC	-0.077 (.209)	-0.048 (.452)	0.053 (.411)	0.029 (.633)	**-0.122*** (.047)	**-0.128*** (.018)
3	CMM	-0.077 (.203)	-0.079 (.212)	0.083 (.217)	-0.088 (.176)	-0.033 (.611)	-0.096 (.068)
7	CMP	0.056 (.325)	0.035 (.545)	-0.035 (.542)	-0.058 (.294)	0.023 (.668)	0.006 (.647)
9	ORT	0.093 (.162)	0.058 (.388)	-0.044 (.513)	**-0.142*** (.032)	-0.067 (.328)	0.002 (.930)
4	IMP * QUA	**0.136*** (.019)	0.052 (.342)	**0.210***** (.000)	**0.143**** (.007)	-0.008 (.905)	**0.143**** (.005)
5	URG * ACC	0.052 (.359)	-0.017 (.797)	0.116 (.075)	-0.005 (.938)	0.082 (.194)	0.035 (.369)
6	URG * CMM	-0.050 (.419)	-0.002 (.974)	-0.120 (.069)	0.004 (.946)	0.012 (.851)	-0.023 (.533)
8	CMP * CMM	0.094 (.089)	0.029 (.591)	-0.026 (.639)	0.061 (.260)	-0.044 (.422)	0.050 (.165)
R-Square		0.202	0.22	0.181	0.21	0.221	
Adj. R-Square		0.154	0.171	0.131	0.162	0.175	

+ p<0.06 * p<0.05 **p<.01 ***p<.0001

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Table 46 Regression (for different source types) & HLM results for behavioral use (average of useFreq, useMost & useFirst)

USEBehavioral (useFreq, useMost, useFirst)

		OnlineInfo (N=336)	Book/Manual (N=322)	Email/Forum (N=334)	Phone/Chat (N=333)	Face2Face (N=341)	**HLM**
Hypothesis	Ind. Variable	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Beta (Sig.)	Std. Coefficient (P-value)
Control	Gender	-0.032 (.520)	-0.069 (.183)	0.004 (.932)	**0.104*** (.045)	0.020 (.692)	0.009 (.897)
Control	Age	0.023 (.697)	0.082 (.180)	**0.255***** (.000)	0.030 (.620)	-0.092 (.136)	0.006 (.238)
Control	Role Tenure	-0.035 (.542)	0.029 (.628)	-0.070 (.246)	-0.021 (.720)	-0.027 (.655)	-0.001 (.536)
Control	Team Count	**-0.098*** (.049)	-0.016 (.747)	0.009 (.863)	0.060 (.241)	0.010 (.846)	0.022 (.384)
Control	Education (R)	0.034 (.497)	-0.051 (.322)	0.035 (.510)	0.077 (.133)	-0.013 (.807)	0.043 (.182)
Control	ENV	-0.061 (.302)	-0.061 (.309)	-0.049 (.414)	-0.108 (.065)	0.047 (.430)	0.035 (.257)
Control	CFT	0.027 (.657)	0.016 (.780)	0.100 (.111)	-0.002 (.976)	-0.033 (.573)	**-0.155*** (.015)
Control	EFF	-0.034 (.546)	0.054 (.364)	-0.041 (.506)	0.027 (.646)	-0.058 (.324)	0.039 (.225)
	IMP	-0.087 (.187)	-0.053 (.439)	-0.019 (.786)	0.130 (.052)	0.058 (.405)	-0.015 (.686)
	URG	-0.014 (.804)	-0.084 (.138)	0.109 (.060)	**0.123*** (.027)	0.049 (.383)	0.002 (.936)
1	QUA	**0.496***** (.000)	**0.446***** (.000)	**0.351***** (.000)	**0.429***** (.000)	**0.393***** (.000)	**0.616***** (.000)
2	ACC	-0.003 (.963)	**-0.161**** (.009)	0.027 (.664)	-0.007 (.905)	**-0.152*** (.013)	**-0.153**** (.001)
3	CMM	-0.109 (.054)	-0.026 (.666)	0.017 (.792)	-0.025 (.686)	0.025 (.696)	-0.073 (.085)
7	CMP	**0.118*** (.027)	0.084 (.125)	-0.011 (.851)	-0.041 (.435)	0.033 (.535)	**0.065**** (.009)
9	ORT	0.108 (.082)	0.065 (.314)	0.002 (.981)	**-0.127*** (.045)	**-0.155*** (.023)	-0.017 (.662)
4	IMP * QUA	0.094 (.084)	**0.107*** (.041)	**0.192**** (.001)	**0.174**** (.001)	0.029 (.650)	**0.121**** (.009)
5	URG * ACC	0.045 (.397)	-0.013 (.836)	0.056 (.370)	0.007 (.909)	0.087 (.164)	0.031 (.326)
6	URG * CMM	**-0.117*** (.043)	-0.079 (.211)	**-0.186**** (.004)	-0.016 (.802)	0.050 (.444)	-0.032 (.236)
8	CMP * CMM	**0.121*** (.020)	0.050 (.335)	-0.002 (.977)	**0.104*** (.047)	-0.076 (.160)	0.032 (.266)
R-Square		0.301	0.28	0.23	0.272	0.236	
Adj. R-Square		0.259	0.235	0.183	0.228	0.19	

+ p<0.06 * p<0.05 **p<.01 ***p<.0001

APPENDIX J – QUALITATIVE ANALYSIS OF TASKS & INFORMATION SOUGHT

Table 47 Examples of tasks and information sought by respondents based on different industries

Industry (% of respondents)	Task/Problem at hand that would continue for a few weeks	Information sought from source(s) for the specific problem/part of the task
Banking and finance (26.30%)	Industry analysis; IPO (Initial Public Offering), company analyses, automation of reporting, business integration, restructuring, implementing a banking solution, credit backlog, financial advising, income tax computation, merger and acquisitions, new loan organization system, problem solving of financial systems, team restructuring, training, troubleshooting wrong calculations, etc.	Information on estate planning; feedback from potential investors; Excel usage; background information of borrower; list of currencies for evaluation; statistics on Asian capital markets; USD denominated investment funds; team management; system set-up; information based on reports; change in market pricing convention; etc.
Software/ technology (19.94%)	Code optimization; coding; finding solutions to meet customer requirement; sales; development project; testing; recruitment of IT consultants; setting up servers; Weblogic migration; QA Testing; website design; R&D; understanding H.264 specifications; etc.	Algorithm solution; Java; design document; load testing related information; modules for online game; technical details of project; troubleshooting; programming information; activation flowchart; test cases; Perl programming; how to test cellphone; how to tune database properly; LINUX kernel migration; integration between projects; etc.
Education (12.72%)	Developing lesson plan; arrival planning of international students; facilities and securities offered by polytechnic libraries; leads generating for sales team; meeting minimum class size for each program; course fee changes; recruiting students; review of library operations; teaching a science module on biodiversity; to revitalize a dying program; purchase of reading materials for staff; etc.	Academic/university information; structure of a text type (lesson); arrival details of students; list of free periodicals; smarter solution to the problem; Macintosh guides; market identification; competitor studies; guidelines for collection development; current library practices and library designs; ecosystems; etc.
Manufacturing (10.12%)	Failure analysis; GUI design; improving & enhancing eBusiness application; increase product range; product development and testing; product planning; resource management; system development for inventory center; vehicle project; an engineering project; yield enhancement; notebook hard-disk drive development; etc.	Six sigma; securing products/materials; new checking method for new product; answer to a technical issue; software security and protection; technical information; design solutions; test methods; robotics development and application research; etc.

Industry (% of respondents)	Task/Problem at hand that would continue for a few weeks	Information sought from source(s) for the specific problem/part of the task
Accounting (5.78%)	Audit of shipping company; audit engagement; book-keeping; customer relationship management; understanding latest accounting statements; etc.	Scrap metal prices (historical graphs, etc.); a problem related to audit engagement; accountancy standards & auditing standards; new accountancy standard; reporting standards; etc.
Service (5.78%)	Cash flow statement; salary review/portfolio; service contract in the lift industry; service excellence project; organizing tour groups to Batan; etc.	More information about the course; salary scale; report; activity/facility cost for Batan, etc.
Shipping/ logistics (3.18%)	Business expansion; credit issue; man hour data collection for ship building; office relocation; etc.	New opportunities; financial statement; disaster recovery; negotiating the man-hours and tabulating it against tasks; technology awareness; data size, applications used; commerce on board ship data; TradeNet, FortNet; etc.
Consulting (2.89%)	Build reliance management; insurance ratings; channel of knowledge sharing among teams; organization restructuring; road management; system integration; analysis of data; etc.	Client mapping and satisfaction; resource mapping; functional knowledge & project knowledge; cost information; data details; market share; etc.
Research (2.6%)	High-throughput genome sequencing; JC design for biomedical wireless circuit; R&D in storage; etc.	Heat output of servers; detection algorithm for ECG; content based search and retrieval; C++ syntax; how to extract proteins; etc.
Healthcare (2.02%)	Infection control; invoicing, data entry; patient care; blood sugar; development biology; etc.	Prevent infection; unable to allocate which ledger it belongs to; rare and unusual problems; analysis of embryo development; etc.
Law (1.45%)	Course; legal research; litigation, mediation; etc.	Prospectus; accounts; legal principles; procedural matters e.g. e-filing; etc.
Energy (1.45%)	Engineering design; financial investment; software framework analysis; etc.	Investment avenues; technical details; software framework design details; etc.
Defense Science (1.16%)	Scripting (windows); software development; etc.	A particular code that does not execute as required; improving software development; windows vista; etc.
Insurance (1.16%)	Database synchronization; deliver point-sale system; life cover for non-Singaporeans; etc.	Python UTF-8 support; how to manage the source code better; criteria and regulations; etc.
Others (3.48%)	Project Management; offshore installation; continuous improvement, market research; serve customer, set target, prepare report; IC design; customer loyalty program; designing project submissions; brochure making; etc.	Contractual requirements; planning, scope of work; advertisement & promotion; financing options; standard/proper procedure to carry out vibration monitoring due to construction activity; etc.

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APPENDIX K – QUALITATIVE ANALYSIS OF TYPICAL SOURCES SPECIFIED BY RESPONDENTS

Table 48 The person with whom the respondent would typically (or could) discuss the specific problem/part of the current task face-to-face e.g. Mr. A

MyFace2FaceSource	n=341	Total 100%
Some person (with name specified)	236	69.21%
Senior/manager at work[85]	50	14.66%
Not specified	36	10.56%
Colleague[86]	9	2.64%
Customer/client[87]	8	2.35%
Friend/brother	2	0.59%

Table 49 The person with whom the respondent would typically (or could) discuss the problem on phone or online chat e.g. Miss B (or Mr. A on phone)

MyPhone/ChatSource	n=333	Total 100%
Some person (with name specified)	220	66.07%
Not specified	50	15.02%
Customer/client[88]	23.5	7.06%
Senior/manager at work[89]	19.5	5.86%
Colleague[90]	15	4.50%
Friend/brother	5	1.50%

[85] Manager; project manager; marketing manager; audit senior; boss; director; director of IT; project leader; team leader; supervisor

[86] Local colleague; my team; my partner

[87] Agent; vendor; product vendor; counterpart tester

[88] Broker; vendor; overseas vendor; product vendor; overseas supplier; user; business people; offshore tester; sub-contractor; US client; agents

[89] Manager; project Manager; marketing manager; audit manager; boss; India boss; director of IT; advisor; supervisor; mentor; senior; team lead

[90] Overseas colleague; people with prior experience; fellow lawyer; maintenance team; my team

Table 50 Typical person to email or post online queries about the problem e.g. Mr. C (or Mr. A on email), or Mr. D in an online forum, as specified by the respondent

MyEmail/ForumSource	n=334	Total 100%
Some person (with name specified)	201	60.18%
Not specified	54	16.17%
Senior/manager at work[91]	23.5	7.04%
Online forum[92]	22	6.59%
Customer/client/agent[93]	20.5	6.14%
Colleague[94]	10	2.99%
Friend	3	0.90%

Table 51 Typical book/manual specified by the respondent to help in the problem e.g. Book-A

MyBook/Manual	n=322	Total 100%
Some book (with topic specified)[95]	119	36.96%
Not specified	111	34.47%
Some report/manual[96]	85	26.40%
Some journal	3	0.93%
Some magazine	2	0.62%
Some newspaper	2	0.62%

[91] Manager; department manager; project manager; IT manager; marketing manager; supervisor; advisor; boss; senior; director of IT; team lead; tech lead; management officers

[92] Yahoo answers; Yahoo group; ExpertsExchange; kirupa.com; software forum; dailymarkets.com (gracecheng.com); mysql.org; robotics experts; people in the same industry; mailing list; Microsoft TechSupport; supportConnect

[93] Including government agency; overseas agent; US client; users; broker/trader; product vendor; sub-contractors

[94] Including overseas colleagues; maintenance team; helpdesk

[95] On financial risk management; C++; reference; dictionary; ecommerce; primary school textbook; robotics; building LINUX systems; marketing kit; molecular biology; ActionScript 3.0; audit methodology; children's development; HR Guide; Idiot's Guide; Microsoft Office; how to be smarter; VMware; exhibition design; firm intellectual property; high performance management; interface design; Windows scripting; organizational accounting; principles of database tuning; Singapore tax law; statistical analysis; recruitment; other unspecified topics

[96] Report; law report; annual report; market research report; metal research report; manual; company manual; operation manual; system manual; solution manual; technical manual; procedures manual; reference manual; shipping manual; audit & accounting manual; campus manual; system specs; specifications; user guide; product guide; handbook; mechanical handbook; record book; document; design document; supporting document; technical document; testing doc; contractual docs; product documentation; standards; international standards; papers; quotation; policy; lecture notes; data dictionary

Table 52 Typical online/electronic information source specified by the respondent to help in the problem e.g. Google, company digital library, intranet, etc.

MyOnlineInfoSource	**n=336**	**Total 100%**
Google	142	42.26%
Other Internet sources	68	20.24%
Not specified	39	11.61%
Company's Intranet/digital library	38.51	11.46%
Yahoo	9	2.68%
Wikipedia	7.33	2.18%
Client's intranet/digital library	5	1.49%
Lawnet	4.33	1.29%
MSDN	2.5	0.74%
Ask.com	2	0.60%
Google Scholar	1.5	0.45%
Medline	1.5	0.45%
Specific online source listed once[97]	11 x 1	11 x 0.2976%
Specific online source listed along with another source[98]	8 x 0.5	8 x 0.1488%
Specific online source listed along with 2 other sources[99]	1 x 0.33	0.098%

[97] Answers.com; Baidu; Bloomberg; iStockPhoto; IEEE; NCBI PUBMED; Singapore Exchange (sgx); RentACoder.com; www.ipos-society.org; salesforce.com; ASI iMIS

[98] ACM.org; Factiva; Gartner; Gov.sg; Forbes; Citeseer; Investopedia; Monster.com

[99] Greenbook.org