TASK COMPLEXITY, INFORMATION TYPES AND INFORMATION SOURCES:
Examination of Relationships

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Task Complexity, Information Types and Information Sources: Examination of Relationships

ACADEMIC DISSERTATION
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ABSTRACT

In this study, the effects of perceived task complexity on the relationship between information types and information sources were examined. The information activities focused on were seen as a sub-process in task performance process. The information types to be acquired were expected to determine types of information sources used. Further, the perceived complexity of task was expected to determine what types of information were needed. This was considered in a real life work setting where the observation units were the actual work tasks of municipal administrators in two Finnish towns. By concentrating the analysis on the individual work tasks, the action-centred orientation was emphasised with the understanding that both individual as well as social aspects place constrains on these processes.

The main research data consisted of 80 task diaries recorded by 39 participants. This material was supplemented through subsequent interviews. Additional background data were collected by unstructured observations, document review and by an e-mail questionnaire. The data were analysed according to a process-analysis method that focuses on the identification of different aspects of task performance, their classification and finally their cross-tabulation. Both qualitative and quantitative techniques were utilised in the data collection and the analysis. The statistical significance of the findings was not tested.

The research results show that there is a clear relationship between information types needed and information sources used, and that the effects of task complexity are mainly related to the need for information types during task performance. However, there are also indications that task complexity leads to a preference for people as information sources, especially general-purpose sources such as experts and meetings. Contrary to expectations task complexity or the need for multiple information types was not related to the increase in external information source use generally. However, the growing task complexity especially seems to increase the use of people inside the organization and to decrease the use of internal documentary sources. The increase of information source use was almost linear when more information types had to be acquired. The number of information sources used also increased in relation to task complexity, but much less steadily.

The study elaborated the relationships between task complexity and information source types by introducing information types into the analysis. The findings of this and earlier studies by the present author indicate that there are common information related patterns of how perceived work task complexity is coped with. Additional studies are needed to further clarify these patterns.

In Memory of Unto Murtonen

FOREWORD

It is with a bittersweet joy that I view the present dissertation. There are so many memories and feelings attached to it – from the first moment when the idea was born to this moment today.

It has been an interesting process, a meandering path with surprises. Sometimes it has been difficult to see the path and find a footing. At other times I have enjoyed moments of clear sight and firm ground. I have learned a lot, not only in an academic sense but also about myself. All in all, it has been a great journey!

Sometimes I have shared this path with other people. Some of them have just crossed my path. Others have walked along – or taken me along – quite a bit. Without all these persons I would not write this today. I would like to express my gratitude to everyone who has made an effort to give this thesis a form, both substantially and otherwise.

I am deeply grateful to my advisors, Professors Pertti Vakkari, Kalervo Järvelin and Reijo Savolainen, for the demands and trust they have placed on me. Their interest in my work has been the best reward any student can hope to get. I would like to thank my fellow Ph.D. students at the Department of Information Studies in the University of Tampere. They have provided a good forum to debate ideas and to discuss the work process itself. Special thanks to Hannele Fabritius and Kimmo Tuominen for stimulating discussions. I would also like to thank those persons at the University who have helped me with diverse practical issues. Mirja Björk has been a dependable ally who, firm and friendly, took care of all kinds of matters over the years. Marita Alanko (for the layout) and Virginia Mattila (for checking the language) deserve my warm thanks, too.

I acknowledge the participants from the cities of Pori and Tampere. Without their effort I would have been in trouble. Special thanks to Town Clerk Helena Metsälä who guided me into the practice of municipal administration, and Head Registrar Maija Saarinen who provided me with valuable assistance with data collection.

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I am especially thankful for my family: my parents, Sirkka and Unto, for guiding me into academic studies; my siblings, Pauliina and Mikko, for the interest they have always shown in my topic; my grandmother, Lenny, for her effort to follow this process; my parents-in-law, Ulla and Kjell, for genuine discussions on related and unrelated topics; my brothers-in-law, Mats and Erik, and their families as well as my sister-in-law, Anna, for good company that I could not have done without.

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Örebro, 26 May 1999

Katriina Byström

CONTENT

Chapter 1

Introduction

1.1. THE FIELD OF INSU RESEARCH

The present study examines information seeking in work tasks of different levels of complexity. Information seeking research is a crucial part of all information studies (Järvelin & Vakkari, 1993). It focuses on information activities – like information needs, seeking and use (INSU) – on various professional and other everyday life settings. Some twenty years ago a general shift of perspective from information systems and services to their users began to take place. However, as Julien (forthcoming) points out, the change is not always so drastic since a lot of research has merely adjusted the point of view keeping the systems and services still firmly in focus. The most recent research approach recognises the simultaneity of several aspects of reality and thus emphasises a holistic approach on information activities (Ginman, 1995; Dervin, 1997).

INSU research over the years has emphasised various dimensions and taken different perspectives. An illustrative pyramid diagram for the research area of INSU is presented in Figure 1.1. Each corner of the pyramid represents one of the four main dimensions emphasised in INSU research. One corner of the pyramid is occupied by the *means* of information seeking (e.g., information systems, information services, information seeking channels and information sources), another by *information* (e.g., type of information, content of information, usability of information), a third by *individuals* (e.g., cognitive styles, information seeking styles, information profiles, and demographic factors), and a fourth by *contexts* (e.g., aspects of work organizations, jobs, individual tasks, and everyday life situations).

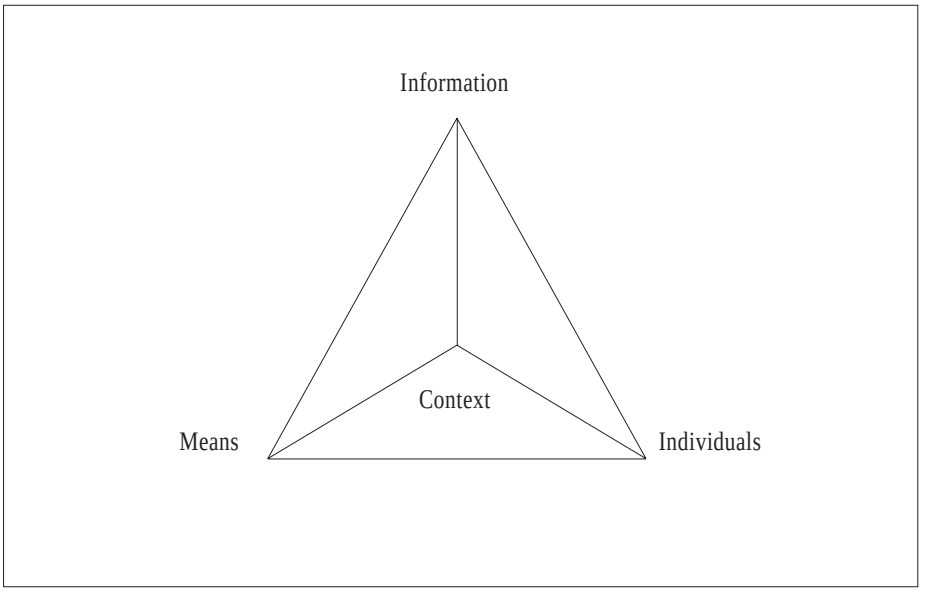

Figure 1.1: Main aspects in INSU research

The closer to the middle point of the pyramid a study lies the more equally all dimensions are considered. Moreover, the pyramid can be approached from different perspectives. Thus, the same research problem (e.g., the use of commercial databases) might be treated quite differently as the overall perspective varies (e.g., the perspective of systems or contexts). The more holistic the research approach, the more comprehensively different dimensions as well as perspectives are considered. This appears to be a fruitful direction because it enables a better understanding of INSU phenomena. This understanding not only provides a solid platform for the planning and development of information systems and services for certain contexts, but also facilitates the development of the information activities themselves in the contexts studied.

In the present study the dimensions of information and means of acquiring it are contemplated from the joint perspective of context and individuals. The examination is based on task performers' perceptions of genuine work tasks and their complexity. Types of information are used to define the information that task performers consider necessary in connection with varying (work) task complexity. Similarly, types of (information) sources are related to task complexity. Furthermore, the relationship between types of information and types of sources is considered. Thus, this study focuses on the relationships between task complexity, types of information and types of information sources.

1.2. THE GOAL OF THE PRESENT STUDY

Generally, information studies aim to facilitate access to information. This main purpose may be further divided into more specific goals of INSU research (Järvelin, 1981). First, the goal of an INSU study may be the identification of the role that INSU aspects play as a part of actions in a certain context (e.g., as a part of professional activities). Second, an INSU study may concentrate on the practices of information seeking and use, and seek ways to improve them (e.g., upgrade the quality of these practices or provide more appropriate solutions). Third, the most commonly explicated goal in INSU studies is to support the planning and development of information systems and services. (Järvelin, 1981, 26–27).

The present study pursues the first type of goal, which may be seen as a precondition for the achieving to the two other. The aim is to provide fundamental knowledge about the nature and customs of the area where the practices of information seeking and use take place, and where the information systems and services serve. Without this knowledge it is difficult either to improve the practices or to develop systems and services. Wilson (1981) and Ellis (1984) argue that it is possible to design more effective information systems by means of understanding better activities that individuals are engaged in, environments in which they act, and information needs they perceive.

In the present study, this general goal crystallises into the development of a model of the relationships studied. This is based on the empirical research partly done in this study and partly in some earlier studies by the present author as well as by other researchers. The general research problem is to find out what kinds of effects task complexity has on information needs and information seeking. Task complexity (in terms of *a priori* determinability) is used to distinguish between tasks. A subjective view on tasks is preferred to an objective one, since information needs and information seeking depend on how the task in hand is understood by its performer. Information needs are considered on the basis of different types of information. Information is classified either as task information (closely related to task in hand and normally unusable in other tasks), as domain information (related to a particular task domain and usually useful in several tasks) or as task-solving information (instructional information that is useful in several tasks). Similarly, information seeking is examined indirectly through sources used. Sources are divided into people as sources, documentary sources and visits as sources. Two former classes have elucidatory subclasses. The general research problem is further divided into four sub-problem areas:

1) Information types and (information) sources
2) Task complexity and information types
3) Task complexity and (information) sources
4) Task complexity, information types and (information) sources

1.3. THE TASK INTO FOCUS

This study focuses on task performance. The methodological starting point in INSU studies ought to be to analyse the actions that information seeking supports (Vakkari, 1997). By switching the level of analysis from general categories of work to individual work tasks, a less complicated, and thus, more easily comprehensible basic unit of analysis is obtained. Tasks situate information activities in a specific and purposeful context. This increases the potential for more thorough research findings compared with job-based analysis.

There are very few INSU studies that are based on individual tasks. Most studies, and especially those which relate INSU to task complexity, have considered the phenomenon studied on the basis of jobs (i.e., as a host of certain tasks) (e.g., Tiamiyu, 1992; Culnan, 1983, Hart & Rice, 1991; Van de Ven & Ferry, 1980). In this respect, the present study covers an area that has not previously been addressed within INSU research. Since no conceptual model concentrates sufficiently clearly on the aspects of tasks and INSU, one was created to serve the present work (cf. Byström & Järvelin, 1995; Byström, 1996; Byström, 1997). An information seeking model constructed by Feinman et al. (1976) and Mick, Lindsey and Callahan (1980) provided a starting point for the development of this model. These researchers described different INSU moments of task performance. However, they did not explicitly consider the task that prompts the information activities. Kuhlthau's (1991, 1993a) model of information seeking processes is another, more recent and clearly more comprehensive model that has connections with the model used in this study. However, Kuhlthau's model focuses fairly exclusively on information seeking processes, which are perceived to be very difficult.

Perceived task complexity was chosen to distinguish the work tasks. This characteristic has been acknowledged as a central aspect affecting task performance in several studies. Organizational studies especially have utilised it in order to consider and explain job satisfaction, goal setting and other organizationally noteworthy phenomena (e.g., March & Simon, 1967; Van de Ven & Ferry, 1980). Recently, task complexity has also merited increasing attention in information studies (e.g., Vakkari, forthcoming; Kuhlthau, 1999, forthcoming). Task complexity is in itself a complex concept and difficult to operationalise. Since no satisfactory definition and measure system of task complexity was found for the purposes of the present study, an alternative based on a general task complexity categorisation was applied. The main starting point for both determination and operationalising of task complexity was adopted from the information system literature (Tietosysteemin ..., 1974). According to this task categorisation all information intensive tasks, i.e., tasks whose completion is clearly information bound, can be divided into one of five task categories on the basis of their *a priori* determinability.

The previous studies on task complexity and INSU introduce a relationship between task complexity and source use. Source use and communication in general

have been found to increase in more complex situations (e.g., Tiamiyu, 1992; Tushman, 1979; Van de Ven & Ferry, 1980; Culnan, 1983). Some studies have connected the increasing task complexity with the increasing use of sources that are external to the organization (e.g., Tiamiyu, 1992; Daft, Sormunen & Parks, 1988; Fischer, 1979; Pinelli et al., 1993). Others have not been able to confirm this relationship (e.g., Tushman, 1979). Some findings indicate that task complexity generally increases the timeliness and amount of information, but that the effects of task characteristics vary according to the nature of the job (e.g., administrative, managerial, technical work) (Zeffane & Gul, 1993).

The basic relationship is usually considered to be between task complexity and source use (Vakkari, 1998). In this study, the information types needed are introduced as an intermediate aspect linking task complexity and source use. Task complexity is anticipated to affect the information types needed, which further steer the source use (Järvelin, 1986, 1987; Murtonen, 1991, 1992, 1994; cf. Byström & Järvelin, 1995; Byström, 1996, 1997, Vakkari & Kuokkanen, 1997). In the present study, these relationships are further elaborated. First, the relationship between the need for information types and source use is studied. Second, task complexity is added to the previous relationship, and third, the direct relationship between task complexity and source use is examined.

1.4. THE STUDY OUTLINE

The present study consists of both theoretical and empirical parts. Theoretical foundation is introduced on three conceptual levels. General positioning of the present study within the research area of information seeking is presented in Chapter 2. The basic concepts of the study and their underlying connections to different metatheoretical aspects are introduced in this general framework. In the next conceptual level, the framework is focused on the model of task performance process, in Chapter 3. INSU processes are seen as a part of task performance. Finally, a specific model emphasising task complexity and the need for information types and use of information sources is derived from the task performance model and preceding findings. Here the concepts of the previous levels are specified for the purposes of the present study.

Chapters 4, 5 and 6 are related to the empirical part of the study. The research problem is defined in detail in Chapter 4. Central relationships are considered and associated research questions are explicated. After the definition of the research problem, the nature of the work tasks focused in the empirical study, their performers and the work organization are introduced. The research method and the techniques applied are presented in Chapter 5. The main research data were collected with task diaries where the individual task performances were followed from the beginning to their completion. Data in task diaries were completed with subsequent interviews,

and some background information was collected through e-mail questionnaires. The analysis of the research material and its results are presented in Chapter 6. The analysis was based on a process-analysis method where different aspects of task performance and related INSU are considered as relationships.

Finally, the conclusions are presented in Chapter 7. The results of both theoretical and empirical findings are brought together. Their significance, implications and further research problems in INSU research are discussed in this final chapter.

Chapter 2

General conceptual framework

2.1. CENTRAL INSU CONCEPTS AS A FRAMEWORK FOR PROFESSIONAL SETTINGS

A considerable number of characteristics formulate INSU phenomena (i.e., information needs, seeking and use). The framework below considers the basic characteristics for a task-based INSU study in a professional setting. Thus, it explicates a general foundation for the present study by stating the metatheoretical standpoints. Below, the concepts of the framework are presented first together, and second, they are specified.

Environments of information seeking were considered in the very first theories about INSU. They were usually seen as different systems surrounding information seekers (e.g., Paisley, 1968; Allen, 1969). Environments have also received a lot of attention lately, but now as variable contexts instead of the stable surroundings (cf. Taylor, 1991; Savolainen, 1993; Hjørland & Albrechtsen, 1995; Dervin, 1997). Wersig (1973) emphasised the aspect of work and elaborated conceptually the relationships between task requirements and information needs. Similar aspects have also been considered on some other occasions (e.g., Paisley, 1980; Ginman, 1983; Byström & Järvelin, 1995; Ingwersen, 1996). Different *situational* factors have been incorporated indirectly in some theories (cf. barriers by Wilson, 1981, and overall situations by Dervin, 1992). Several researchers raise the centrality of personal properties of *individuals*. Experience and different information processing profiles especially have been recognised (e.g., Feinman et al., 1976; McClure, 1978; Palmer, 1991a, 1991b; Cool et al., 1996). There seems to be a prevailing understanding about the process nature of information seeking within INSU research. This view has been promoted by Feinman et al. (1976), Dervin (1983), Ellis (1993), Marchionini (1995), Byström and Järvelin (1995), Kuhlthau (1993b) and Campbell and Van Rijsbergen (1996) among others. These theories and findings give a basis to the conceptual framework of this study. The basic presupposition is that information activities of professionals are affected by individual as well as contextual characteristics.

2.1.1. Task performer

Information activities of professionals form a central and attractive area of INSU research. Several occupational branches have been studied, including:

- researchers (e.g., Ellis, Cox & Hall, 1993)
- social workers (e.g., Wilson, Streatfield & Mullings, 1979)
- government ministers (e.g., Tiamiyu, 1992)
- municipal administrators (e.g., Byström & Järvelin, 1995)
- engineers (e.g., Gerstberger & Allen, 1968; Tushman, 1978)
- managers / decision makers (e.g., O'Reilly, 1982; McLeod & Jones, 1986; Ginman, 1987)
- journalists (e.g., Ginman, 1983; Byström, 1996)
- physicians (e.g., Gorman, 1995; Hibberd & Meadows, 1980)
- educators (e.g., Summers, Matheson & Conry, 1983) and also
- studies comparing information activities of different groups of professionals (e.g., Leckie, Pettigrew & Sylvain, 1996; Taylor, 1991; Ginman, 1983).

Despite the user-centred perspective gaining attention during past fifteen years or so, little attention has been paid to the concept of "doer" in INSU studies (Byström, forthcoming). The contextualising of actions has been fairly external, that is, it has concentrated on concrete environments with certain resources and structures of duties (e.g., Taylor, 1986, 1991). The contextualising of "doers" also involves cultural and social aspects. This means that an abstract environment with values, beliefs and norm structures is acknowledged (e.g., Giddens, 1979, 1984). Byström (forthcoming) identifies three types of "doers": *the Platonian man*, *the Debater* and *the Chessman*. At one extreme, there is the Platonian man, an autonomous subject, who acts independently of her environment. At the other, there is the Chessman, an anti-individual, being moved by particular social and cultural norms. The Debater is a dialectical actor, who possesses a will of her own, but who constantly is influenced by her concrete and abstract environments. These views naturally affect the kinds of explanations of information activities that are considered. (Byström, forthcoming).

In the present study individuals are seen as debaters. Moreover, they are considered in connection with a particular membership, as employees, and, more exactly, in the role of a task performer (cf. Byström, forthcoming). In the context of work, environments are understood to consist of the nature of duties and the resources available as well as related social and cultural structures (Rosenbaum, 1993). In accordance with the viewpoint of a debater, individual characteristics are also seen to affected actions. As an example, motivation or ambition and experience

can directly be linked to information activities (e.g., Allen, 1977; Paisley, 1980; McDaniel, Schmidt & Hunter, 1988; Toms, forthcoming). Salancik and Pfeffer (1978) argue for this view of individuals by claiming that individuals' attitudes, needs, and behaviour are bound to both social and personal constructions of reality. They stated that

> "The social context, through informational social influence processes, can affect beliefs about the nature of jobs and work, about what attitudes are appropriate, and, indeed, about what needs people ought to possess" (Salancik & Pfeffer, 1978, p. 233).

And further,

> "These effects of context make behavior in work organizations different from individual behavior and individual cognitive processes considered in isolation" (Salancik & Pfeffer, 1978, p. 233).

People may have several motives for working (e.g., covering living expenses and satisfying the need to create and/or succeed) (e.g., Peltonen & Ruohotie, 1989; cf. Maslow, 1970). On the basis of these motives, work is viewed differently. Generally, the more needs the work (or even a single task) satisfies, the better motivated a person is (Peltonen & Ruohotie, 1989). Humphreys and Revelle (1984, p. 157) defined motivation as a "state that results from a combination of individual needs and desires with the stimulus properties of the situation". Although motivation is a difficult phenomenon to clarify, it is agreed to have considerable effects on human behaviour (e.g., Terborg & Miller, 1978; Child, 1986; Gleitman, 1991).

Prior knowledge may be seen as one of the main assets in task performance (e.g., Court, 1997). It determines how eventual problem situations are perceived. If a person has a wide knowledge of a certain domain, many situations within it may never appear as problematic. Both experience and formal education increase the level of prior knowledge (e.g., McDaniel, Schmidt & Hunter, 1988). For information seeking this means that people tend to develop particular information seeking routines. These routines, together with valuations and opinions, form a specific information seeking style for selecting a suitable information seeking action(s) (Feinman et al., 1976; cf. Fulk et al., 1988). An information seeking style is comparable to a habit that directs actions unconsciously, that is, it turns on an action suitable for well-known situations nearly automatically (cf. March & Simon, 1967). The link between work experience and information seeking style is well acknowledged (Gralewska-Vickery, 1976; Tiamiyu, 1993; Strasser, 1978; Stinson & Mueller, 1980).

2.1.2. Tasks as identifiable parts of work duties

Hackman (1969, p. 97) wrote that

> "tasks play an important role in much research on human behavior, and differences in tasks and task characteristics have been shown to mediate differences in individual and social behavior".

Likewise, it is widely accepted that INSU depends on the tasks people are performing (e.g., Belkin, Oddy & Brooks, 1982; Byström & Järvelin, 1995; Ingwersen, 1992, 1996; Mick, Lindsey & Callahan, 1980; Marchionini, 1995; Solomon, 1997a). Numerous studies have investigated the relationships between types of tasks and information seeking activities or communication. A vast majority of these studies has approached these phenomena on the basis of jobs.

The concept of task may have at least to two different meanings. First, a task may be understood abstractly: task is an object of work duties (cf. McCormick, 1979). It is *an abstract construction* that does not include its performance. A task, especially a larger one, may include specifiable smaller sub-tasks. According to the second and perhaps more common definition, a task is viewed from a functional perspective: a task is *a series of actions* in pursuit of a certain aim (e.g., Marchionini, 1995). These actions may be organised successively as Paisley's (1980) sequences (e.g., decision making includes searching for information, selecting and processing it, comparing alternatives and finally making the decision) or McCormick's (1979) operational functions (i.e., sensing by receiving information, information processing and decision, and action functions such as physical control or communication).

Whereas the first definition excludes performance, this is the very core of the second definition. The performance of a task includes physical and/or cognitive actions. This performance has a recognisable beginning and end, and it essentially has a meaningful, but not necessarily a tangible, purpose. "A task, when performed, results in a meaningful product" (United States Air Force Manual, 1973 as in McCormick, 1979). For instance, a common purpose of decision making is to direct action. In the present study, the term 'task' is used to refer to the abstract construction that excludes the physical and mental actions to reach a result. The term combination 'task performance' is used to refer to the process of coping with the task. The focus is on information intensive tasks whose performance is clearly knowledge bound.

Every task imposes some requirements for its performance. Some of these are unconditional: they must be fulfilled to complete the task. Others may be conditional: task completion does not require their fulfilment, but it may lead to a higher standard of result. The requirements may be psychological and/or physical in nature. One part of the psychological requirements can be classified as cognitive requirements, and further, information requirements are particular kinds of cognitive requirements.

Information requirements focus on information which is (perceived as) relevant to task performance.

Wersig (1973) analysed information requirements in relation to tasks and their performers. Potential information requirements comprise all information relevant for task performance. Factual information requirements refer to those requirements that are not covered by the performer's prior knowledge. However, the performer is not always able to recall all her relevant knowledge. Thus, actual information requirements are a combination of factual information requirements and information requirements that the performer does not realize to answer with her prior knowledge. (Wersig, 1973).

Hackman (1969) proposed an important dimension for differentiating among task definitions. It focuses on the conceptual difference between tasks as independent entities and tasks as an integral part of the overall situations (or simply as situations). Both of them are used in research on INSU. For instance, Dervin's sense making approach is formulated around a general situation that includes problematic aspects for a person within it. Empirical studies of information seeking have only recently begun to base their scrutiny on individual tasks (e.g., Byström & Järvelin, 1995; Kuhlthau, 1993a, 1993b, 1997; Algon, 1997; Limberg, 1998). Tasks as independent entities have more commonly been used in laboratory experiments (e.g., Levine, Samet & Brahlek, 1975; Ingwersen, 1982).

Another related aspect is a task – job dimension. Work is commonly defined as an effort (or activity) directed to some purpose. It is often but not always paid (e.g., as in salary, gratitude or respect) and usually but not always undertaken voluntarily. A job is a paid set of work defined by certain duties in a certain professional setting (e.g., the job of district nurses, small business accountants, occupational recruiting-officers and high school teachers). A task is a specific object of duties belonging to a job. Its performance demands a definite piece of work. (cf. McCormick, 1979). Job-based INSU research in professional settings is voluminous. Several studies examine the relationship between a certain job category and sources used (e.g., Aiyepeku, 1982, about policy-makers' channel and source use; Hibberd & Meadows, 1980, about medical doctors' source use; and for wider review in the humanities, see Stone, 1982). There are also studies which concentrate on the effects of task complexity as a job dimension on INSU (e.g., Tiamiyu, 1992; Zeffane and Gul, 1993; Culnan, 1983). INSU has also been related to performance of teams in a number of field studies (e.g., Tushman, 1978; Allen, 1977; Sonnenwald & Lievrouw, 1997; Manning Barnes, Spink & Yeatts, 1997; Solomon, 1997a).

Another important dimension emphasised by Hackman (1969) focuses on the subjective vs. objective view of tasks. Tasks as objective entities are understood to be external to the performer and imposed on her. They have a specific existence, and they are *independent of their performers*. Subjective tasks are seen as internal to the performer and defined by her. They are *subordinate to comprehension of their*

performers. (Hackman, 1969). Objective and subjective tasks can be described in relation to each other (Fig.2.1). A subjective task is a task performer's construction of an objective task[1]. Thus, one objective task may be the origin of several subjective constructions which all can be distinguished from each other (Newell & Simon, 1972, p. 63). A subjective construction of an objective task can further be reformulated by others, etc. Naturally, the match between objective and subjective task may vary.

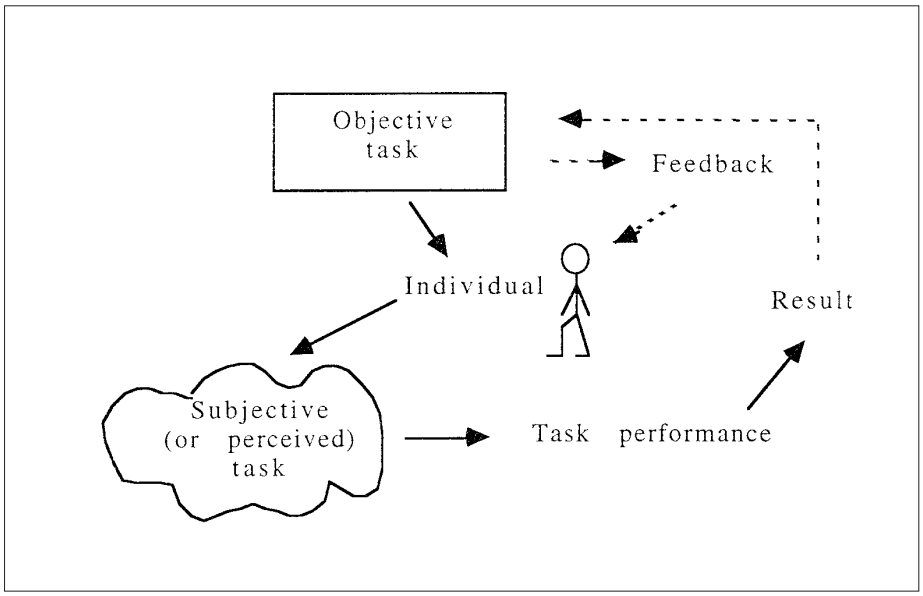

Figure 2.1: Objective and subjective task

Again, both subjective and objective tasks have been used in the research of INSU. When objective tasks are used, human behaviour is compared against a given task description, external to the task performer. Use of the objective tasks is particularly typical in psychological experiments (e.g., Naylor & Briggs, 1963; Latham & Steele, 1983; Gardner, 1990). In studies on INSU, objective tasks are often used in experiments conducted under laboratory conditions (e.g., Levine, Samet & Brahlek, 1975; Morehead & Rouse, 1982).

The use of subjective (or perceived) tasks is sometimes criticised as improper in psychological and organizational studies. For example, Wood (1986) argues rather strongly that

[1] Subjective formulation of an objective task is the result of a complex process, which is affected by several factors. These may be both internal (e.g., experience) and external (e.g., time available) to the individual. (For a review, see Eysenck & Keane, 1992)

"the definition of a task by an individual who performs it, which may not correspond with the formal definition, is an individual characteristic, not a task characteristic" (Wood, 1986, p. 63).

However, one may argue that the subjective view of tasks is the most central point of departure. Subjective task perceptions are formed in accordance with the characteristics of, not only an individual but also of a social context (Fulk et al., 1987; cf. Salancik & Pfeffer, 1978; Liang, 1996). The use of subjective tasks is reasonable, and perhaps even imperative in cases where the phenomenon to be studied is primarily connected to the perceptions of task performers. This is the case when examining INSU in real-life settings (cf. Dervin, 1992). Furthermore, the determination of objective tasks may be difficult in many real-life professional settings (cf. Quaid, 1993). It can even be proposed that objective tasks do not exist as such in these settings. For example, it can be difficult to determine in detail the features of an objective task behind the subjective task of a researcher or a manager.

In this study, tasks are seen as abstract constructions depending on their performers. They are considered as particular objects of work duties whose performance have a meaningful purpose as well as a recognisable beginning and end. They imply several information requirements of which the perceived information requirements are central to the task performance.

2.1.3. Situational factors

A task performance process within its natural setting can be understood as a situation (cf. Dervin & Nilan, 1986; Dervin, 1992). In the present framework this overall situation is divided into elements like tasks, task performers and organizations. However, there are certain conditions that are clearly situational in nature. Situational factors (e.g., lack of time, political pressure) often have adverse[2] effects on task performance. Their presence is not inevitable, but some situational factors may have a tendency to occur constantly so that their absence, rather than their presence, becomes exceptional. Some situational factors, like lack of time, are independent of the task at hand whereas others, like secrecy and political pressure, are more or less bound to the tasks.

Lack of time is the most commonly studied situational factor and it has usually been studied in the manipulated conditions of laboratory settings. It has also been found to be a common situational factor in many real-life contexts (e.g., small business: Kaipainen, 1989; administration: Murtonen, 1991, 1994). Journalistic

[2] Note, that the discussion concerning the objective and perceived task complexity in Chapter 3 is also relevant in the case of situational factors. For instance, a swift person performing the same tasks as her slower colleague may only seldom recognise the existence of lack of time whereas her colleague complains about it continuously.

work is considered to be extremely time pressured. For example, Harris, Nicholas and Erbach (1987) stated that in a large British newspaper an answer to a normal, non-urgent query presented to a newspaper librarian is wanted within two hours. Byström[3] (Murtonen, 1992) noted that lack of time affected not so much the number as the *types* of sources used by journalists: under time pressure journalists decreased the use of experts and archival records[4] and increased the use of people involved.

2.1.4. Information: needs and seeking

The term information has been related to several meanings. Feinman et al. (1976) defined information as stored knowledge, which is usable for those who have access to the storage medium. Farradane (1979, p. 13) claimed that information is "any physical form of representation, or surrogate, of knowledge, or particular thought, used for communication". Paisley (1980) stated that information can be defined both structurally and functionally. When defined from structural perspective "information denotes an encoding of symbols (e.g., letters, numbers, pictures) into a message of any mode, communicated through any channel" (Paisley, 1980, p. 118). From a functional point of view "information denotes any stimulus that alters cognitive structure in the receiver" (Paisley, 1980, p. 118). Moreover, according to Paisley (1980, p. 118), "something that the receiver already knows ... is not information". On the other hand, Niiniluoto (1989) arrived at the conclusion that information is a wide concept that includes knowledge as a separate sub-unit, which is associated with specific requirements of success, truthfulness and thoroughness.

Taylor (1991) sees information from its user's perspective. He (1991, p. 220) considers the concept of formal information which can be either in a recorded or in an oral form. According to Taylor (1991), information is not formal because of its physical format but because of its perceived relevancy to a particular problem. Buckland (1991) brings these aspects together by considering *information as a thing* (i.e., recorded knowledge), *knowledge* (personally believed by somebody), and *process* (becoming informed, a change in knowledge). Thus, in INSU contexts, information-as-thing is collected and assimilated in the pursuit of a positive change in information-as-knowledge (Buckland, 1991). However, oral information (e.g., discussions) is explicitly excluded from this specification. If Buckland's information-as-thing is modified according to Taylor's formal information, the specification becomes clearly more universal.

As the short review above reveals, there have been several – and sometimes contradictory – attempts to capture the innermost meaning of information. This goal seems to be unattainable since information can be viewed from a number of

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[3] Formerly Murtonen.

[4] The journalists of the participating newspaper at the time of study had electronic archives at their disposal at their own terminals.

perspectives. The perspectives are already varied within information studies, let alone other disciplines (e.g., psychology and computer science). Wilson (1981) argued nearly two decades ago, but still quite validly, that the real problem is not the multiple meanings associated with the term but the undefined or inappropriate use of it in individual studies. Wilson (1981) stressed that it is of most importance, first, to define the term information so that it fits the level and purpose of an individual investigation, and second, to clearly explicate the definition used.

In the present framework, information is seen as whatever piece of individual or common knowledge represented orally, in writing or as pictures (cf. Farradane, 1979). Moreover, following Niiniluoto (1989), information is not bound to any requirements of success, truthfulness or thoroughness, nor is it bound to any requirements of intention or novelty. Information is seen in the role of *an abstract tool* that enables, or is intended to enable, the completion of task performance.

2.1.4.1. Information needs

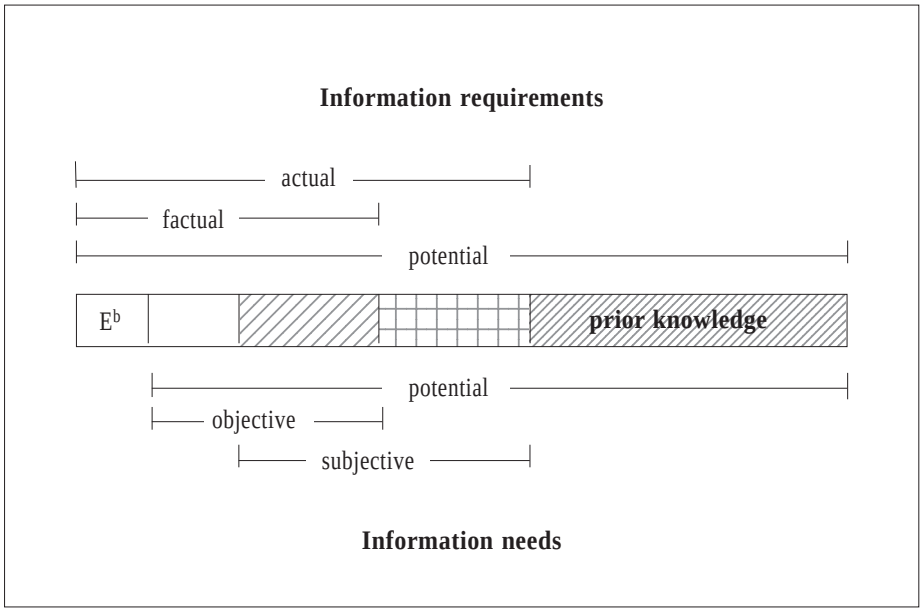
In professional settings, information needs can be classified according to their connection with tasks. *An applicational information need* is strictly bound to the task in hand. The satisfaction of this kind of information needs focuses on task completion. On the other hand, a nutritional or *orientative information need* focuses on information that is not primarily related to any individual task, but which is expected to facilitate several future task performances. (Feinman et al., 1976; also Mick, Lindsey & Callahan, 1980).

Derr (1983) analysed the concept of information need and claimed that information need is a condition rather than a psychological state of an individual. Information need is based on the relationship between individual goals and information making it possible to achieve them. Derr (1983) raises a question of the nature of information need. There are several ways to define information need. It is often equated with lack of information, but simultaneously people daily need information that they already possess (e.g., bankcard code). Information may also serve other than practical purposes, as for the sake of interest or curiosity (e.g., historical events or neighbour's activities).

Derr (1983) further claims that information need involves two judgements about the validity of information purpose (i.e., whether the goal is legitimate or appropriate) and contribution value of information (i.e., whether the information in question, contributes to the achievement of an individual goal). This can be confounded by stating that objective, valid judgements, like those of Derr, have nothing to do with a person experiencing an information need. Thus, an information need exists when the person realizes that her current knowledge does not enable her to complete the task in hand, and that she needs some information to cope with it. If the situation is misinterpreted, and as a result an information need is not correct (objectively or subjectively), a person has still *experienced* an information need.

Wersig (1973) analysed the relationship between the information requirements of a task and the information need perceived by its performer (Fig. 2.2). *A potential information need* corresponds to all information requirements of the task that the task performer is able to become aware of. *An objective information need* corresponds to factual information requirements of the task (i.e., information requirements which remain after subtracting those information requirements which can be covered by the prior knowledge of the task performer) which the task performer is able to become aware of. *A subjective information need* corresponds to actual information requirements (i.e., factual information requirements together with those information requirements that the task performer could cover, but does not realize to, by her prior knowledge). In other words, a subjective information need focuses on information that is perceived as sufficient for task completion by its performer.

In the present framework, the information needs focused on are task-related (i.e., applicational), individually formed wants or necessities of information. They are subjectively perceived and their satisfaction is seen as a key to task completion. These information needs are not restricted by any objective judgements. Thus, information needs are not seen as unconditional needs (e.g., need for food or need



Legend: E^b represents those information requirements that are impossible for the task performer to fulfill.

Figure 2.2: Information needs and information requirements (Wersig, 1973, p. 171)

for warmth) but rather as deliberate mental actions in the process of task performance in the present study.

2.1.4.2 Information seeking

Information seeking may be viewed from at least three perspectives with varying width. First, trying to get hold of an existing piece of information is information seeking with fairly narrow perspective (e.g., consulting a knowledgeable person or looking for a research report on an intranet). Information retrieval is a particular type of such information seeking. Second, gaining knowledge from existing information is a certain kind of information seeking (e.g., discussing with a knowledgeable person or reading a research report). Third, in a broad sense, creating new information is also information seeking (e.g., research) as well as it often involves the two above-mentioned kinds of information seeking. In the area of INSU research the first kind of information seeking is common and rather exclusively referred to with the concept of information seeking. However, there are studies where information seeking is seen in a wider perspective (e.g., Kuhlthau, 1991; Dervin, 1992; Limberg, 1998; Solomon, 1997abcd).

Irrespective of the approach, information seeking is often understood as a reaction to an information need. "Information seeking behavior refers to specific actions performed by an individual that are specifically aimed at satisfying information needs" (Feinman et al., 1976, p. 3). However, information seeking may well have *a reciprocal action* through feedback on information needs, which are modified on the basis of the result of present or past information seeking. In theory, information need precedes, by definition, information seeking. This causality is more complicated in practice, where preceding information seeking sequences may affect present information need perceptions. For instance, a certain piece of information may have been difficult to acquire during an earlier information seeking sequence. This may cause a modification of the later information need (i.e., excluding the information proved to be difficult to acquire).

Information needs reflect the information requirements of tasks (Wersig, 1973). This is why the actions to satisfy information needs are essential in pursuit of task completion. This information is normally sought from various sources through various information seeking channels (cf. Fig. 2.3). In most settings, traditional information systems and services are just some alternatives among others. Moreover, they are often found to be of little use (e.g., Hurd, Weller & Curtis, 1992; Brittain, 1982; Allen, 1977; Keegan, 1974).

An (information) source is, or is supposed to be, a bearer of information that is believed to satisfy an information need (Murtonen, 1991; cf. Byström & Järvelin, 1995). Brown (1991) specified three source types: the self, interpersonal sources and impersonal sources. Because in the present framework information need is defined as a reaction to those information requirements of task that a person cannot, or does

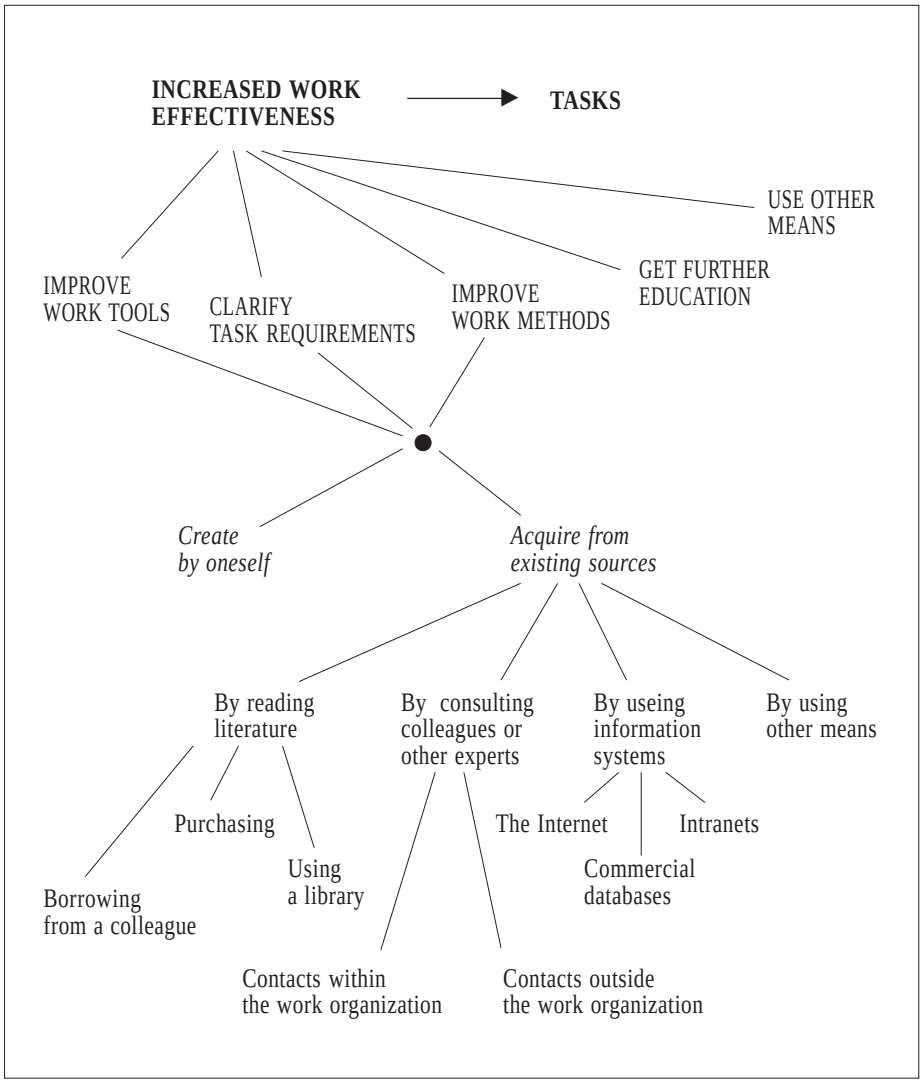


Figure 2.3: Some possibilities to increase work effectiveness (modified after Järvelin, 1981, 26)

not notice to fulfil with her prior knowledge, the self is not considerable as a source. Colleagues, experts and other people involved are examples of (inter)personal sources. Books, newspapers, letters, memoranda and registers are some examples of impersonal sources.

An (information seeking) channel is an intermediary which guides, or is supposed to guide, an individual to a source (Murtonen, 1991; cf. Byström &

Järvelin, 1995). Channels, like sources, may be personal (e.g., colleagues and experts) or impersonal (e.g., newspapers and registers) and, like sources, they also exclude the individual herself. Accordingly, channels are not understood as synonyms to technical communication media (e.g., telephone, video and e-mail).

The distinction between sources and channels is principal: a source contains, or is supposed to contain the information relevant to satisfying the information need, whereas a channel guides, or is supposed to guide an information seeker to the appropriate source. This distinction is pertinent because it distinguishes sources and channels on the basis of their clearly different function in a clearly relevant dimension. (Murtonen, 1991; cf. Byström & Järvelin, 1995).

Although information use or information seeking environments are not directly considered in the present study, their presence is essential in order to complete the framework. Generally, the information use is what each particular person does with the information obtained (Dervin, 1989; Taylor, 1991). In a work context, information is often used to complete a task. An information seeking environment refers to available channels and sources. *The potential information seeking environment* includes all channels and sources in principle available for a person or a certain group of people (cf. information horizons in Sonnenwald, forthcoming). It has two sub-environments. A person's *working organization* constitutes one of them. It provides certain channels and sources for its members as a part of its striving for organizational goals. The other environment is *the habitual information seeking environment*, which refers to those channels and sources that are regularly used by a person or a certain group of people. Even though major parts of task performers' habitual information seeking environments are usually provided by the organization, they may also regularly rely on channels and sources outside the organization in certain situations. Clearly, the shape of a habitual information seeking environment depends upon both individual characteristics (e.g., activities and preferences) and contextual characteristics (e.g., task and norm structures and public opinions).

2.1.5. A conceptual framework: general level

The basic concepts described above form a general framework of the study (Fig. 2.4). The central elements within the work environment are task performers, tasks and situational factors. A number of relationships appears when the elements and information activities (needs, seeking and use) are brought together.

The framework implies two specific processes. The task performance process puts the INSU process into a meaningful and focused context. These processes are based on the perceptions of tasks by their performers. The information needs occurring orientate information seeking in these processes. Information seeking focuses on certain information (seeking) environments (internal and external to the organization). The result of information seeking is applied, and if there is no

mismatch between task requirements and information acquired, the task is completed. These two processes are considered more closely in the next chapter.

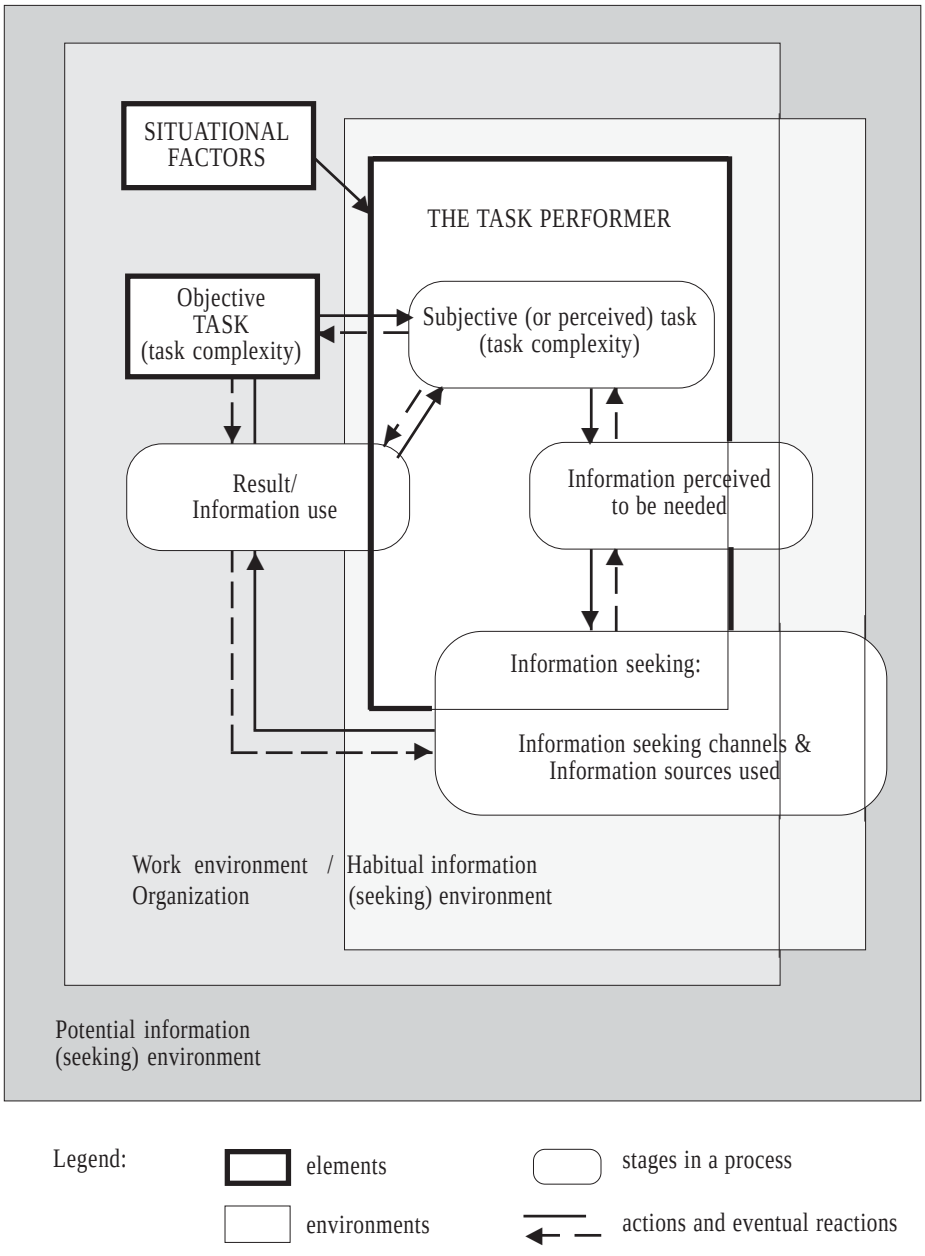


Figure 2.4: General concepts of the present study

Chapter 3

INSU in work tasks of different levels of perceived complexity

3.1. A MODEL OF INSU PROCESSES WITHIN TASK PERFORMANCE

Task performance is a process, a chain of mental and physical actions in pursuit of task completion. Information needs, seeking and use (INSU) are understood as a part of task performance process (e.g., Rouse & Rouse, 1984; Wersig & Windel, 1985, Saunders & Jones, 1990; Dervin, 1992; Solomon, 1997a). Further, the part of the task performance process which includes INSU is also understood as a process, a chain of mental and physical actions linked to information in pursuit of task completion (e.g., Rouse & Rouse, 1984; Wersig & Windel, 1985; Dervin, 1983; Dervin & Dewdney, 1986; Kuhlthau, 1991; Ellis, 1993; Marchionini, 1995).

3.1.1. A task performance process

The framework (Fig. 2.4, p. 34) suggests a task performance process. Task performance may be seen to include three central parts (Fig. 3.1). First, there is an initiation phase of task construction (I). At this phase a task performer creates her own construction of the task. She formulates necessities, defines her goal, sets limits, outlines information requirements etc. She may be attending to a task on her own initiative or due to an assignment (cf. internally vs. externally motivated task in Marchionini, 1995). Either way, if she considers her task construction to be too vague, additional information may be needed to clarify the preconditions. Thus, INSU processes may already take place in the initial phase of task performance.

Task construction is followed by the actual task performance phase (II), where the task performer takes most actions with the direct aim of task completion. The INSU processes are especially characteristic in information intensive tasks. Only one INSU process may be sufficient in cases where the information requirements are well known. In these cases, the task performer is able to determine all relevant

information requirements at the beginning of the process. Logically, more INSU processes are due in cases where information requirements are less familiar. In other words, if the task performer is not able to determine all relevant information requirements at once, they are likely to emerge during the task performance and lead to additional INSU processes.

When the task performer considers she has collected information enough she continues with information processing and possible execution at the task completion phase (III). INSU processes may even occur in this final phase of task performance. For instance, information processing may reveal additional information requirements.

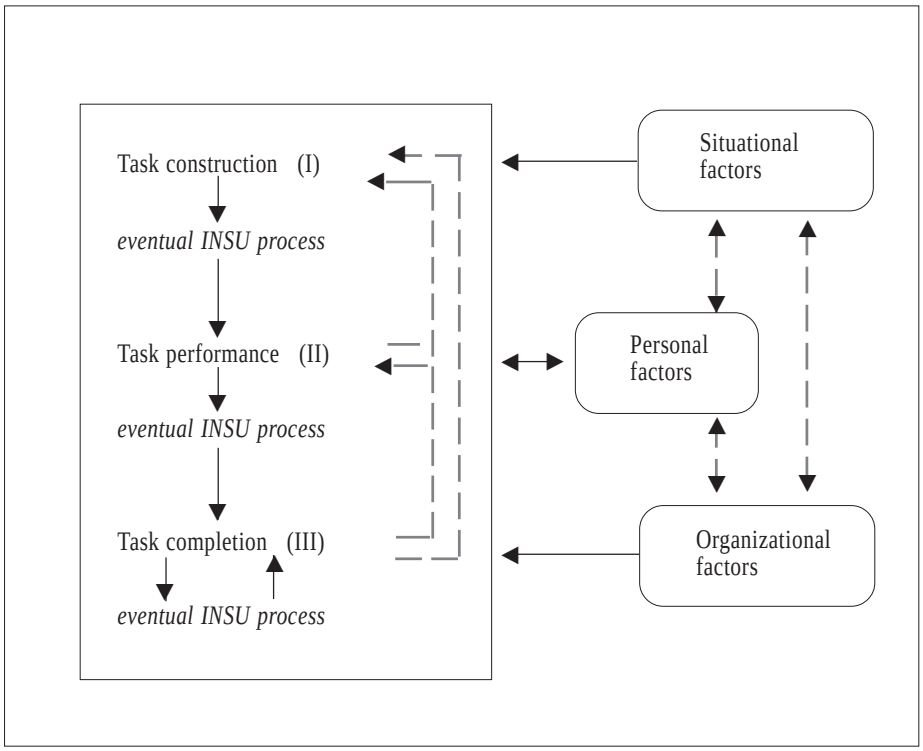


Figure 3.1: A task performance process

Kuhlthau's ISP (information search process) is a sound model of tasks which include an extensive task construction phase. She has specified four stages that are distinctive to task construction. Students[1] who have to write a term paper as an

[1] ISP was originally developed in an educational context, but it has later also been applied in a professional context (e.g., Kuhlthau, 1997).

assignment, begin their task by becoming "aware of a lack of knowledge or understanding" (Kuhlthau, 1993b, 343). At the selection stage, they seek to "identify and select the general area or topic to be investigated or the approach to be pursued" (Kuhlthau, 1993b, 343). Students move on to the exploration stage where they "investigate information on the general problem in order to extend personal understanding" (Kuhlthau, 1993b, 343). Finally, at the stage of formulation students were able to "form a focus from the information encountered" and their "thoughts become more clear and defined as a focussed perspective or point of view on the problem is formed" (Kuhlthau, 1993b, 344). Thus, Kuhlthau's ISP tasks include several INSU processes during task construction. Naturally, not all tasks prompt as extensive task construction phase as Kuhlthau's ISP tasks.

Accordingly, the phase of actual task performance is analogous to Kuhlthau's collection stage where students had "a clearer sense of direction" and they become able to "gather information pertinent to the focussed problem" (Kuhlthau, 1993b, 344). Kuhlthau's final stage of presentation may similarly be compared with the phase of task completion. At this final stage, students were completing their search and preparing their term paper (Kuhlthau, 1993b, 344). Actually, the process that Kuhlthau evaluates and calls ISP (information search process) is a task performance process where several INSU processes take place.

Dervin's sense-making theory is generalisable for a number of different situations (Dervin, 1992). Thus, it is also possible to relate it to the three phases of the task performance process. Aspects of task construction approach the aspects of "facing a gap" where a person is prevented by a gap from proceeding on her path. By construction of the situation and anticipation of desired "helps" or "uses", the person prepares to move on "gap-bridging". Information is acquired and utilised in order to bridge the gap. These actions may be compared with the phase of actual task performance. The "helps" or "uses" gained through the information acquisition and a person's opportunity to continue her path are likewise generally comparable with the phase of task completion.

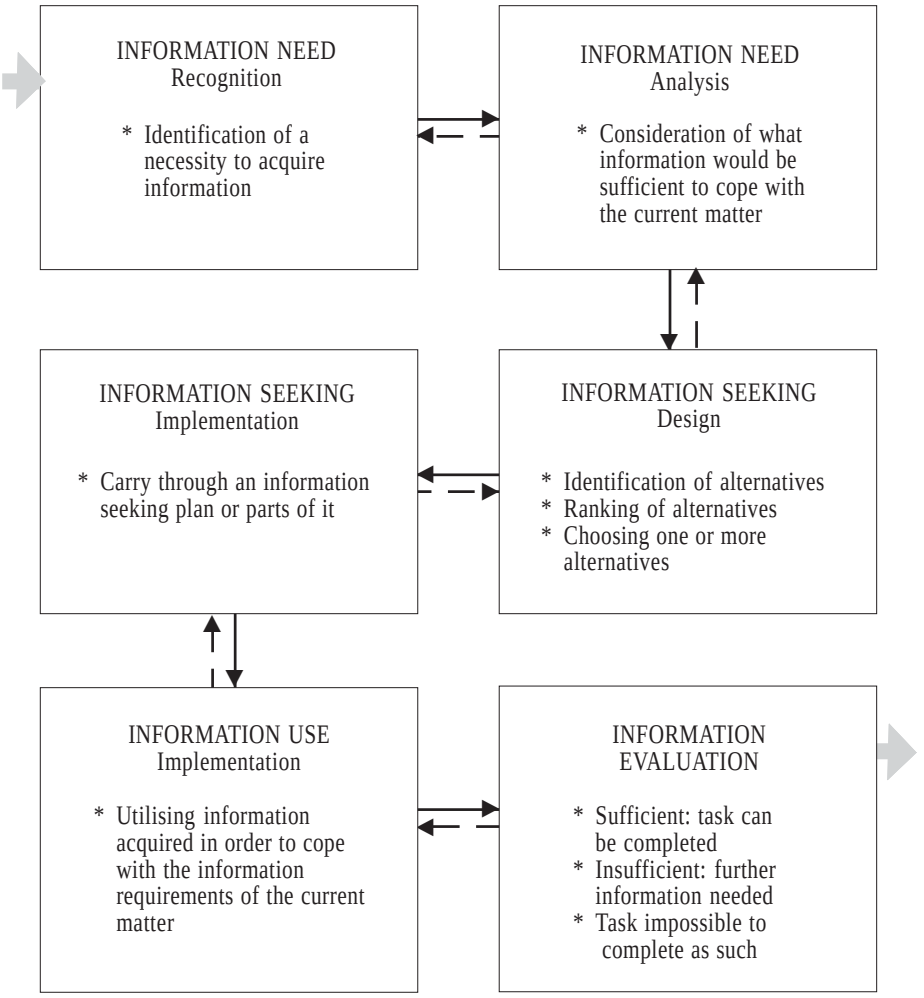
3.1.2. An INSU process

INSU processes take place within task performance processes (Fig. 3.2). An INSU process begins with the recognition of a need for information (1). The task performer realises that the knowledge she possesses at the moment will not allow her to complete the task performance without additional information.

After the recognition of the need for information, the task performer tries to resolve what information is necessary in order to cope with the current matter (2). An information need is formulated, or attempts to do so are made. The information need reflects the anticipated completion of the task (cf. Dervin's helps in Dervin, 1992). Moreover, information need is by nature subjective: it focuses on the

information which the task performer considers adequate for the matter, but which she cannot or does not realize to answer with her prior knowledge (cf. Wersig, 1973). Naturally, the information needs may vary between precisely specifiable and very vague (Belkin, Oddy & Brooks, 1982). But if a person recognises an information need, she most likely will also be able to outline it at some level.

An information need analysis is followed by an information seeking design (3). First, possible channels and sources to satisfy the perceived information need are



Legend: Gray arrows represent the task in which the INSU process occurs, broken arrows represent the possible return/feedback alternative.

Figure 3.2: An INSU process

identified. Second, these channels and sources are ranked. Third, the preferred alternatives are chosen. (Feinman et al., 1976; Mick, Lindsey & Callahan, 1980). Thus, the task performer makes advance relevance judgements of available channels and sources, or rather about information accessible through them, determined in terms of situational relevance, i.e., pertinence, usefulness, or utility (cf. Schamber, 1994; Saracevic, 1996). The advance relevance judgements are based on the experiences, knowledge and beliefs about different sources and channels held by a task performer, or on a personal information seeking style in terms of Feinman et al. (1976) and Mick, Lindsey and Callahan (1980). The task performer then takes the actions to conduct information acquisition (4).

The INSU process continues with an implementation of information acquired (5). At this point the information is applied to cope with the original matter. This is followed by an evaluation of the information (6) in relation to, not primarily the information need experienced, but the original matter to be attended to (Feinman et al., 1976; cf. Dervin's sense-making metaphor). Thus, even though the information gained might satisfy the perceived information need perfectly, the INSU process may still not be over. This could be the case, for example, when the initially perceived information need does not cover all information requirements necessary, or proves to be more or less purposeless for the original matter to be resolved. Depending on how well the information gained corresponds to the requirements of the original matter, the INSU process is either completed for that time or continues at another suitable phase (i.e., information need reanalysis or information seeking redesign).

The specific INSU process described above is mainly based on the work of Feinman and colleagues (1976; Mick, Lindsey & Callahan, 1980), but such models are fairly common. They are utilised especially as frameworks in studies on information retrieval. However, the crucial difference is that information search (or retrieval) processes are often seen as independent processes where answer to the information problem is seen as the ultimate purpose of information seeking. For example, an information-seeking process in electronic environments by Marchionini (1995) does more or less include phases similar to those of the INSU process.

3.1.3. Contextuality and dynamics of the processes

The above descriptions of the task performance process and the INSU process are naturally simplified. The parts are likely to be separable and precisely ordered only in theory. In practice, the task performance and INSU processes are intertwined, contextually bound, dynamic, non-linear and open processes (cf. Dervin, 1992; Saunders & Jones, 1990). The processes are not autonomous actions but are firmly anchored in their context (e.g., environment and overall conditions). Moreover, a large part of them does not involve a conscious consideration each time they occur.

Work tasks themselves are prompted by employing organizations, that is, they are something to be done on behalf of the organization. Thus, there are expectations about how they are performed. For instance, what aspects are emphasised and in what manner (cf. Salancik & Pfeffer, 1978). Moreover, conditions for task performance and INSU processes may vary. For instance, a task performer may have either plenty of time or she may need to hurry.

Furthermore, phases of both processes are likely to proceed in sequences where some sequences may advance more rapidly than others do. For instance, an information need may lead to the consultation of several sources. Some sources are readily available and consultation does not take a long time. Other sources may require more time. Thus, a task performer may move to the implementation of the information that she has acquired from a readily accessible source, while she at the same time remains at the phase of implementation of information seeking with more time consuming sources. The sequences may affect each other. If information gained more rapidly indicates that information from a more time-consuming source is unnecessary, the task performer may just cease pursuing it. The information acquired during the processes may also indicate that the whole or some part of the information need experienced is inappropriate (e.g., erroneous) or inadequate (e.g., biased). This makes the task performer return to the phase of information need analysis, and, as a consequence, some on-going sequences might be cut off, modified or postponed.

To summarise, task performance and INSU processes are likely to be interrupted whenever they are deemed unsuccessful. The task performer may move between phases both back and forward in both processes and she may be engaged in several phases simultaneously. The processes may be interrupted and altered for various reasons.

3.2. A MODEL OF TASK COMPLEXITY, INFORMATION AND INFORMATION SEEKING

The general model for task performance above can be specified to focus on certain characteristics of tasks and INSU. Three particular characteristics are studied in the present study. They are task complexity and two INSU aspects, namely the need for information types and use of sources.

Task complexity is chosen because it is frequently used to differentiate tasks from each other in several areas of research (e.g., information studies, organizational studies and psychological experiments). It has an acknowledged status as one of crucial factors affecting task performance (e.g., March & Simon, 1967; Meister, 1976; Locke et al., 1981; Van de Ven & Ferry, 1980; McDaniel, Schmidt & Hunter, 1988). However, because there is great variation from one study to another in how task complexity is understood and operationalised, precise comparison of results is difficult (Wood, Mento & Locke, 1987; Huber, 1985).

The chosen INSU aspects constitute a meaningful combination where the information type sought is seen to be closely related to the source types used (e.g., Järvelin, 1986; 1987; cf. Byström & Järvelin, 1995; Vakkari & Kuokkanen, 1997). The first aspect, information types needed reflects the reactions of a task performer to task complexity and the second, source use, their realisation in actions. The central characteristics (i.e., task complexity, information types and source types) are explicated conceptually below. Thereafter a number of related statements are considered on the basis of earlier studies.

3.2.1. Task complexity

Fiske and Maddi (1961) defined a task as a piece of work. A difficult task is hard to do. This may be the case if the task is complex. Its completion requires a high cognitive and/or skill level to be accomplished properly. But a task may also be hard to do because it requires a lot of effort. Thus, even a low-complexity task can be difficult if its performance involves a lot of effort. Accordingly, task complexity can be seen as a sub-concept to task difficulty.

Task complexity has generally been approached from two perspectives (Campbell, 1988). First, complexity may be treated as an interaction between the task and the person attending to it, i.e., perceived task complexity. According to this view, task complexity is determined on the basis of the characteristics of both task performer (e.g., education and experience) and task (e.g., analysability). The task performer's knowledge and skills play a major role in determination of task complexity. Second, task complexity may be viewed as a function of objective task characteristics. Contrary to the first perspective, task complexity is determined independently of any particular task performer. Relevant characteristics in determining task complexity are the number of alternative actions, multiple and/or conflicting goals, uncertainty of actions and goals, etc. (Campbell, 1988). These two approaches are compatible with Hackman's view of tasks (1968) that may be considered from subjective and objective viewpoints (see Chapter 2.1.2., p. 24).

Most studies using task complexity or related task characteristics rely on objective conceptions (e.g., Van de Ven & Ferry, 1980; Tiamiyu, 1992; Zeffane & Gul, 1993). This approach stresses that similar tasks will be classified at the same complexity level. Thus, people's actions can be studied and compared on the basis of objective task complexity. For instance, one may ask how experts and novices perform tasks on different levels of (objective) task complexity. This is a typical approach used in psychological experiments. For example, a group of experts and another of novices perform a task. Two other groups of experts and novices perform basically the same task, but some factors are manipulated to make the task more complex (or difficult).

Perceived task complexity is used in some studies (e.g., Culnan, 1983; cf. also Iselin, 1990). Because perceived task complexity is a result of characteristics of both task and task performer, tasks on the same level of objective task complexity may belong to different levels of perceived task complexity. This approach makes it possible to study how people react on different levels of perceived task complexity. For instance, one may ask what similarities and differences there are in the task performance of experts and novices examined on the same level of perceived task complexity. There is naturally a connection between objective and subjective or perceived task complexity (Huber, 1985; Campbell, 1988; cf. Iselin, 1990). Thus, the higher the objective task complexity the higher also the perceived task complexity is.

Both ways to approach task complexity have their strengths and weaknesses. The perceived task complexity provides more situation bound understanding of the effects of task complexity in general, but it is often difficult to determine exactly the various aspects affecting the perceptions. Whereas an objective approach allows exact aspects of task complexity to be considered, it is extremely difficult to apply this view to field studies. Thus, many studies using objective task complexity are actually only partially objective. For instance, a set of questions (including certain aspects and excluding others) are put to participants; and then task complexity – or some other task characteristic – is determined on the basis of the answers by researchers or acknowledged authorities (e.g., Hart & Rice, 1991). Quaid (1993) touches this issue by claiming that job evaluations, in general, are nothing but an institutional myth based on widely held beliefs that cannot be tested objectively.

Complexity has been tied to several factors in the literature. Some common factors are:

- *repetitivity / routine / frequency*
  (e.g., March & Simon, 1967; Fischer, 1979; Hart & Rice, 1991; Tiamiyu, 1992; Zeffane & Gul, 1993)
- *analysability*
  (e.g., Van de Ven & Ferry, 1980; Daft & Macintosh, 1981; Hart & Rice,1991; Zeffane & Gul, 1993)
- *certainty of actions to be taken*
  (e.g., Van de Ven & Ferry, 1980; Daft, Sormunen & Parks, 1988; Tiamiyu, 1992, Campbell, 1988)
- *variety*
  (e.g., Hackman & Oldham, 1975; Tushman, 1978; Van de Ven & Ferry,1980; Daft & Macintosh, 1981; Zeffane & Gul, 1993)
- *number of cognitive and skill demands*
  (e.g., Fiske & Maddi, 1961; MacMullin & Taylor, 1984; Campbell, 1988)
- *multiplicity of possible actions*
  (e.g., Meister, 1976; Terborg & Miller, 1978; Campbell, 1988)

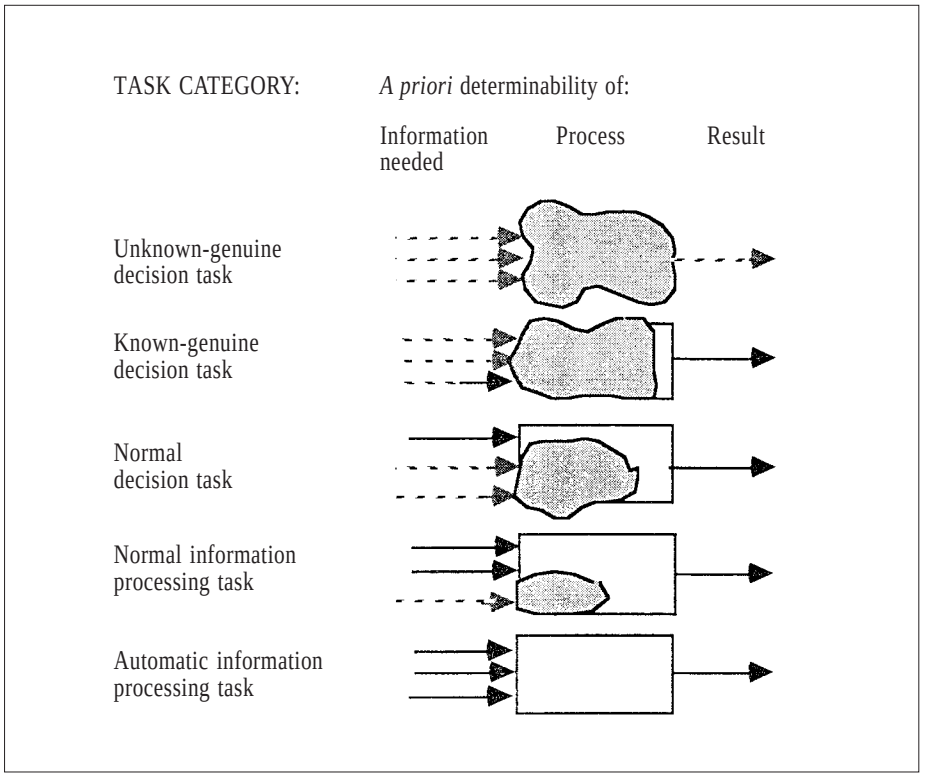
– *multiplicity of goals*
  (e.g., Campbell, 1988)
– *number of inputs*
  (e.g., Meister, 1976; Wood, 1986)
– *changes in tasks during performance*
  (e.g., Meister, 1976; Wood, 1986)
– *activity duration*
  (e.g., Tiamiyu, 1992; Campbell & Gingrich, 1986)
– *outcome novelty*
  (e.g., Tushman, 1978).

These factors can be divided under two headings: *a priori determinability of task* (repetitivity / routine / frequency; analysability; certainty of actions to be taken; variety; changes in tasks during performance; outcome novelty) and *extent of task* (number of cognitive and skill demands; multiplicity of goals; number of inputs; activity duration). (Murtonen, 1991, 1994; cf. Byström & Järvelin, 1995).

To make the concept of task complexity more suitable for analysis a task complexity categorisation is applied (Fig. 3.3). This categorisation is based on the *a priori* determinability of tasks with the focus on inputs, process and outcome of tasks (Tietosysteemin ..., 1974; see also Byström & Järvelin, 1995). This type of view of tasks and their complexity is common in information system design and also in organizational studies (e.g., Wood, 1986; Van de Ven & Ferry, 1980. It has likewise been used in INSU studies (Vakkari, 1998). In the least complex tasks, the type of the task result, the work process through the task, and the types of information can all be described in detail in advance. On the other hand, in the most complex tasks none of these aspects can be determined *a priori*. The more complex the task, the more case-based arbitration it entails. Additionally, the amount of input information varies from task to task. The greater the amount of input information which needs to be processed differently, the more probable it is that the task is less *a priori* determinable (Wood, 1986).

Automatic information processing tasks are *a priori* completely determinable so that, in principle, they could be automated – whether actually automated or not. Example: Computation of a person's net salary yields a real number in some known range and requires the person's gross salary and tax code, and the taxation table. *Normal information processing tasks* are almost completely *a priori* determinable, but they require some case-based arbitration. For instance, the sufficiency of the information normally collected may need to be evaluated. Thus, part of the process and information needed is *a priori* indeterminable. Example: Tax coding is mostly rule-based, but some cases require additional clarification (i.e., case-dependent information collection). (Byström & Järvelin, 1995).

Normal decision tasks are still quite structured, but case-based arbitration plays a major role in them. Example: Hiring an employee or evaluating a student's term



Legend: the *a priori* determinability of information (both input and output) and task processes are represented by solid arrows and solid boxes; the case-based consideration is represented by dashed arrows and shaded-in boxes

Figure 3.3: The task categorisation (adapted from Tietosysteemin ..., 1974)

paper. In *known, genuine decision tasks* the type and structure of the result are *a priori* known, but permanent procedures for performing the task have not yet emerged. Thus, the process is largely *a priori* indeterminable and so are its information requirements. Example: Deciding the location of a new factory or conducting medium-range planning in organizations. *Unknown, genuine decision tasks* are unexpected, new, and unstructured. Thus, neither the result, the process, nor the information requirements can be described in advance. The first concern is structuration of the task at this level. Example: An entrepreneur facing the information technology related Year 2000 problem. (Byström & Järvelin, 1995).

The above task categorisation covers all information intensive tasks from the simplest ones to the most complex tasks. It is general in nature and thus applicable

in various contexts. It can be used regardless of which perspective, objective or perceived, is used to determine task complexity. When perceived task complexity is employed, task categories are relative to the qualities of both performer and task: what is a known, genuine decision task to a novice may be a normal decision task or an even simpler task for an expert.

3.2.2. Types of information

In the present study information is seen in the role of an abstract tool which enables, or is initiated to enable, the task completion. Information need is considered as a necessity or desire to acquire that tool in order to complete the task. Thus, both information and the need for it are viewed from the task performer's perspective. In accordance with this functional view on information, it can be categorised into (Järvelin & Repo, 1983, 1984; Järvelin 1986, 1987; cf. Barr & Feigenbaum, 1981):

– *problem information*
– *domain information*
– *problem-solving information.*

These categories emphasise the problematic nature of situations mainly in scientific and technical contexts. Their contents are construed below to adapt to everyday work duties which are more often perceived as routine than problematic for their performers (Byström, 1997). Thus, the concept "problem" is replaced by the more neutral concept "task". Naturally, a task may be problematic but it is not a qualification of task.

Task information (previously called problem information) covers the case-specific aspects of a task. This information type is seen to comprise mainly answers to the information requirements that are related only to the particular task. This information is often in factual form (although not necessarily facts), i.e., names, addresses, courses of events, circumstances, places, numbers, etc. For example, in a journalistic setting, facts about a traffic accident are typical task information (Byström, 1996).

This view differs somewhat from the original definition of problem information that seems to lay more stress upon the description of the problem itself, that is, the structure and requirements of the task (cf. Järvelin, 1986, 1987; cf. Järvelin & Repo, 1984). The present definition emphasises information that *answers* the task-specific questions, and does not guide either the formulation of the questions themselves or the consideration of their relevance for the task.

Gorman (1995) created a comparable information type classification for medical setting. He defined five information types used by clinicians. Patient information refers to information about a specific patient (e.g., items of a patient's medical

history, observations from physical examinations and results of diagnostic testing). This is typical task information.

Domain information consists of subject-general aspects of a task. This information satisfies information requirements that are common to several tasks of the same kind. "Known facts, concept, laws, and theories" belong to the area of domain information (Byström & Järvelin, 1995, 195). It may be in the form of facts as well as interpretations. For example, in a journalistic setting, information about general reasons for traffic accidents and a point of law in traffic accidents come under domain information (Byström, 1996).

In a medical setting, population statistics refers to aggregated data about groups or populations of patients (e.g., informal epidemiological information about recent illness patterns in the community and formal rates of communicable diseases in a region) (Gorman, 1995). This information type together with a part of medical knowledge is typical domain information. Medical knowledge refers to information that is generalisable to the care of all patients (Gorman, 1995). The part of medical knowledge, which considers the descriptions of disease pathophysiology, is domain information, whereas descriptions of diagnosis and treatments fall into the area of task-solving information.

Task-solving information (previously called problem-solving information) covers the aspects of task treatment. It describes how tasks should be seen and formulated (i.e., the descriptions of the structure and requirements of tasks are considered as task-solving information, not as task information). It also describes what task and domain information should be used (and how) in order to complete the task, that is, it is instructional information (Byström & Järvelin, 1995). Thus, this information helps task performers to cope with their tasks by guiding actions to be taken. Like domain information, task-solving information is useful in several tasks, and it can be in the form of facts and interpretations. For example, in a journalistic setting, task-solving information concerns journalistic procedures: how to structure a news article or feature story on a traffic accident, and how to investigate it (e.g., who ought to be interviewed, what type of pictures are appropriate, etc.) (Byström, 1996).

The two remaining information types of Gorman (1995) fall into the class of task-solving information together with a part of medical knowledge (descriptions of diagnosis and treatment). Logistic information refers to "local knowledge about how to get the job done" (e.g., information specific to a practice setting and payment mechanism) (Gorman, 1995, p. 731). Social information refers to knowledge expectations and beliefs held by members of the community (e.g., peers, patients and local authorities).

These information types represent three different dimensions. They have different roles in task performance, which means that they are all, in principle, needed in every single task performance. However, the degree to which a certain information type is *needed to acquire* (referred to later in the text as information types needed) for performing a specific task depends upon the qualities of a task performer (e.g., level

of expertise). (Järvelin, 1986, 1987; cf. Wersig & Windel, 1985). Additionally, these degrees are likely also to depend on time and context for each specific task performance (cf. Solomon, 1997b, 1997c). Different contexts may lead to the emphasis of different information types (e.g., learning task vs. work task, or information rich vs. information poor environment). Similarly, changes within the contents of different information types may also have effects (i.e., time in macro scale). Furthermore, different information types may be emphasised at the different phases of task performance (i.e., time in micro scale).

3.2.3. Types of information sources

In the present study, sources are seen as bearers of information sought. Source use refers to an attempt to get hold of information believed to be carried by the source. Thus, source use does not indicate that the information sought is actually obtained from the source consulted nor the actual use of the information gained. Neither does it indicate the amount of effort required by a particular source. A division of sources into human and documentary sources is a starting point to consider sources. This division can be taken further to make it more specific (see for example: Byström, 1996; O'Reilly, 1982; Keegan, 1974; Culnan, 1983; Tiamiyu, 1992). These more specific subdivisions are usually tailored for the purposes of individual studies.

Two common dimensions to characterise sources are (1) the role in which the source is consulted and (2) its location. For instance, Tiamiyu (1992) classified human sources further to persons into state government ministries, in academic and research institutions, and in private sector organizations. Thus, his criterion was the location of personal sources. Murtonen[2] (Studies I and III) used two sub-categories of personal sources in a local government setting: experts and people concerned. Her criterion was based on roles. She further divided the sources used into internal and external to the work organization. She added several other types of personal sources in a journalistic setting: officials and authorities of various kinds, representatives of organizations as well as colleagues were separated from experts and person concerned (Study II).

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[2] The present author (formerly Murtonen) has previously studied the problem area in three academic theses (Murtonen, 1991, 1992, 1994). The first study (Murtonen, 1991), referred later in the text as *Study I*, is a thesis for a Master's degree. The effects of task complexity on information activities were studied on the basis of a sample of 25 tasks in a local governmental setting. The second study, referred later as *Study II*, is a thesis in a subsidiary subject, and it considered the effect of task complexity on information activities in a (newspaper) journalistic setting (a sample of 84 tasks). The third study, referred later as *Study III*, is a thesis for a Licentiate degree, and the findings of Study I are refined in it. These reports are in Finnish. An article by Byström & Järvelin (1995) comprises a part of the findings from Studies I and III (cf. Murtonen and Järvelin, 1992, in Research Notes, University of Tampere, Dept. of Information Studies, RN-1992-2).

The empirical part of the present study also involves a local government setting. Thus, a similar classification of sources is applied as in Studies I and III. An additional type of personal source is considered. Meetings are seen as a specific source type insufficiently described if reduced to people concerned and experts (cf. Solomon, 1997b). Meetings often serve as sources for several participants. Additionally, some persons attending a meeting would not be otherwise consulted at all.

3.2.4. Relationships between the main characteristics of the model

The general idea of a model about work task related information activities affected by task complexity was first formulated by Järvelin (1986; 1987) and it was further developed and empirically tested by the present author (Studies I–III; cf. Byström & Järvelin, 1995; Byström, 1996, 1997). In these studies, a model of an information seeking process by Feinman and his colleagues (1976; cf. Mick, Lindsey & Callahan, 1980) and two classifications introduced into information studies by Järvelin (1986, 1987; cf. Järvelin & Repo, 1984) were combined. These classifications were a task complexity categorisation and an information types classification both of which originate from the information system design literature (e.g., Barr & Feigenbaum, 1981; Tietosysteemin ..., 1974). The relationships between these characteristics have clearly been insufficiently recognised in INSU research (Byström & Järvelin, 1995; Vakkari & Kuokkanen, 1997).

Task complexity, need for information types and source use have been combined with some individual (education, experience and ambition) and situational (time restrictions) characteristics. As a result several relationships have been recognised and studied (Fig. 3.4). For instance, task complexity was found to affect information needs and further information seeking; ambition levels seemed to be linked to task complexity; experience affected which information types were required; lack of time led to utilisation of certain source types; the type of organization affected the externality of sources etc. (Studies I–III). A more elaborate attempt to formulate a theory was offered by Vakkari and Kuokkanen (1997) on the basis of Byström and Järvelin (1995) and it resulted a number of hypotheses.

The following statements are relevant for the present study. Although they are mostly based on Studies I–III with no measurement of statistical significance, they are also supported by quantitative studies (e.g., Culnan, 1983; Tiamiyu, 1992; Zeffane & Gul, 1993; Pinelli et al., 1993). The statements serve as a point of departure for the present study. The purpose is to elaborate them, rather than to test them as hypotheses.

The higher the task complexity, the more information types are needed during a task performance (Järvelin, 1986, 1987; Studies I–III). According to the results of a preliminary study of municipal officials (Studies I and III), only one information

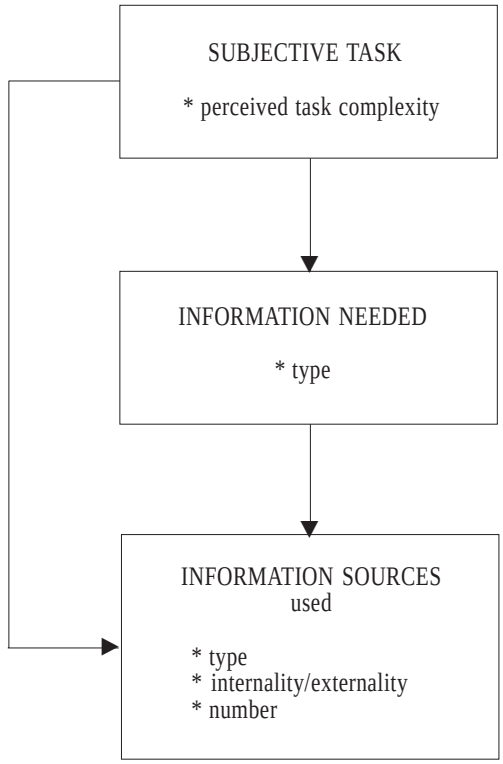


Figure 3.4: A model of the relationships among the study characteristics

type (task information) was sufficient in the low levels of task complexity. Two information types (task and domain information) became necessary in the medium level of task complexity. Finally, all three information types (task, domain and task-solving information) were needed in the high level of complexity. Similarly, the need to acquire several information types increased with the task complexity of journalistic tasks, despite the fact that no need to acquire task-solving information was recognised (Study II).

Increasing task complexity leads to increasing consideration and utilisation of sources (Studies I–III; Tiamiyu, 1992; Culnan, 1983). Journalists utilised more sources as task complexity increased, although the increase was rather moderate (Study II). A similar trend emerged in a local government setting in another preliminary study (Studies I and III), in addition to the fact that the number of sources considered also increased with task complexity. Culnan (1983) found that the use of nearly all source types, including the less accessible sources, increased with task complexity. Similarly, Tiamiyu (1992) found a clear connection between

job complexity and source use. However, there are also contradicting findings. According to Daft and Macintosh (1981) more complex tasks seemed to involve less information processing, indicating a use of fewer sources than in less complex tasks. Zeffane and Gul (1993) examined this contradiction. Increasing variety of tasks (i.e., an aspect of job complexity) resulted in an increase of information processing in jobs of an administrative and technical nature. However, the information processing of managers and engineers remained indifferent in relation to the task variety. They concluded that the nature of the job is more closely related to the amount of information processing than task variety. (Zeffane & Gul, 1993, 713).

The higher the task complexity, the more popular general-purpose sources are (Studies I–III; cf. Tiamiyu, 1992). Both journalists and municipal officials utilised general-purpose sources more frequently than fact or task-oriented sources as task complexity increased (Studies I–III). The use of experts in particular, which are typical general-purpose sources, was affected by task complexity. For instance, the share of personal sources remained nearly unchanged throughout all task complexity categories in the journalistic setting, but the share of experts increased at the expense of other, more task-oriented personal sources when task complexity increased (Study II). In the local governmental setting, the use of experts outstripped official documents, which are typical task-oriented sources, when task complexity increased (Studies I and III). Tiamiyu (1992) arrived at a similar conclusion: government officials doing complex work used general-purpose sources (e.g., consultancy reports) frequently, whereas their colleagues with less complex work were mainly using fact and task-oriented sources (i.e., internal files). According to Katz and Tushman (1979: as in Grosser 1991, 371), complex tasks required widespread face-to-face contacts inside and outside the organization, whereas formal hierarchy was more relied on in more routine tasks (cf. Daft & Lengel, 1986; Trevino, Daft & Lengel, 1990; Webster & Trevino, 1995). On the contrary, formal information seeking channels have been found to gain value as technical uncertainty and/or complexity increases (Pinelli et al., 1993).

The relationship between the acquisition of information types and source use was studied in the journalistic setting (Study III; Byström, 1996). There were some distinctions between tasks where task information was sufficient for task completion and tasks where both task and domain information were acquired. For instance, journalists used more sources in cases where the two information types had to be acquired than in cases needing only task information. Similarly, journalists acquired information not only from several sources, but also from multiple locations[3] in tasks where both information types were required. The number of these locations did not alter notably in relation to task complexity categories. In addition, journalists

[3] Some sources could be reached from the same location (e.g., press conferences, trade fairs, exhibitions, and sports events attended by several of the people concerned and/or experts that the journalist consults).

normally evaluated the sources used as "the information sought was obtained wholly and it was well-applicable" in tasks where only task information was acquired. In tasks where both information types were required, the most used evaluation was "the information sought was obtained partially and it was well-applicable". However, there was no specific relation between these evaluations and task complexity.

Additionally, some other relationships were revealed. *If lack of time is perceived, the share of task-oriented sources tends to increase and/or the number of sources used tends to decrease*. Journalists avoided the use of general-purpose sources (i.e., experts and archive articles) and instead favoured task-oriented sources (i.e., people concerned), when they worked in a hurry (Study II). On the other hand, municipal officials cut down the number of sources used (Studies I and III; cf. Vakkari & Kuokkanen, 1997). *Level of ambition seemed to increase with task complexity in the journalistic setting* (Study II), but this relationship remained indifferent in the preliminary study of municipal officials (Studies I and III).

A number of other relationships have been studied between task complexity and information activities, but no consistent results have emerged. One of them is between task complexity and *the internality of source use*. It has received a lot of attention, but the results have been contradictory (e.g., Culnan, 1983; Tiamiyu, 1992; Fischer, 1979; Tushman, 1978; Katz & Tushman, 1979; Daft, Sormunen & Parks, 1988; Höglund & Persson, 1980). It is commonly assumed that external sources are more used in complex tasks than in simple ones. The source use by municipal officials is mainly internal (Studies I and III; Tiamiyu, 1992; Wilson, 1988), but after being high in routine tasks, there were seemingly no further connection to increasing task complexity (Studies I and III). Source use of journalists concentrated as heavily on external sources as municipal officials' on internal sources (Study II; Ginman, 1983), but no relationship to task complexity emerged (Study II).

At the level of individual jobs, Tiamiyu (1992) was able to state that government officials with complex duties used more external sources than their colleagues with less complex duties. Fischer (1979) found that R&D managers generally emphasised internal sources over external ones, but that external sources were relatively more important in non-routine problem solving. He suggests that less normal communication contacts and especially the contacts with holders of external information (e.g., vendors and government agencies, i.e., people concerned and experts) ought to be actively established in non-routine research tasks. By contrast, Tushman's (1978) results indicate that intraproject communication was more important in the most complex projects, whereas communication with other members (outside the project) of the organization was common in the least complex projects. Communication outside the organization seemed to be independent of project complexity and in general scarce. More recently, Pinelli et al. (1993) found that use of external sources increased along with technical uncertainty and/or complexity in an R&D setting.

In sum, the research on the effects of task complexity on INSU indicates the existence of a relationship, but the findings are rather obscure on the whole. Thus, task complexity based INSU research is still largely an open research area. This makes further research on the basic relationships between task complexity, information types and sources both necessary and interesting.

Chapter 4

The research problem and the research setting

4.1. DEFINITION OF THE RESEARCH PROBLEM

The research problem is to study *the relationships between perceived task complexity, information types needed and source use*. It is presumed that task complexity evokes a need to acquire certain types of information that again lead to the use of certain types of sources (Järvelin, 1986; 1987; Studies I–III; cf. Vakkari & Kuokkanen, 1997). In addition to this general assumption, it is considered whether task complexity directly affects source use. The research problem is considered on a basis of individual tasks in a Finnish local government setting.

The study is naturalistic in the sense that it was conducted in a real-life work setting where the participants in the study were performing their ordinary work tasks. The research problem focuses on a narrow phenomenon in a wider context. Relating the research problem to its actual context enhances a better understanding of the findings.

4.1.1. Need for information types and use of information sources

In order to consider the main research problem stated above, a crucial relationship between information needed and source use is examined. The specific research question is: what types of sources are consulted for acquiring different types of information? This relationship has received surprisingly little attention in studies about information activities. The relationship is considered on the basis of Järvelin's hypotheses (1986, 1987; cf. Byström & Järvelin, 1995). *Problem – or task – information* is typically available in the problem environment but in the case of old problems it may also be available in documents. Gorman (1995) gives a practical example within medicine: patient data are usually obtained from a patient himself, his family and friends as well as from medical records. *Domain information* – considered in scientific or in technical contexts (i.e., tested scientific and technical

information) – is typically published in articles in journals and in textbooks. Again, Gorman (1995) provides a good example within medicine: population statistics and medical knowledge are available in journals and textbooks, besides memory, consultants and colleagues. Finally, instructional *problem (or task)-solving information* is typically available from knowledgeable persons. According to Gorman (1995) relevant information for clinicians about how to get the job done is available from colleagues and manuals.

Accordingly, the more types of information are needed, the more and various types of sources ought to be utilised (cf. Vakkari & Kuokkanen, 1997). Another aspect to consider is related to the location of sources. The findings of Studies I–III imply a slight increase in the use of external sources in accordance with the information types acquisition (cf. Järvelin, 1987; Vakkari & Kuokkanen, 1997).

4.1.2. Task complexity, need for information types and use of information sources

In the present study, the effects of task complexity on the basic relationship between information types need and source use is analysed. First, task complexity is expected to affect the need for information types (cf. Studies I–III; Byström & Järvelin, 1995; MacMullin & Taylor, 1984; Järvelin, 1986, 1987). Second, whereas task complexity is mainly expected to affect source use through the need for different information types (Studies I–III; Byström & Järvelin, 1995; cf. also Vakkari & Kuokkanen, 1997; Vakkari, 1998), an eventual direct relationship between task complexity and source use is also examined.

The first relevant relationship is between task complexity and the need for information types during a task performance process. The specific research question is: how task complexity is related to the information types needed? It is assumed that more types of information are needed in more complex tasks than in less complex tasks. Another question to examine is: whether the type of information that is anticipated at the beginning of task performance differs from the acquisition of information types during task performance?

Another relevant relationship is between task complexity and source use. The question is: what types of sources (type and internality) are consulted for the acquisition of similar information types on different levels of task complexity? This question is unusual compared with other studies concerning task complexity and information activities (e.g., Culnan, 1983; Tiamiyu, 1992). The goal is not to simply to relate source use to different levels of task complexity, but to specify the eventual effects of task complexity on the basic relationship between information types needed and source use.

In the light of the preliminary findings (e.g., Studies I–III; Byström & Järvelin, 1995; Tiamiyu, 1992; Culnan, 1983; Pinelli et al., 1993; Blythe & Royle, 1993) several assumptions are recognised considering the relationships between task

complexity, information types needed and source use. First, general-purpose sources are expected to become increasingly utilised as task complexity increases. This implies a decrease of the share of task and fact-oriented sources as task complexity increases. This relationship is considered in the present study, too. Another relevant question is: whether their absolute number will alter, that is, does the number of task and fact-oriented sources used per task diminish as task complexity increases? Second, it is often assumed that the increase of task complexity leads to increasing use of external sources. As above, this means a decreased share of internal sources but their absolute numbers might still remain unchanged. Third, the number of sources used is expected to increase with task complexity.

The relationships are then considered together in order to see whether task complexity affects source use only through the information types needed, or if it has some direct effects. Previous studies considering task complexity and source use have mainly emphasised a direct relationship between them (Vakkari, 1998). However, earlier studies by the present author lead to the assumption that task complexity mainly affects the source use by altering the need to acquire different information types (Studies I–III; Vakkari & Kuokkanen, 1997; Vakkari 1998). The ultimate aim of the present study is to construct a model of the relationships between task complexity, information types and sources on the basis of the findings from the preliminary studies as well as from the present one.

To summarise, the following research questions are considered in the present study (Fig. 4.1):

1. *Information types and information sources*

    1a. What types of sources (internal / external; fact-oriented / task-oriented / general-purpose; people in different roles / different documentary sources / visits) are consulted to acquire particular types of information (task information / domain information / task-solving information) in the studied research setting (Finnish local governments)?
        1a.1. What are the typical sources of task information?
        1a.2. What are the typical sources of domain information?
        1a.3. What are the typical sources of task-solving information?
    1b. Does the number of sources used and their variety increase when several types of information are needed?
    1c. Does the use of external sources increase when several types of information are needed?

2. *Task complexity and information types*

    2a. Does task complexity (i.e., automatic and normal information processing tasks, normal, known-genuine and unknown-genuine decision tasks) affect the need for information types and, if so, how

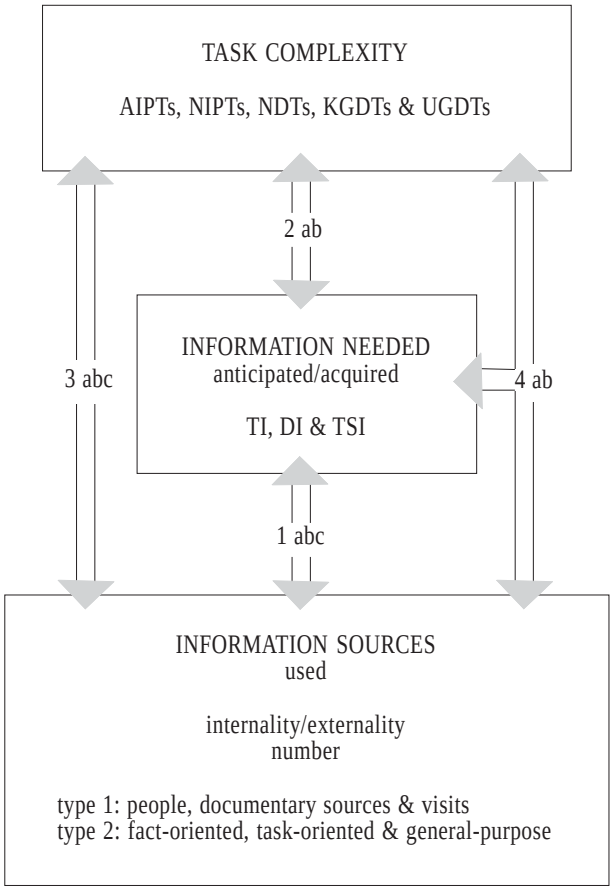


Figure 4.1: The research problem: task complexity, information types and information sources

2b. Does the types of information that are anticipated at the beginning of task performance differ from the types of information actually acquired during the task performance on different levels of task complexity and, if so, how?

3. *Task complexity and information sources*

3a. Does increasing task complexity affect the use of sources for particular types of information and, if so, how?
  3a.1. Does the types of sources used change and, if so, how?
  3a.2. Does the use of external sources increase?
3b. Does source use increase with increasing task complexity?
3c. Does external source use increase with increasing task complexity?

4. *Task complexity, information types and information sources*

   4a. Does task complexity affect source use mainly through different information types?
   4b. If task complexity seems to have direct effects on the source use, what are they?

4.2. STUDY SETTING: LOCAL GOVERNMENTS IN FINLAND

The study was conducted in two Finnish local governmental organizations (the Cities of Tampere and Pori). The primary study setting is a large local government on a Finnish scale: Tampere is the third largest city in Finland (approx. 200 000 inhabitants) whereas Pori is clearly a smaller town (approx. 80 000 inhabitants). Finnish local governments are traditionally seen as introverted bureaucracies with a long history and slowly changing procedures. Their public image is ambiguous: it is not particularly positive although not directly negative.

The main purpose of the local governments is to promote the welfare of the local inhabitants (Fig. 4.2). As public organizations they have a traditional formal organization structure. Both the protection and rule of law as well as the requirements to guarantee democratic decision-making set the standards for them. The Finnish local governments function on three levels: operational, administrative and political levels. The operational level attends to basic functions of local government (e.g., different services provided to local inhabitants). The administrative level plans, develops, organises and manages the functions of local government. In other words, it guides and maintains the actions of the operative level. The political level (town council, municipal government, municipal boards and other positions of trust) works in order to create the prerequisite for and to lay down the general outlines for the functions of the two other levels. Furthermore, the officials (elected directly by the town inhabitants) possess the supreme authority in local governments, whereas employed officials are responsible for the preparations for decision-making and their execution. (Kuinka kunta toimii, 1988, 47–48).

During recent years, both local governments in the study have gone through both physical and structural organizational changes. For instance, the executive power has been delegated to the lower levels in the formal hierarchy. As an example of physical changes, old manual registry systems have been replaced with full-scale electronic document handling systems. Cultural changes have also taken place. For instance, instead of subjects, residents are referred to as customers, work is viewed in terms of quality, and bureaucracy often frustrates not only the inhabitants but also the municipal administrators. Despite all the changes, the local governments are still bound to a number of detailed regulations and rules that direct task performances of

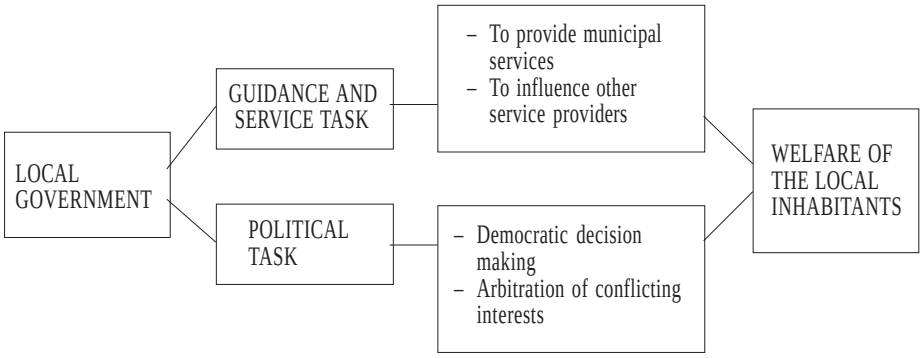


Figure 4.2: The fundamental tasks and goal of local government (adopted from Kuinka kunta toimii, 1988, 12)

municipal administrators. Accordingly, the formal documents continue to be extremely important for local governments.

The participants in the study were municipal administrators whose duty was to prepare matters for the decision-making organs (i.e., a town council, a town board, or individual municipal officials with executive power). Thus, the participants have a central role in the decision-making. The purpose of the preparatory work is to lay foundations for the actual decision-making. In practice, these officials act as filters who collect and construct the essential information about the matter in hand.

The basic research data consist of tasks that were a part of the actual work duties of the participating municipal administrators. These tasks were related to matters addressed to local government by inhabitants of the district (either as private persons or as representatives of different local communities). The tasks dealt with various matters from temporary traffic arrangements to questions about protection of animals and attending to damaged landscapes.

This study focused on the part of the local governmental handling of these matters that involved their preparation for decision-making. Thus, a task was considered to begin at the moment when it arrived in the hands of the proper municipal official and it was considered to be completed when it was ready for decision-making. The preparations included considerations of different aspects of the matter (e.g., factual, legal etc.) and its possible connections to other matters, and they usually concluded with the formulation of a resolution draft to put forward. In principle, all official documents (including the resolution drafts) are public, but only after a decision in a matter has been reached. Both organizations have distributed their official agendas and minutes of town government and town council for a public use via the Internet during the past few years.

The organizations and work practices within them were considered in some participants' own words as follows:

> "It is, of course, a value in itself, the security of administration, and that the people are feeling that they are treated in the same way as the next person. ... The positive aspect is the legal rights. On the other hand, the negative aspect is that things change, they develop, and they need to be able to be altered. ... And thus, an old Chinese saying 'don't be afraid of slow progress but beware of standing still' is fairly relevant." (T48)

Several participants felt that their work organization as well as the work practices were changing. These changes were considered to be slow, especially in comparison with the private sector. However, there were aspects, like the legal rights of the inhabitants, that were considered legitimate reasons for stable practices. Simultaneously, the changes were considered necessary in order to serve the inhabitants correctly:

> "Well, we are here for the local inhabitants, and we had already got feedback from them that everything is not in order. ... It was all the time necessary to keep in mind that service ability and capacity for functioning have to remain. After all, it is not only the townscape and landscape that are the main aspects." (T62)

> " I wouldn't say that any matters are that simple ... matters like answering questions, inquiries ... They too have their problems. For instance, you might be aware of some situation and you answer accordingly. And then the situation might change, and in a way you have to go back on your word. You maybe have promised something that is no longer possible. This has caused quite a lot of trouble for me, since I like to give a good service to persons proposing motions, and that their goals would also be reached. You always try first to figure out how it could be pursued, but sometimes it happens that a snag comes up. ... Well, quite often we get concrete requests ... and we are fairly flexible if it's not a question of extra expense or big changes. This type of service can be very spontaneous, but sometimes the problem is that our way of thinking is so fixed that we don't necessarily notice all the options. ... When this kind of contributory acting becomes more common, and I hope that it will, it might be a problem to fit it into the necessary requirements and norms considering economy, safety and other issues..." (T63)

Not all responsibility of reducing bureaucracy was considered to be only a matter of local administration and municipal administrators. Some changes were also hoped for among the local inhabitants:

"[The local administration] has become, and is still becoming, much more open ... and there is not that much secrecy involved any more. I think that we should also inform the public about matters under preparation when they are significant and when they affect several people. That is, of course, a matter of interpretation. ... One other thing came to my mind, I might be wrong, but it seems that the local inhabitants could have a clearer picture of the town's line of action, future works, what is up, and what is planned and considered. ... it might be that some hastily initiated matters are not put forth at all, and that would save resources." (T63)

Information flows inside the organizations and the interdependency of decision-making were other present issues:

"Tampere is a town that is small enough for us to be able to acquire the internal statements quite fast. It also makes it easy, for instance compared with Helsinki [the capital city of Finland], to just go over and have a talk with a town planning officer. We can ask a statement by a certain date. Same goes with other relevant departments." (T48)

"Fairly often the motions ... involve several administrative departments. For instance, a condominium wishes some faults in their environment to be attended to. They might include aspects considering several other administrative departments. Then it is necessary to acquire their opinions, too. It is rather indifferent what my personal opinion is, but the matter is not going to advance, if the others don't do their part." (T65)

"... the amount of information is continuously increasing and so are the ways of storing it. This leads us to consider what kind of information we want to maintain. I think it is still largely an unfinished issue. In other words, how wide information content is continuously maintained. ... This is related to its heaviness. And in the public sector, as well as in private businesses the problem is often that maintenance of information storage is not functioning. It is too heavy, and it is constantly necessary to lighten it. Some parts are outdated, and the bad thing is that they tend to hang on. ... [The document handling system] is especially good in big cases. On the other hand, we have a lot of small matters, and we have to consider if they are worth registration at all. For instance, hiring out a sausage stand for two hours in a market square. Is it really necessary to put it through the whole system? These are both administrative and economic issues. I also think that aspects of publicity as well as legal rights are relevant. Is it necessary today to document a matter that does not hurt anybody, does not involve anyone but the parties involved, and where agreement is reached? I think that this kind of matter does not an necessarily require an awful lot of documentation." (T48)

Altogether, the participants seemed to be fairly well aware of the time of changes in their work organization. Interestingly, it was not so much the information technology *per se* that was in the focus of municipal administrators participating in the present study as the principles and impact of the decisions regarding this technology.

4.3. LIMITATIONS OF THE STUDY

The research problem is studied as a case. It concentrates on certain kinds of tasks performed by certain types of professionals in two similar kinds of organizations in Finland. Thus, the results are not generalisable to all kinds of tasks. Of course, there are believed to be common features, but identifying them requires a number of comparable studies.

The research problem concentrates on information that is acquired in order to complete a task in hand. Thus, the focus is on a very practical type of information need which excludes unrecognised or not pursued as well as non-task related information needs from the scope of the study (cf. Gorman, 1995; Feinman et al., 1976; Wilson, 1981; Wersig, 1973). As a consequence, only those sources that are used to cope with task-related information needs are examined in this study.

The study focuses on task complexity as a modifier of information activities. It is more exactly task complexity as perceived in terms of *a priori* determinability by task performers. There are several other dimensions connected to task complexity in the literature on various subject areas (cf. Chapter 3., p. 42). *A priori* determinability has been chosen as a single uni-dimensional aspect of task complexity that is understood to cover several related aspects, such as novelty and uncertainty. Some aspects (e.g., task duration, task ambition as well as task performers' expertise and experience) and their effects on the information activities studied were also analysed. However, these examinations as such are not in the central focus of the present study.

The actual utilisation of acquired information is also outside the scope of the present study. Although clearly an interesting aspect of the information activities, and probably also connected to task complexity, it was considered as another separable information activity. It is a separable part in the sense that it constitutes a comprehensive phenomenon of its own whose examination requires specific methodological tools. This is by no means impossible to combine with the focus of the present study, but this study does not aim to meet this challenge.

Chapter 5

The process-analysis method

Especially since the late 1970's some successful attempts at creating alternative research methods for examining information activities have been made (e.g., Wilson & Streatfield, 1981a, 1981b; Dervin & Dewdney, 1986; Dervin, 1992; Sonnenwald, 1995; Barry, 1997). A somewhat more general shift in perspective from systems towards individuals took place in empirical studies during the late 1980's and the early 1990's (Wilson, 1994). Later in the 1990's the shift readjusted towards individuals in certain environments rather than just individuals as such (Vakkari, 1997; e.g., Taylor, 1991).

A method that permits the use of both qualitative and quantitative techniques is used in this study. It utilises both qualitative, for instance diary keeping (unstructured items), theme interview and observation, and quantitative, for instance diary keeping (structured items) and (email-) questionnaire, research techniques. The different research data are brought together by a process-analysis method that first takes the phenomenon studied to pieces and then reconstructs it by explicating the relationships between different parts.

The research method builds on its applications in earlier studies by the present author in journalistic and local-governmental settings (Studies I–III). The method has also been used to study the information seeking activities of district nurses (see Sundin, 1997). It has been found to serve well in these settings. It is especially designed to study information needs and information seeking in connection with individual tasks in a real-life work environment.

5.1. DATA COLLECTION: TECHNIQUES AND SCHEDULE

5.1.1. The pilot study

The data collection began with a pilot study in the City Office of Pori in August 1995. This material is included in the research material. Even though the researcher was familiar with the organization from an earlier study, one municipal official was observed for two working days in order to get an up-to-date idea of the organizational atmosphere. She also explained the general principles and procedures of local government decision-making to the researcher. This kind of information was also available in different guideline documents (e.g., a handbook of quality, municipal ordinance and other regulatory documents). There were also a few rather unofficial talks with people taking care of practical aspects of document handling processes in decision-making.

Six municipal officials volunteered to participate in the pilot study in September 1995. The purpose of the study and the practical aspects of data gathering were explained to them in informal discussions. Thereafter they selected a total of eight tasks to be examined (four officials participated with one task and two officials with two tasks). All these tasks were new or nearly so on the participants' agendas.

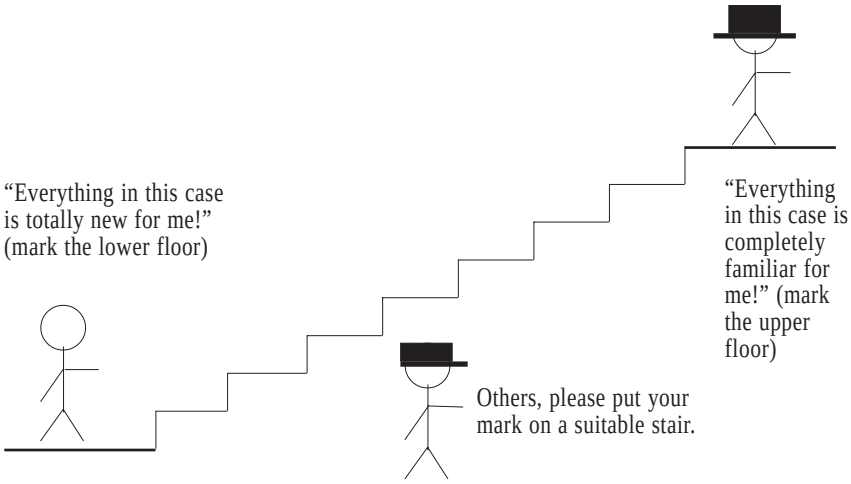
The participants were asked to fill out particular task diaries during the progress of task performance (Fig. 5.1). These diary forms were the core data gathering technique of the study. Their purpose was to enable the recording of a process that usually extends over several, often inexactly predictable occasions. This was also the very reason why observation was dismissed as the main data gathering technique. It would have been unrealistic to expect the researcher to be present on all occasions where the particular tasks were attended to: for instance, five minutes today after a staff meeting, one hour tomorrow or the day after tomorrow depending on when the expected document arrives and another matter on the agenda is finished, etc.

The task diary forms consisted of two parts (Fig. 5.1, Appendix 1). The first part was semi-structured and it concentrated on the initiation stage of task performance. The participants were asked to fill in this part at the beginning of task performance. The items in this part considered task performers' initial thoughts about the task, its performance and some individual aspects (e.g., level of ambition, subject expertise and perceived level of complexity). Some specific questions about information aspects were also asked. In order to engage the participants with the task diaries, various ways of inquiring were utilised (i.e., open questions, choosing a suitable alternative, and continuums of different forms).

PART I ASSESSMENT OF THE INITIAL SITUATION
(Please fill in at the beginning of the task performance)

What is your task in the handling of the case? _____

Estimate your level of expertise in this case:



Please tick the alternative that best describes your ambition level:
( ) "I'm pleased just to get this matter over with."
( ) "I want to get this done well."
( ) "Only a very good result will satisfy me."
( ) "None of the previous alternatives match, instead _____

Estimate how well you can describe the progress of your task at the beginning:

"I don't even know how to begin with." "I can describe the whole progress in detail."

25 50 75

(Please shade in – from left to right – the further, the better you believe you are able to describe the task progress in detail.)

Figure 5.1: An extract from a task diary
(see the complete diary form in Appendix 1)

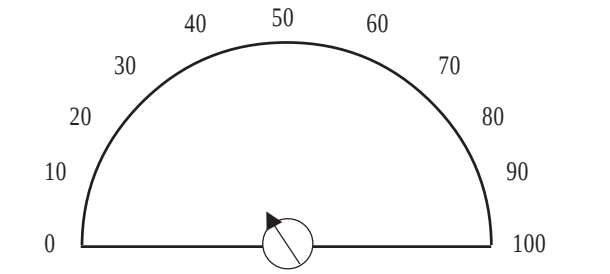
The second part of the task diary concentrated on task performance itself. The participants were urged to fill out this part during the task performance to minimise inaccuracies in their recordings. This part of the task diary was unstructured, although there were certain guidelines for task performers. They were asked to make notes about the stages of task performance and the ways of gathering information. People contacted, meetings and material acquired was to be evaluated in terms of how well they met the task performer's expectations. The participants were also encouraged to describe the situational factors recognised by them during the task performance, and to write down any notions which the task performance brought to their minds. Finally, as they were finishing their task, their satisfaction with the result was inquired.

Tasks included in the pilot study varied a lot in their overall duration. Some were completed in a couple of days whereas others lasted for months. Most contacts between task performers and the researcher during task performance processes were conducted via telephone, but in some of the larger tasks face-to-face meetings were arranged. After task completion a closing interview followed. The idea of these interviews was to minimise misunderstandings, and to complete and amplify the data recorded in the task diaries. This increased the depth of the study as well as its credibility.

The answers and the descriptions of task performance process were checked in a conversational manner with the participants. Related items were invited (e.g., task performer's evaluation of different aspects of task complexity). Furthermore, the participants were asked to make a subsequent complexity estimation on a similar scale than at the beginning of the task performance. This made it possible to see if the perceived level of task complexity had altered during the task performance. At the end of the interview the participants were asked to classify their task into one of five categories depending on how much discretion was involved in the task (Fig. 5.2).

Finally, the interviews were concluded with a discussion about the data gathering techniques used from the participants' point of view. Their reactions were positive overall. They noted that even though the task diaries demanded continuous attention and required concentration, this was balanced by the interest they raised. It was even noted that task diaries led the participants themselves to consider their own work and the ways of doing it. The untraditional presentations of some items and easy comprehensibility were also recognised. The diary technique itself received some notions (the curious: "Where has this technique been used before?", and the relieved: "Thank God, it was not yet another questionnaire!").

1. In your opinion, how complex did the task seem to be after you completed it?



(Please point the arrow to an appropriate level.)

2. Place your task in one of the task categories below, and estimate the amount of task-based consideration in percentages. The more the task descriptions below include dashed arrows and shadings, the larger part of the task demands task-based consideration.

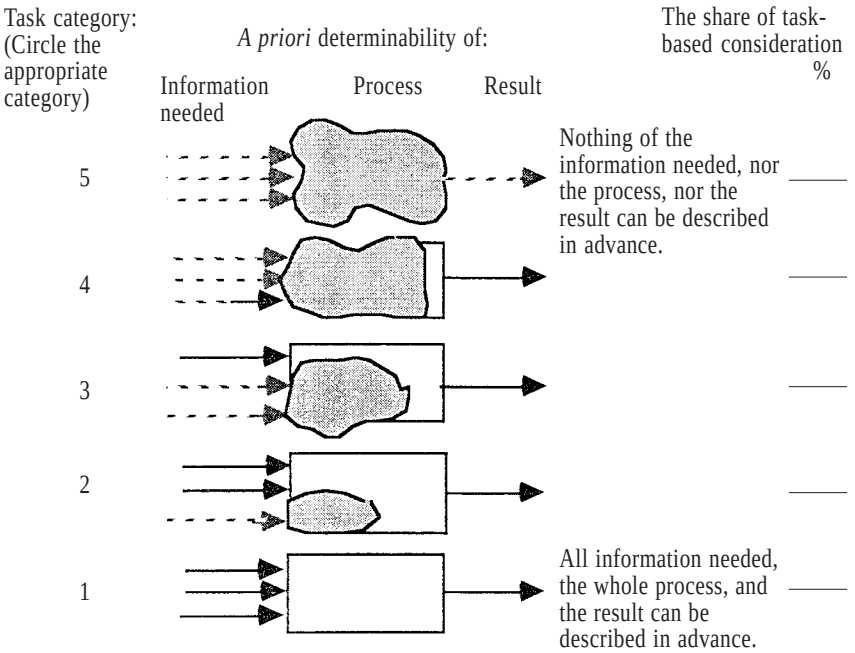


Figure 5.2: A complexity form

5.1.2. Primary data collection

After the pilot study some minor corrections were made to the task diary. For instance, instead of just a diary, the form was called a *task* diary and the question "how often do you prepare cases *like this* for the decision-making bodies?" was corrected (the words in italics were added). From the subsequent interview the part considering the data gathering techniques was cut off, and an additional question about the actual time spent working with the task was added.

The major data collection took place in Tampere. It began in October 1995, while a couple of tasks of the pilot study were still in progress. It was decided that all cases initiated as new during a two-week period would be put under surveillance. There were two reasons for this. First, an overall picture of what kinds of tasks were initiated by town inhabitants for a local government decision-making was desired. And second, the level of complexity was of interest. The cases were caught as they arrived at the registrar's office of the City Office. It is only after a matter is explicated in written form and has gone through registration, that it became an official case. These documents are then taken to the appropriate department to end up on the desk of some municipal official whose duty it is to prepare the case for decision-making. These officials were tracked down, often even before the cases had arrived[1] , and they were asked to participate in the study.

All nineteen officials contacted agreed to participate. The purpose of the study and the practical aspects of data gathering were explained to them in informal discussions as was done in the pilot study. In some cases, when there were difficulties in contacting a particular official, the case was already being dealt with. If the tasks had only just started, they were included in the study. Six cases were excluded because they were already finished or nearly so when their performers were contacted.

Altogether fifty-four cases were placed under surveillance during the two-week period. Most of them were finished within a month, many even a week after their arrival in the registrar's office. But some cases lasted up to one year. There were contacts between the researcher and the participants (either face-to-face, by telephone or by e-mail) about how the tasks were progressing. A closing interview – similar to the one conducted in the pilot study – took place after task completion. These interviews lasted from twenty minutes up to two hours, depending of the case, the number of them, and the participant's possible earlier interviews for the present study. All interviews were tape-recorded as agreed in advance.

The low number of new cases that arrived for local government decision-making as new in the two-week period led to the need to gather additional material. The preliminary analysis of the tasks recorded – including the tasks from the pilot study

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[1] At this point the organization had not yet taken the electronic document handling system into use. The matters were delivered to municipal officials by internal mail.

– revealed that most of them were characterised by rather low complexity (Byström, 1997). Thus, it did not seem a good idea to use the same data gathering strategy. Instead, it was decided to try to select more challenging cases. Some of the participants were urged to hand pick such cases and simultaneously the researcher sifted through the cases arriving at the registrar's office. Another eighteen cases were included in the sample and an additional fourteen officials participated in the study. When the data collection by the task diaries and the related interviews was concluded in February 1997, the sample consisted of altogether eighty cases, including cases from the pilot study.

These cases were divided between the thirty-nine participants as follows. Most officials – twenty-nine of them – performed only one task that was included in the research data. Three officials performed two tasks each and another three officials completed three tasks each. Four officials performed more than three tasks: one official participated with four tasks, another with six and yet another with seven tasks. One official had as many as nineteen tasks included in the sample. This was because the two-week data collection period was a time during which certain types of business administrative matters accumulate each year.

During the data collection by task diaries and related interviews, a large amount of observation was conducted. This was done during the interviews conducted in participants' offices during regular office hours. The participants were encouraged to proceed as they normally would; for instance, receive telephone calls and exchange a couple of words with colleagues dropping in during the interviews. Attention was paid to how their offices were organised: for instance, was there a computer or a terminal on their desk, and if so, was it on or off, were there high piles of papers on their desk and shelves etc. A lot of this was informal observation that gave a picture of what was probably happening during the course of cases being recorded, too. More resolute observation was conducted by attending both formal and informal meetings of one working party. The researcher also attended some meetings related to other cases. This was valuable, since meetings were frequently mentioned in the task diaries. The observations together with discussions with staff members of both towns gave an insight into the work practice of Finnish local government. This made it less confusing to begin the analysis of collected data.

The data collection was completed with an e-mail questionnaire in November 1997. This way some background information about the participants was gathered. There were twenty-one structured and open-ended questions (see Appendix 2). The participants were asked questions about themselves (items 1–4), i.e., official rank, education and experience. Another set of questions was about their work (items 5–12), i.e., responsibilities, difficulty and variability of work, advantages and disadvantages, and changes. There were some questions about information (items 13–15), i.e., useful/useless information, ways of communicating, and criteria of quality. There were also questions about information seeking (items 16–20), i.e., type and form of most important sources, own facilitations of information acquisition,

and usability of information acquired. The final question (item 21) considered the actual utilisation of information acquired. Because of troubles with e-mail systems, most participants returned the questionnaire in paper form.

5.2. THE PROCESS ANALYSIS: SPECIFICATIONS

The analysis of the research data was partially simultaneous with the data collection. The first analysis took place after the pilot study. Its purpose was to test and improve the main data collection methods, the task diaries and the related interviews, and check the basis for classification of the data. Thus, no conscious analysis of any results was pursued at this point. Nevertheless, it gave the present author an intermediate view of the nature of the data obtained.

Another tentative but clearly more specific analysis was conducted after the data collection of the two-week period. This time the focus was on the analysis method itself and the preliminary results (cf. Byström, 1997). The analysis revealed the low number of more complex cases. This guided the subsequent data collection to concentrate on such cases.

The tentative analysis provided an opportunity to try out the classifications related to the process-analysis method. There are three major classifications: *task categorisation*, *information classification* and *source classification*. These are operationalised below. The tentative analysis confirmed that the classifications were appropriate for the present setting.

Before the final analysis, an important decision had to be taken; the decision to cease data collection was caused by a partial saturation effect. The finding of cases of greater complexity proved to be rather difficult in the kind of case domain studied. Instead, the number of cases of lower complexity increased, and they were increasingly similar to the existing material in relation to information activities. Thus, it was concluded that there were enough research data to form a representative sample of the type of tasks of municipal administrators studied.

5.2.1. The task categorisation

The final analysis was partly explicitly present already in the data collection phase. Task complexity categorisation has five complexity levels that are based on *a priori* determination of task performance (see Fig. 3.3, p. 44). It was decided to base the classification of tasks on the task performers' perceptions of task complexity. In the earlier applications (Studies I–III), this classification was done by the researcher on the basis of task descriptions provided by task performers. Both intra-classifier reliability (one classifier) and inter-classifier reliability (two classifiers) testing proved this classification technique acceptable (Byström & Järvelin, 1995).

The credibility of the classifications by the participants was treated on the basis of the ideas of triangulation in the present study (e.g., Denzin, 1989; Lincoln & Guba, 1989). First, the task performers who had the most profound conception of their own tasks in real-life settings, classified the tasks themselves. The five task categories (see Fig. 5.2, p. 66) were introduced to the participants in the interview taking place after task completion. Second, a number of related aspects were considered in connection with these classifications (e.g., knowledge of information requirements and task processes, subject expertise, level of ambition, and task frequency). The classifications were compared with measurements of these related aspects in two levels: intra-task performer (i.e., the tasks of the same performer were compared with each other) and inter-task performers (i.e., the tasks perceived to belong to the same complexity level were compared). The researcher merely acted as a controller and made judgements only in a few cases where there appeared inconsistencies between the task classification and the measurements of related aspects.

After the first analysis of the related aspects, seven seemingly inadequately classified tasks emerged. On the basis of task descriptions, other related aspects and task interviews, the researcher reclassified four tasks whereas three tasks held their original classification. In one case the performing official classified a larger task of her colleague: the actual task was reclassified as a normal information processing task. The same official performed all the three remaining tasks. He classified his tasks into task categories that clearly indicated more complexity than was evident in the tasks. Three of his total of four tasks were reclassified by the researcher: one normal decision task and two known, genuine decision tasks were reduced to normal information processing tasks.

The tasks of the sample fell into four task categories:

- automatic information processing tasks
- normal information processing tasks
- normal decision tasks
- known-genuine decision tasks.

No task was classified as unknown-genuine decision tasks. Because of the low number of decision tasks (12 + 7 tasks), the possibility of joining these categories was considered. Patterns that emerged in normal decision tasks were strengthened in known-genuine decision tasks. There was also a clear similarity between all decision tasks as well as they were clearly different from both types of information processing tasks. Thus, their combination was legitimate. To be sure that the combination of these categories would not cause distortion of results, the joint category of decision tasks (DTs) was created, but the original categories were sustained throughout the final analysis.

The classifications of the related aspects were simple groupings created to illustrate the present research data. There were three groups identified within *task duration*. Tasks whose performance took less than a half of an hour were considered to be completed in minutes. Tasks that took from a half of an hour to eight hours were completed during a working day. Tasks that took more than eight hours to complete were considered to take several days to complete. The level of *ambition* was considered on the basis of three given alternatives:

- low ("I'm pleased to get this matter over with")
- medium ("I want to get this done well")
- high ("Only a very good result will satisfy me").

It was emphasised that the alternative anticipating the lowest level of ambition did not mean that the task would be completed improperly, but only without a greater ambition. Moreover, the task performers had an option to define their ambitions in their own words. The *frequency of similar tasks* was estimated on the basis of four given alternatives:

- daily
- weekly
- monthly
- less than monthly.

There were some aspects that concerned task-independent characteristics of task performers. One was about the *education* of task performers. It was specified only in terms of three classes: academic degree (at least a bachelor's degree), college level education (a qualification from a polytechnic or commercial college etc.) or lower education. Another classification considered the *experience* of task performers. The participants were divided into four groups depending how many years of experience they possessed in their present or in previous similar positions:

- five years or less (≤ 5 years)
- more than five years but at most ten ($5 < x \leq 10$ years)
- more than ten years but at most fifteen ($10 < x \leq 15$ years)
- more than fifteen years (> 15 years).

An additional set of aspects was used in order to check the consistency of task categorisations made by task performers. These considered the level of knowledge about information requirements and the level of knowledge about task process as well as the level of complexity in unspecific terms of task performers, and the amount of discretion included in a task. The levels of *knowledge about information*

requirements and task processes were presented on continuum bars that were later converted into percentages. There were five levels:

- extremely low (≤ 10 %)
- low (10 % < x ≤ 30 %)
- medium (30 % < x < 70 %)
- high (70 % ≤ x < 90 %)
- extremely high (≤ 90 %).

Similar classes were also used to illustrate the differences according to the amount of *discretion* perceived to be involved in tasks and their *perceived complexity* in participants' own terms. The perceived level of *subject expertise* of task performers was considered this way. The standard division into five levels on a scale from zero to ten was used as a basis for boundaries of classes.

5.2.2. The classification of information types

The second major classification considers the nature of information. At the beginning of task performance participants made notes in the task diaries concerning information they expected to need in their tasks. This data was specified in the subsequent interviews where information acquired during task performance was specified. There were no difficulties in identifying the different types of information. The information expected to be needed and the information actually acquired was classified into three classes (see also Chapter 3.2.2., p. 45). The following three information categories were considered in the present study:

- task information (TI)
- domain information (DI)
- task-solving information (TSI).

Task information is information typically mainly useful only for the task in hand. This information is normally factual in nature, e.g., names, addresses, events, places, numbers etc. *Domain information* is likely to be useful in several tasks of the same kind. This information can be in the form of facts (e.g., a section of a law) as well as more interpretative information (e.g., opinions of experts). The third information type, *task-solving information*, is instructional in nature. This information helps task performers to cope with the task by guiding their actions (e.g., advises about whom to contact). It is useful in several tasks and may take forms similar to domain information, but concentrates only on information that answers questions as to what and how to do something.

Information connected to the tasks was considered furthermore in terms of *an information complexity value* (Murtonen & Järvelin, 1992; Byström & Järvelin, 1995). This is an index, a number between zero and five that indicates the information types involved as well as the degree to which the information is useful to several tasks. The closer to the value five the index rises, the more information types are involved and the more useful the information is for several tasks. Task information that is mainly usable only for the task in hand is given a value of one, whereas both domain and task-solving information that are usable in several tasks are given a value of two. Thus, for information needed in a single task the information complexity value is easily calculated: the values of each information type needed are added together. For instance, if task and domain information is required in a task, its information complexity value is three. Accordingly, the information complexity value for a set of tasks is a mean value of all task values in it. Thus, the index is solely intended to comprise the different information types involved, but it does not reveal to what extent each type is utilised. This simple index is used to illustrate the differences between different groups of tasks.

5.2.3. The classification of information source types

The third major classification is about sources. This classification is based on the sources used by the participants. A similar classification was originally created for a preliminary study (Studies I and III; cf. Byström & Järvelin, 1995). The data for the present classification came from task diaries and it was checked in the subsequent interviews. There emerged three main categories for sources used:

- people as sources
- documentary sources
- visits as sources.

People were considered as sources when they were consulted in a such role, that is, when they were consulted in order to make progress in the task. Usually the task performer contacted the person in question, but sometimes this person may have contacted the task performer. This main category consists of three general source types:

- people concerned
- experts
- meetings.

People as sources were considered as *people concerned* in the following cases: (1) they were the initiators of a case (i.e., they either proposed a motion or initiated

a matter for local governmental consideration), (2) they were affected by the decision of the case, or (3) they became involved because of their work, but could not be considered as experts. *Experts* master extensive knowledge (and/or skills) in a specific domain where their knowledge (and/or skills) is considered to be extraordinary (Nykysuomen sanakirja, 1967; The Cassell Concise English Dictionary, 1989). A person is classified as an expert source when she is consulted in the role of expert in the case. Among other people, knowledgeable colleagues were considered to fulfil this description in most of the cases in the present study setting. *Meetings* are considered as sources of a specific nature that cannot be reduced to people concerned and experts (cf. Solomon, 1997b). These occasions are seldom only for the task performer but also for other participants to gather information. There needs to be a subject for the meeting and more than two people present.

Documentary sources contain information in a recorded form. In practice, this meant written information and sometimes maps and photographs. Other types of recorded information, like tape recordings or videotapes were not utilised in the sample of tasks. Thus, the general source types within the documentary sources were:

- literature
- official documents
- registers.

Literature includes printed materials like books, reports, journals and newspapers. *Official documents* consist of a number of different written, printed or electronic papers. There are agendas, minutes, letters, applications, memoranda, complaints, etc. Maps, photographs and unpublished planning documents are also included (Kuinka kunta toimii, 1988, 121). *Registers* consist of all manual or electronic catalogues. Commercial databases could have been included to the class of registers, but they were not utilised in the sample of tasks.

Visits as sources formed the third main category of sources. These sources consist of – mainly visual – observation. This means that a task performer leaves her office and checks the place in question in order to make appropriate judgements regarding the case. Since visits were limited in number, there was no need to create a more specific classification within them.

Secondly, sources were classified according to their *location*. Despite their origin, sources were classified as *internal* when they were available within the (work) organization, and as *external* when they were obtained from outside the organization. Nearly all previously mentioned source types were also considered in this respect. People were internal sources if they worked within the organization and otherwise external. The visits as sources were always external sources by nature. Meetings were accordingly classified into internal sources, but all meetings where people from outside the organization took part were considered as external sources.

Thus, there were external meetings where other internal people in addition to the task performer were participating. All registers utilised in the tasks of the sample were internal. Official documents were divided into external, internal actively acquired and internal passively acquired official documents. Many official documents usually provided by an initiator of a case were received automatically by task performers. Since no effort was necessary to obtain these documents, they were separated from actively acquired documents.

Thirdly, *a parallel classification for the main categories* of the above classification was utilised. Sources were classified into *fact-oriented*, *task-oriented* and *general-purpose sources* (Byström & Järvelin, 1995; cf. Murtonen & Järvelin, 1992). Registers were the only fact-oriented source type in the present study. There were three types of task-oriented sources, namely people concerned, official documents and visits as sources. The remaining three source types, i.e., experts, meetings and literature, were all general-purpose sources.

In sum, there were three separate principles for source classification. The first classification into and within the people as sources, documentary sources and visits as sources is domain specific, since it was created on the basis of the present research material. The second and third classifications are clearly more general and therefore also more readily applicable in several settings.

5.3. THE PROCESS ANALYSIS: COMBINATION

After familiarisation with the research data and its classifications, it was synthesized on the basis of the various classifications introduced above. At this point, it made no difference what data collection techniques had been utilised. The analysis followed the idea of work charts where the relevant aspects of a task were coded and that of process tables where all tasks of particular grouping were laid out (see Studies I and II; Byström & Järvelin, 1995). The work chart of the present study is presented in Figure 5.3. However, because of the larger size of the present sample and the greater number of affecting factors, the following analysis is presented in a condensed form.

The analysis was triggered to expose the effects of task complexity on need for information types and source use during task performance processes in a real-life setting. Additionally, attention was paid to four aspects related to task complexity: task duration, subject expertise, task ambition and frequency of similar tasks. The complexity values for anticipated information types as well as for actually acquired information types were counted for each task group of each aspect (e.g., tasks whose performance took minutes, a day or days). Similarly, the source use in each task group of each aspect was analysed. Most of the variables that were the result of different groupings were cross-tabulated in order to reveal patterns in the data. However, no statistical testing was conducted. This had two reasons. First, the total number of cases (n = 80) is fairly small in statistical terms, especially since the cases

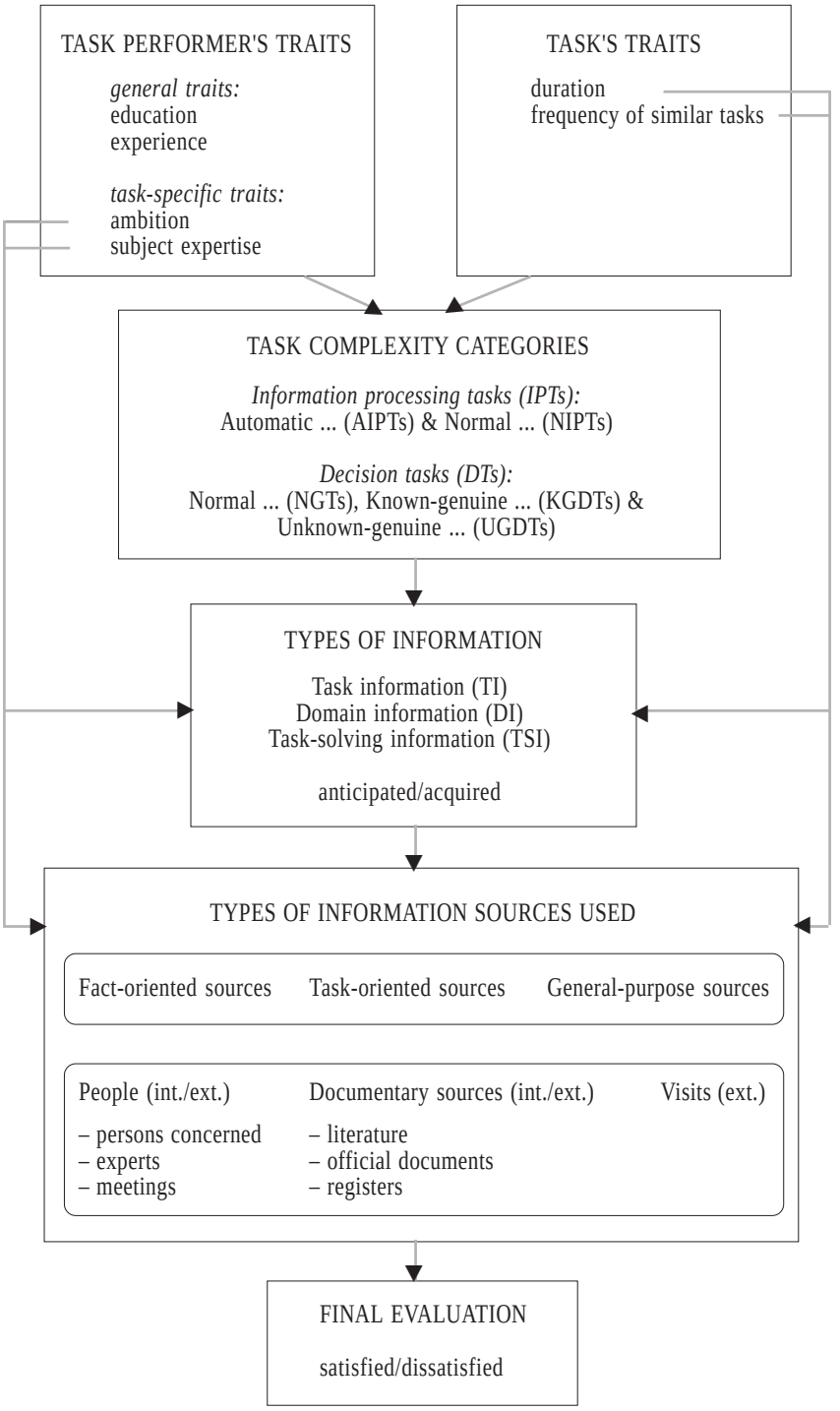


Figure 5.3: A work chart

were further grouped into three task categories. Furthermore, the cases were not sampled according to any statistical technique, but selected in order to gather as rich data as possible in the task domain studied.

Chapter 6

Analysis and results

The analysis starts with an examination of the main characteristics of the study, i.e., task complexity, information types and information sources, on the basis of the research data. This is followed by an analysis of relationships between them. First, the crucial relationship between the need for information types and information source use is considered. Second, it is related to task complexity.

6.1. THE MAIN CHARACTERISTICS OF THE STUDY

6.1.1. Task complexity

Generally, participants estimated their work to be fairly challenging and variable (see Appendix 3, items 7, 8 and 10). Despite this, they perceived the tasks in the sample either as simple (i.e., *a priori* well determinable) or as moderately complex. The tasks were first classified by the officials themselves into four different task complexity categories (Table 6.1) (cf. Chapter 5.2.1., p. 70).

Altogether twenty-six tasks were classified in the simplest category of tasks, automatic information processing tasks (AIPTs). These tasks required only a minimal effort to be completed. Each official knew from the beginning how to handle the matter in hand, how to predict what information was going to be required, how to acquire and process it, and what kind of result was expected. These tasks were repetitive, and often only a single piece of information was sufficient for task completion. As many as eighteen tasks were performed by one official. This is the only task complexity category where a same participant performed more than four tasks. Some examples of the matters whose handling was considered to constitute an automatic information processing task follow:

Table 6.1: The distribution of tasks into task complexity categories

Task category	No of tasks
Decision tasks (DTs)	*19 (24 %)*
Unknown-genuine	0
Known-genuine	7
Normal	12
Normal information processing tasks (NIPTs)	*35 (44 %)*
Automatic information processing tasks (AIPTs)	*26 (32 %)*
Total	*80 (100 %)*

- Nomination of a town representative for the Independence Day Celebration [Kaupungin edustajan nimeäminen itsenäisyyspäivän juhlaan]
- Handling of a banderole permit: the petitioner applies for permission to place advertisement banderoles on street sections owned by the town [Banderolliluvan käsittely: Anoja hakee lupaa mainosbanderollien sijoittamiseen kaupungin omistamille katuosuuksille]
- Consideration extending hospitality: International conference Crossroads in Cultural Studies [Vieraanvaraisuuden osoittaminen: Kansainvälinen konferenssi Crossroads in Cultural Studies]
- Handling of a registration referring to the Health Act 24 §: Notification considers an essential change on outdoor sales equipment in a previously licensed outdoor sales stand [Terveydensuojeluasetuksen 24 § mukaisen ilmoituksen käsittely: Ilmoitus koskee hyväksytyssä ulkomyyntipaikassa tapahtunutta oleellista muutosta koskien käytössä olevia ulkomyyntilaitteita]
- Nomination of a town representative to the board of the Association for Institutions of Higher Education of Tampere [Kaupungin edustajan nimeäminen Tampereen korkeakouluyhdistys ry:n hallitukseen]

Normal information processing tasks (NIPTs) were also quite unproblematic for their performers. Although there were some aspects that were necessary to consider separately for each case, the greater part of processes was predetermined. The case-based parts were neither particularly difficult to identify nor especially complicated to resolve. There were thirty-five such tasks. Some examples of these tasks are:

– Formulation of a statement by the town: Giving a statement on an issue which is globally fairly new and still under development – electrical identity and identity card [Kaupungin kannanotto: Lausunnon antaminen maailmassa vielä melko uudesta ja kehitteillä olevasta asiasta – henkilön sähköinen identiteetti ja henkilökortti]
– Handling of a complaint: Neighbour's dissatisfaction with a carport/storage building licensed by notification [Valitusasian käsittely: Naapurin tyytymättömyys ilmoitusluvalliseen autokatos/varastorakennelmaan]
– Handling of an offer to buy land: The area in question is located outside the administrative district of the town which requires specific reasons for its acquisition [Maa-alueen ostotarjous: Alue sijaitsee kaupungin hallinnollisen rajan ulkopuolella edellyttäen erityisiä syitä alueen hankintaan]
– Handling of a motion from the town council: The motion considers the recycling of aluminium foil waste which is in accordance with the obligation of every waste producer according to the Waste Act [Valtuustoaloite: Esitys koskee (aluminifolio)jätteen hyväksikäytön edistämistä, mikä on jätelain mukaan kaikkien jätteen tuottajien velvollisuus]
– Updating a lease: Real estate X has held a land site Y-1 of 27744 m^2 for a multi-storey building since 1 June 1956 for the following 60 years. In 1988 part of the land was designated as a public street by a change in the town plan. The new land site Y-2 has an area of 27629 m^2. The lease needs to be amended accordingly. [Vuokrasopimuksen ajantasaistaminen: Kiinteistö oy X on hallinnut pinta-alaltaan 27744 m^2:n suuruista kerrostalotonttia Y-11.6.1956 lähtien maanvuokrasopimuksella 60 vuodeksi. Vuonna 1988 tapahtuneella asemakaavan muutoksella osa tontista osoitettiin katualueeksi. Uuden tontin Y-2 pinta-ala on 27629 m^2. Sopimus tulee muuttaa ajantasalle eli koskemaan asemakaavan mukaista tonttia Y-2.]

There was clearly more case-based discretion involved in tasks that were classified as normal decision tasks or as known, genuine decision tasks. These tasks contained several alternatives: different kinds of information could be used and/or gathered in different ways, and it could also be processed in several ways. Despite these alternatives in input and process levels, the type of result was always explicit already at the beginning of task performance. Twelve tasks were classified as normal decision tasks and seven tasks as known, genuine decision tasks. These tasks were brought together to form a single category for decision tasks (DTs) with nineteen tasks included (cf. the task categorisation, Chapter 5.2.1., p. 69). Some examples of matters included into this task category follow:

– Extension of an unusual lease: The matter considers whether the leasing of an harbour area to a private person for past 12 years is to be extended by additional ten years [Poikkeuksellisen vuokrasopimuksen jatkaminen: Kysymyksessä on

anomus yksityiselle henkilölle aikanaan 12 vuodeksi vuokratun satama-alueen vuokrauksen jatkamisesta 10 vuodella]

- Handling of a claim for damages: A real estate may have been damaged because of actions taken by the town as the authority of the town plan and building [Vahingonkorvausvaatimuksen käsittely: Kiinteistövaurioiden johdosta, jotka saattavat perustua kaupungin toimintaan kaavoitus- ja rakennusvalvontaviranomaisena]
- Prioritising particular projects involved in a development project of the town centre to be implemented in 1995 and 1996 [Kaupungin keskustan kehittämisprojektiin liittyvien osahankkeiden priorisoiminen toteuttamista varten vuosina -95 ja -96]
- Reorganising the vocational school system of the town (the official was responsible for the work party) [Kaupungin ammatillisen koulutuksen organisaation uudistaminen (työryhmän vastuuhenkilönä)]
- Work party: Reconnaissance of the planning situation, making necessary, plans preparing the budget estimates, planning the actual work project for filling and landscape architectural actions in the gravel pits at Vilusenharju. Own task: Contributing to the designing of the fillings, landscaping and planting plans for areas planned as parks, recreation areas and protection green belts, and preparing the budget estimates for their implementation [Työryhmä: Suunnittelutilanteen kartoitus, tarvittavien suunnitelmien laatiminen, rahoituksen budjetointi ja työohjelman laatiminen ns. Vilusenharjun soranottoalueiden täyttö- ja maisemointitöitä varten. Oma osuus: Osallistua täyttöjen muotoilun suunnitteluun, laatia puistoksi, lähivirkistysalueeksi ja suojaviheralueeksi kaavoitettujen alueiden maisemointi- ja istutussuunnitelmat ja esittää vihertöiden toteutusta talousarvioon]

One participant described these more complex tasks as follows:

> "It is the surprise which is often connected to these kinds of large tasks that make local governmental tasks complex. It is not so much the size of the task and that it requires a lot of getting into a matter – which is of course also one point – but some kinds of surprising aspects may emerge totally unexpected. And it makes it complex in that sense, that it, that it for example ... that one cannot guess beforehand, how complex a task will be in the end."

and later

> "From the point of view of preparing a matter ... difficult situations are those where the person preparing the matter feels that it is impossible to proceed. Decision-makers add new aspects every time they consider the matter, sometimes one may wonder that how to pursue it now." (P41)

No tasks were classified as unknown, genuine decision tasks. This is not particularly surprising since tasks of this highest level of task complexity are rare by nature. In order to fall into this category a task should be extremely ambiguous, leaving the performer uncertain of how and even towards what kind of result to move.

6.1.1.1. Credibility of task complexity classifications

Some characteristics that are related to perceived task complexity were examined to verify the comparability of the classifications[1] . Municipal officials estimated their familiarity with a course of task performance and with information requirements of a task in hand. They also described the expected result of their task. They made numerical estimations about the amount of discretion involved in tasks and about the complexity of tasks (both in the before and after task performance).

Table 6.2: Task complexity and predictability of information requirements and task processes

Level of knowledge		AIPTs (n = 26)		NIPTs (n = 34)		DTs (n = 19)	
		inf. req.	task proc.	inf. req.	task proc.	inf req.	task proc.
Extremely low	(≤ 10 %)	-	-	-	-	-	-
Low	(10 % < x ≤ 30 %)	-	-	-	3 %	5 %	5 %
Medium	(30 % < x < 70 %)	-	-	15 %	12 %	11 %	27 %
High	(70 % ≤ x < 90 %)	15 %	23 %	35 %	44 %	79 %	63 %
Extremely high	(≤ 90 %)	85 %	77 %	50 %	41 %	5 %	5 %
		100 %	100 %	100 %	100 %	100 %	100 %
Md		100	100	88	83	75	75
$\overline{X}$		95.9	94.0	82.5	80.5	72.6	66.8
s		8.7	9.9	16.4	17.3	14.4	17.7

Legend: inf. req. = information requirements; task proc. = task process

[1] Some examinations in this section include statistical analysis (medians, means and standard deviations). However, due to the small number of cases the values are vulnerable to even few exeptional observations. Thus, a purpose is to describe this particular set of cases, not to determine significance or non-significance of the results.

Some additional characteristics were more generally connected to task complexity. Two of them were task characteristics: task duration (i.e., time efficiently allocated for task performance) and frequency of similar tasks performed. Two other characteristics were connected with a task performer: task ambition and subject expertise. Task performers considered all these four characteristics.

There was a clear relationship between task complexity classifications and anticipated predeterminability of the task process and its information requirements (Table 6.2). As appropriate, considering the generally low level of complexity, all officials were fairly confident in their predeterminability estimations. In general, *the officials' ability to anticipate task processes and information requirements was highest for tasks perceived as the least complex (i.e., AIPTs), and lowest in the most complex tasks (i.e., DTs).* The officials were very confident at the beginning of AIPTs. Although they were able to anticipate information requirements as well as task process in both NIPTs and DTs, their confidence decreased progressively as tasks were classified as more complex.

The officials also estimated how much discretion was involved in their tasks (Fig. 6.1). In general, *AIPTs were related to a very low level of discretion, whereas most discretion was clearly related to DTs.* There was a very limited amount of discretion involved in AIPTs. The mean value of discretion for AIPTs stayed as low as six per cent, and it was constant throughout all AIPTs. NIPTs were estimated to

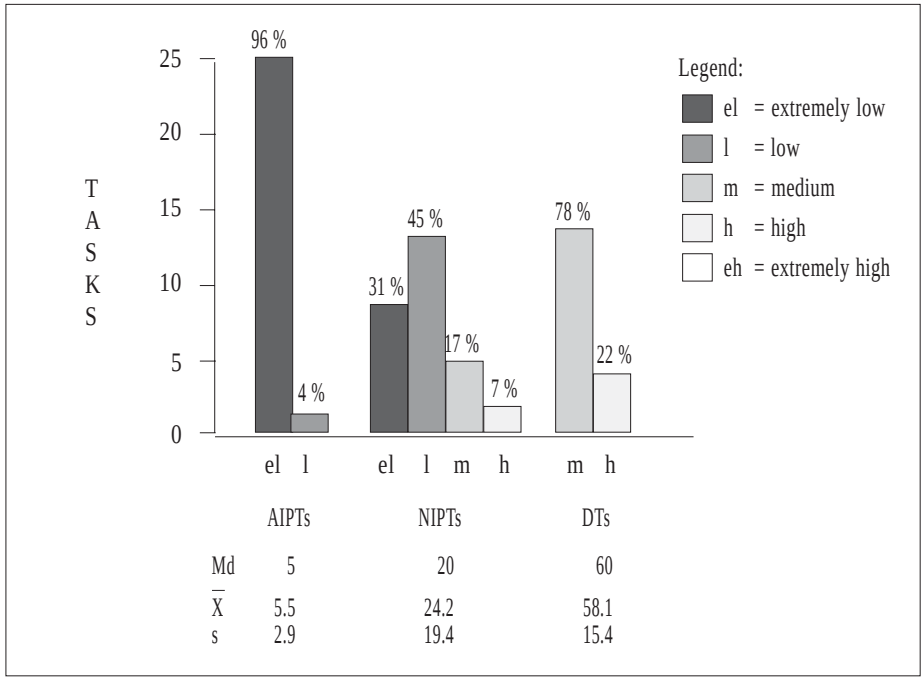


Figure 6.1: Task complexity and amount of discretion

require clearly more task-based consideration than AIPTs (mean value: 24 %) and DTs required even greater amount of discretion (mean value: 58 %).

The officials also made straight numerical complexity estimations (0–100). They were based on the officials' own criteria (Fig. 6.2). *These complexity estimations rose from AIPTs to NIPTs, and further to DTs*. The single most frequently mentioned aspect of complexity was the conflicting aims and views between the parties concerned. One participant put it as follows:

> "Well, a thing that first comes to my mind is that during the preparation process of the matter it is necessary to pay attention to and examine different sides. For instance, there is a matter on which an advisory opinion is requested from, let's say, four places. And all of them are somewhat contradictory. And then we here must form the stance of the city government on the basis of them. So, that is a difficult matter ... Whereas, it is a simple matter when there are statements, or reports, requested from one or two places, and we can directly suggest that this solution is also the stance of city government." (P37)

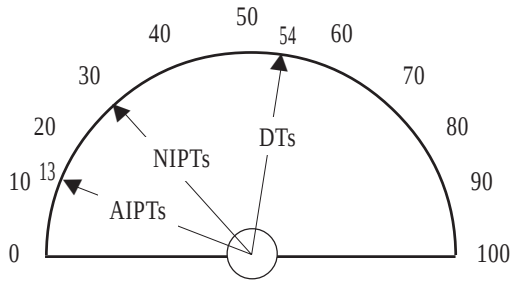
and another:

> "It is rather frustrating when you have a lot of work to do and a group of persons with differences of opinion involved. One wishes one thing and another something else, and they try to influence me in various ways ... each calling separately ... contacting me this way and that way ... well, that feels to me that it is an abuse of taxpayers' money." (T63)

As another measurement of the predictability, the officials were asked to consider whether their complexity estimations made at the beginning of task performance were still valid after task completion. This was the case in most tasks. However, *these estimations were afterwards held to be less valid in the most complex tasks (i.e., DTs) than in the less complex tasks (i.e., NIPTs and AIPTs)*. As a rule, the complexity estimations did not change in AIPTs. The re-estimations in NIPTs or DTs did not have any distinct direction.

The officials participating in the study were highly experienced and well educated within their specific domains (see Appendix 3, items 2 and 3). This is reflected in the mean value of subject expertise estimations by the officials. It was 7.9 on a scale from one to ten, and the estimations were eight or more in as many as seventy-one per cent of all tasks. One participant expressed the importance of experience for information need as follows:

> " One has to be fairly familiar of the town organization, you have to know whom to ask. If you don't know this, it will cause problems. You have to ask several places and you just might be informed that this is not my business, but somebody



	AIPTs	NIPTs	DTs
Md	10	25	60
$\bar{X}$	13.3	30.0	53.5
s	12.5	19.0	20.0

Figure 6.2: Task complexity and mean values of complexity in terms of task performers

Table 6.3: Task complexity and the level of subject expertise

Subject expertise	(levels...)	AIPTs (n = 26)	NIPTs (n = 34)	DTs (n = 19)	All tasks (n = 79)
Extremely low	(1)	-	3 %	-	1 %
Low	(2–3)	-	3 %	21 %	6 %
Medium	(4–7)	-	24 %	47 %	22 %
High	(8–9)	73 %	35 %	32 %	47 %
Extremely high	(10)	27 %	35 %	-	24 %
		100 %	100 %	100 %	100 %
Md		9	9	6	
$\bar{X}$		9.1	8.0	6.0	
s		0.6	2.3	2.0	

else's. I don't have to think of this aspect a lot, since I was a supervisor here for a long time and a lot of field workers became familiar to me. This might be the unfamiliar part in the ordinary office work." (T65)

Task complexity and subject expertise also correlated systematically with each other (Table 6.3). *Self-estimated subject expertise decreased as task complexity increased*. The task performers were highly knowledgeable in AIPTs, and their subject expertise was clearly weakest in DTs. This relationship came up in some interviews:

The more complex task,

"the more the task requires knowledge of some particular subject area. In this case it was construction engineering."

and later

"The more one has to get into a new, unfamiliar domain, because it is an essential part of the problem, the more difficult the task automatically becomes." (P36)

Officials were well motivated to perform their tasks, at least in terms of setting a level of ambition for themselves (Fig. 6.3). The level of ambition was estimated as good or as very good in nearly three quarters of all tasks in the sample. These task-based estimations were in line with general estimations of the positive and negative aspects of the work of participating officials. They mentioned clearly more positive than negative aspects (see Appendix 3, items 10 and 11).

There were ten occasions where the officials did not feel comfortable with the given alternatives but wanted to describe their ambition in their own words. Several of the officials' own descriptions could be summed up with their concern about the dependability of results. It was not so much the ambition that the officials felt but their knowledge that the result needed to hold especial quality to be acceptable in the first place, or as one participant put it: "it is not a question of my ambition, the result must be good" (P36). For instance, one official whose task could be expected to be somewhat problematic from the beginning said:

"This matter needs to be prepared so that it is legally tenable, so I have to be absolutely sure about the underlying factors. If the matter leads to appeal, a simple defect in formality is enough to initiate a rectification process." (P34)

Ambition levels were clearly higher in more complex tasks. The most usual ambition level recognised in AIPTs and NIPTs was the medium level of ambition, but there was much more variation in NIPTs. The highest level of ambition was most often linked to DTs. Some participants touched on this relationship themselves. One stated:

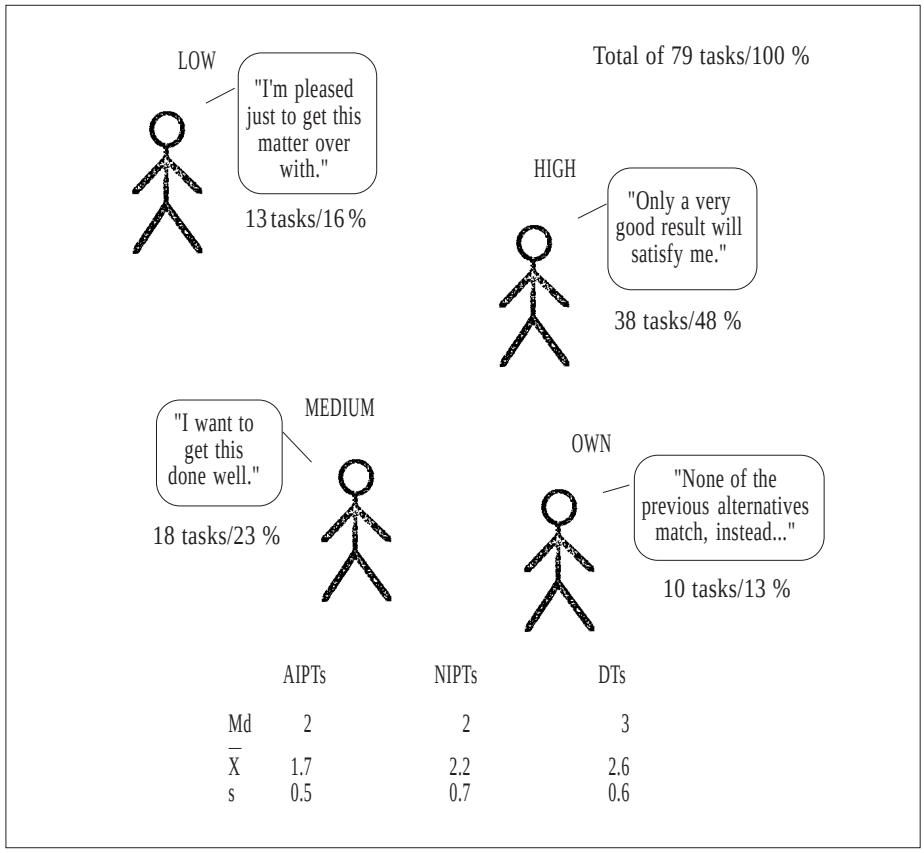


Figure 6.3: Task complexity and the level of ambition

> "...well, I don't know how to respond, except if there is some large challenging task, then these kinds of feelings might become relevant, but not in the ordinary work ... not so strongly nowadays, maybe when one was younger. The important point is that the matter goes well." (T16)

and another:

> "Well, let's say that this was familiar [task] ... I just thought, that it is duly taken care of." (T20)

No standard frequency of similar tasks in the tasks of the sample emerged. Most tasks occurred less than monthly, which is consistent with the general estimations about the high variability of the work of municipal administrators (see Appendix 3, item 8). The picture is strengthened with work descriptions like "this job of mine is like a grocer's shop" (T16). Interestingly enough, the rest of the tasks were quite

evenly distributed into the other three classes. Even though the tasks did not emerge at short intervals in the work agenda of the municipal administrators, they seem to be rather repetitive considering the task processes and information requirements. A municipal official might say, for instance: "Every year recurring business. I'll remember." (T3) or "this event is traditional ..." (T6).

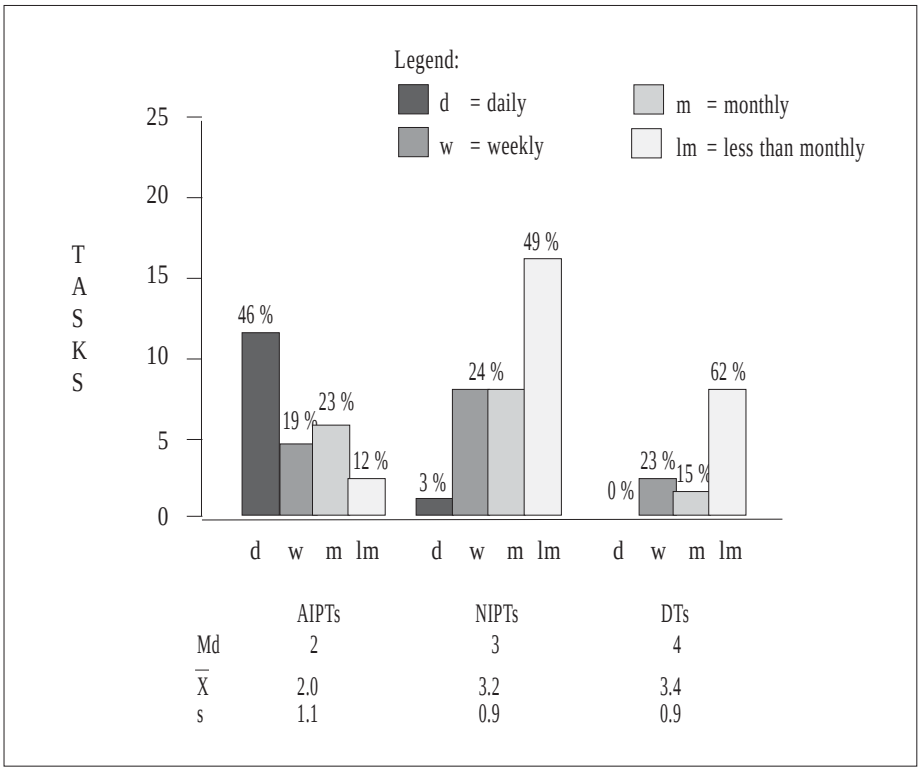


Figure 6.4: Task complexity and frequency of similar tasks

Nevertheless, the frequency of similar tasks seemed to be in relation to task complexity (Fig. 6.4). In general, *the less than monthly frequency of similar tasks was clearly more common for DTs than for AIPTs*. The relationship between task complexity and experience of similar tasks was analysed by some participants. They too seem to emphasise experience as such instead of the short intervals between similar tasks. Two examples:

> "Well, if one has handled similar matters earlier, it makes it easier ... the first [tasks] were rather difficult, but when in the course of time I have been dealing with such matters more and more, now I know exactly whom to contact and then it is easy ... the knowledge about people and their tasks within the organization,

it is rather important, and for a new person, who comes from outside to this organization, it takes some time ..." (T16)

and,

"If we speak of these kinds of tasks, it is simple because I've had ... I've been working here since 1977 ... there have been hundreds of them. In that sense, it is routine..." (T2)

Similarly as in the case of frequency of similar tasks, the task duration varied a lot. Tasks took from a couple of minutes to days. If the tasks where the task duration was missing (altogether 16 tasks) are examined more closely, it seems that there were just few tasks that might have been completed within minutes. Task duration had a clear relationship with task complexity (Fig. 6.5). *It was longer in DTs than in NIPTs, and it was shortest in AIPTs*. Whereas nearly all AIPTs were completed within some minutes, almost all DTs seemed to require days to be completed.

In sum, the consistent results of the above analysis support the credibility of the classifications conducted by the performing officials themselves. All mean values of task complexity categories varied systematically according to these task complexity classifications. Whereas more distinct trends within AIPTs emerged, the task categories of NIPTs and DTs were typically less homogenous. This means that

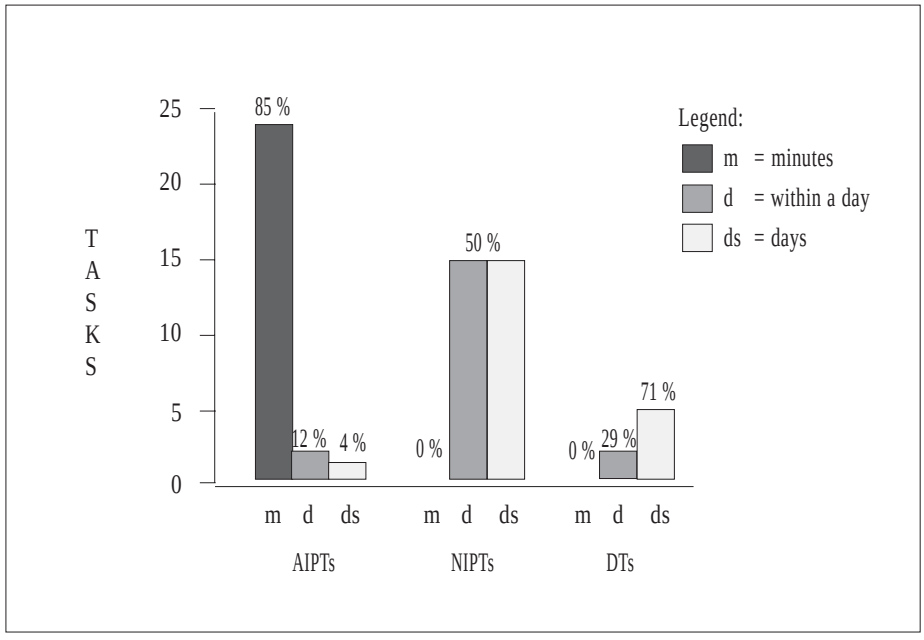


Figure 6.5: Task complexity and task duration

although the emphasis within each task category altered according to task complexity evaluations the individual observations may vary even a lot in some cases. However, the above separate analyses of each characteristic do not expose that when the individual observations of each characteristic *of each individual task* (i.e., predictability of information requirements and task processes, amount of discretion, free complexity evaluations, subject expertise, level of ambition, frequency of similar tasks and task duration) are considered together, the major part of them does support the perceived task complexity category.

6.1.2. Types of information

Municipal officials needed information about various subjects, but it was usually not especially complicated (Fig. 6.6). The officials anticipated themselves to gather information that is useful in several tasks either often or very often in connection with individual tasks (see questionnaire results in Appendix 3, item 20). However, according to task diaries, *the officials most often needed basic task information*, that is, information that is unlikely to be useful in any other task. Task information was anticipated as sufficient to complete sixty-one per cent of all tasks (48 tasks out of the total of 79[2]). One third of these tasks never required any information seeking at all because the information needed was received in the form of official documents provided by the initiators (20 tasks out of the total of 80). One participant analysed the need to acquire information for his task after he had minutely written down all information relevant for task completion into a task diary:

> " Well, in this case I didn't need to acquire this information [domain and task-solving information], but ... I have here [pointing to his head] that data-bank .... That information, which I needed, I've been acquiring it little by little over the years." (P30)

In thirty per cent of all tasks (24 / 79) task information was anticipated together with a need for domain information (Fig. 6.6). This information type is clearly more general in nature than task information. A combination of task and domain information was acquired in twenty-seven per cent of tasks (22 / 80). The third information type, task-solving information, was rarely perceived to be needed (7 /79). However, it was normally also acquired when at the beginning of task performance it was considered to be necessary (8 / 80). Task-solving information was usually needed together with both of the other information types.

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[2] The total number of tasks within different groupings may vary depending on how many of the total sample of 80 tasks were available for each consideration. In some cases, particular task data were incomplete or unclear. These items were excluded from the analysis, which causes a change in the total number of tasks included in that specific consideration.

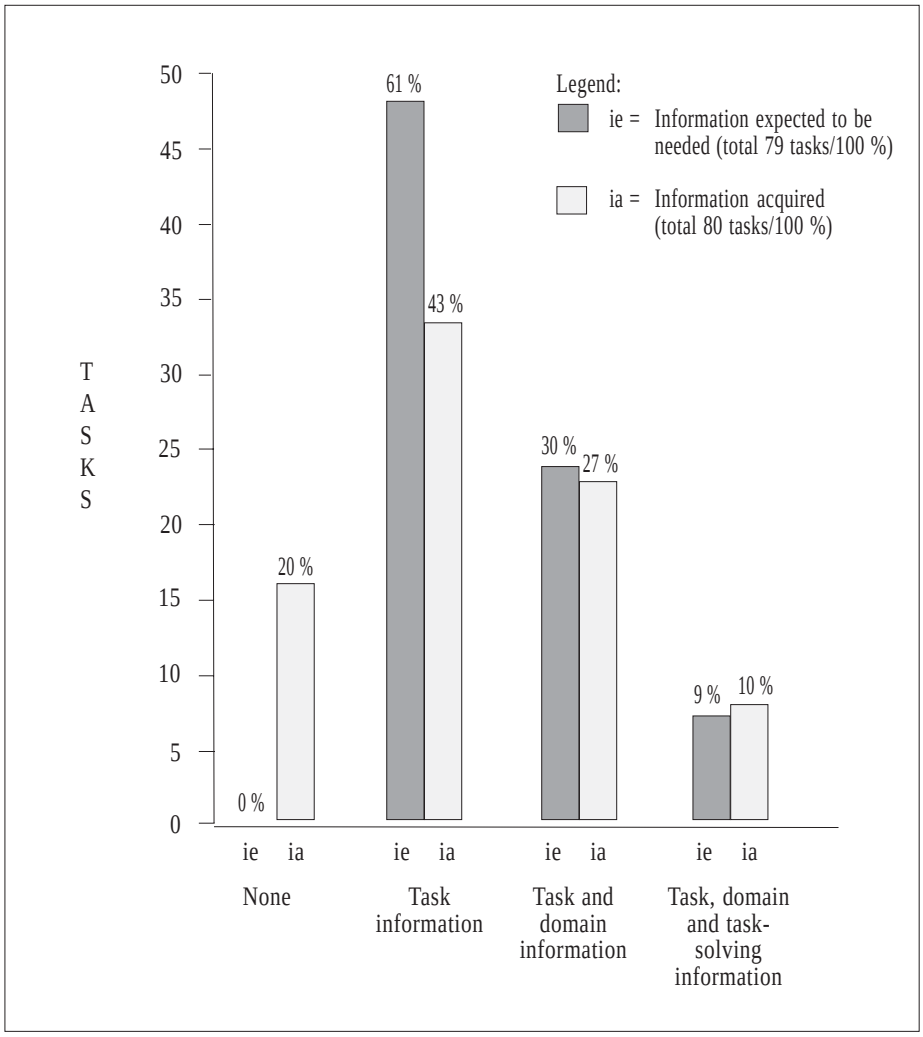

Figure 6.6: Information types anticipated and acquired

The officials seemed to know what information types were needed in their tasks fairly well, which is reflected in both task diaries and questionnaires (see Appendix 3, item 14). There were some occasions where fewer information types were acquired than initially anticipated by the task performer, but there was only one opposite case. This *certainty of information to be acquired* is confirmed by comparing complexity values of both information anticipated to be needed and that actually acquired. The value of information anticipated to be needed was 1.9 and it was 1.7 for information acquired.

6.1.3. Types of information sources

Over five hundred sources were used in the tasks in the sample. An average was 6.5 sources for each task. A detailed specification of source use by the officials is presented in Table 6.4 (see the classification of sources, Chapter 5.2.3., p. 73). *People as sources were clearly more common (60 %) compared to documentary sources (37 %)*, whereas only few visits were made to gather information (3 %). Furthermore, *internal sources* (i.e., sources located inside the organization) *were far more popular than external sources* (i.e., sources located outside the organization) (79 % and 21 %, respectively). Accordingly, internal experts were the most frequently consulted source type: their share of all sources used was about one quarter. Internal official documents were almost as frequently used as internal experts were but most of them were passively received as the initiating documents in the matter.

The officials judged information in paper form to be clearly most important, whereas information in spoken form was placed clearly second (see Appendix 3, item 14). Information in electronic form was still considered to be least important, but constantly increasing in importance. The greatest problems of information in electronic form were considered to be the difficulty in finding information as well as its credibility. In the words of participants:

> "It is often problematic to find information, let's say about a current situation [of old buildings] somewhere, even though there is a register. There is a register [in electronic form] for buildings, but it has been made during such a time and according to such principles, that is risky to trust it. It is indicative, but if one needs exact information about quantity of buildings, retrieving that information is difficult." (T15)

> "For instance, we have The Law of Finland in electronic form. But it takes half a day for me, without a degree in law, to start looking for something in there."

and later:

> "And then the uncertainty, even though it is updated automatically from some statistics, is it real-time and such like..." (T26)

Another participant was generally satisfied with registers (in electronic form)...

> "If one is aware that there might be mistakes. In cases where one has to be absolutely sure, one had better verify it in some other place. But they are fairly good in a preparatory work." (T29)

Table 6.4: Information sources

TYPES OF INFORMATION SOURCES	Share of information sources (n = 508)	Share of tasks where used (n = 78)
People as information sources	*60 %*	*68 %*
int.	75 %	
use per task	3.9	
People concerned	13 %	35 %
int.	24 %	
use per task	0.9	
Experts	30 %	55 %
int.	87 %	
use per task	1.9	
Meetings	17 %	23 %
int.	92 %	
use per task	1.1	
Documentary sources	*37 %*	*92 %*
int.	93 %	
use per task	2.4	
Literature	8 %	21 %
int.	88 %	
use per task	0.5	
Official documents	26 %	90 %
int.	93 %	
use per task	1.7	
Registers (internal)	3 %	14 %
use per task	0.2	
Visits as information source (external)	*3 %*	*15 %*
use per task	0.2	
Total	*100 %*	
int.	79 %	
use per task	6.5	

Legend: *External, if people from outside the organization participate.
Int. stands for the internality within the given source type.

Meetings (17 %) were the third most used source type. Most meetings were internal and the participants were often there due to their expertise in some subject(s). This further strengthens the leading position of internal experts. People concerned (13 %) held the fourth position. They are the only source type with the majority of external sources. Literature (8 %) was placed fifth, although in the questionnaires it seemed to be a source type as important as official documents (see Appendix 3, item 17). Registers came joint last, although their recognition in questionnaires actually anticipated a more frequent use. Registers were used as frequently as visits to obtain information in the tasks in the sample (both 3 %).

The officials did not often have to seek information outside their own organization. As mentioned, only people concerned were mostly external, and clearly so: about three quarters of them were external. However, for the remaining source types the distribution was even more brazed towards internal sources (around 90 %). Overall, there were more external sources among people as sources (25 %) than among documentary sources (7 %).

6.2. RELATIONSHIPS BETWEEN TYPES OF INFORMATION AND INFORMATION SOURCES

The analysis of information types and sources was based on a total of seventy-eight tasks (Table 6.5). There were tasks with no information acquisition at all (16). Task information was sufficient in most tasks (34). There were tasks that required both task information and domain information (22). Additionally, there were a few tasks that also required task-solving information (6).

The information needed to complete the tasks where no information acquisition was necessary was obtained solely from official documents that were enclosed with the matters' initiating documents. Sometimes a concerned person contacted the official preparing the matter for decision-making. As a rule, information obtained from initiating documents was pure task information.

Active information seeking became relevant in tasks that required additional task information. In general, *people as sources were utilised more than documentary sources* (57 % and 41 %, respectively[3]). Experts inside the organization and (passively obtained) official documents were the two clearly most frequently used source types. People concerned from outside the organization, internal meetings and other internal official documents were clearly less used alternatives.

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[3] The percentages represent the share of the specific information source type in the specific groupings of tasks. For instance, in this case tasks that required task information to be acquired for their completion. Note also that the shares do not make the total of 100 % each time. For instance, in this case the share of visits as information sources is not considered.

Table 6.5: Information types and the share, internality, and average source use

TYPES OF INFORMATION SOURCES used	TYPES OF INFORMATION None (task n = 16; source n = 20)	Task inf. (task n = 34; source n = 187)	Task and domain inf. (task n = 22; source n =221)	Task, domain and task-solving inf. (task n = 6; source n = 79)
People as information sources	*10 %*	*57 %*	*62 %*	*71 %*
int.	0 %	71 %	77 %	80 %
use per task	0.1	3.2	6.2	9.3
People concerned	10 %	18 %	12 %	6 %
int.	0 %	15 %	31 %	0 %
use per task	0.1	1.0	1.2	0.8
Experts	0 %	27 %	30 %	40 %
int.	0 %	94 %	80 %	94 %
use per task	0	1.5	3.0	5.1
Meetings	0 %	12 %	20 %	25 %
int.*	0 %	87 %	100 %	80 %
use per task	0	0.7	2.1	3.3
Documentary sources	*90 %*	*41 %*	*33 %*	*25 %*
int.	100 %	97 %	88 %	89 %
use per task	1.1	2.3	3.4	3.3
Literature	0 %	2 %	14 %	9 %
int.	0 %	67 %	90 %	86 %
use per task	0	0.1	1.4	1.2
Official documents	90 %	35 %	17 %	15 %
int.	100 %	99 %	84 %	83 %
use per task	1.1	0.9	1.7	2.0
Registers	0 %	4 %	2 %	1 %
use per task	0	0.3	0.2	0.2
Visits as information sources	*0 %*	*2 %*	*5 %*	*4 %*
use per task	0	0.1	0.5	0.5
Total	*100 %*	*100 %*	*100 %*	*100 %*
int.	90 %	81 %	77 %	78 %
use per task	1.3	5.5	10.1	13.2

Legend: *External, if people from outside the organization participate.
Int. stands for the internality within the given source type.

The role of people as sources was strengthened in tasks where both task and domain information was required (62 % and 33 %, respectively). Experts inside the organization alone were the most consulted sources. Internal meetings followed them. Since there were several experts usually attending the internal meetings, the importance of internal experts was clearly remarkable in these tasks. Internal literature was also fairly frequently used. The share of passively obtained official documents decreased drastically compared with tasks where only task information was needed. Similarly, the share of people concerned from outside the organization decreased somewhat.

Finally, when task-solving information was involved, experts inside the organization were by far the most frequently used sources. As in the previous task category, internal meetings were the second most frequently used sources. Despite the modest use of people concerned, *people as sources were utilised much more than documentary sources* (71 % and 25 %, respectively).

There emerged a clear relationships between the information types needed and the number of sources used. *The more information types it was necessary to acquire, the greater was the number of sources used*. The number of sources increased from about one source per task with no information acquisition to a good thirteen sources per task where all information types were required. Although the use of both people and documentary sources increased when more information types were needed, the *increase was clearly greater for people as sources*. Especially indicative is the difference between experts and official documents considered in absolute numbers of use. Whereas the average of official documents used per task stayed around one or two sources independent of the information types needed, the average use of experts rose from zero in tasks with no information acquisition to a good five experts in tasks where all information types were needed.

Similarly, although not as remarkably, the need for information types affected the use of external sources (Table 6.5). The importance of external sources increased from tasks with no information acquisition to tasks with a need for task information and further to tasks with a need for task and domain information, but remained about the same in tasks with a need for all information types. Thus, the use of external sources seems mainly to be connected to the need for task and domain information. However, the use of internal/external literature that mostly appears to contain domain information, does not follow this trend. This may be due to the distortion caused by the small amount of literature used.

The more distinct trend concerning internality and externality of source use emerged in connection with the two main information types (Table 6.5). *The use of people inside the organization increased as more information types were needed*. The opposite took place in the case of documentary sources, although not as completely. The source internality decreased from tasks where no information was necessary to tasks with a need for task information, and further to tasks with a need for both task and domain information. However, when all three types of information

were necessary, the internality of documentary sources remained at the same level as in tasks requiring task and domain information.

An obvious conclusion from the results is that *people are clearly most important sources for acquisition of all information types*. *Experts especially are sources that are well suited to provide all information types* (Table 6.6). Their shares and absolute numbers increased when more information types were needed. Similarly, *meetings appear to be suitable sources for all information types*. This is understandable, since most people attending the meetings were experts. *People concerned are typical task information sources*. Their shares decreased and absolute numbers were constant from tasks with the need for task information to tasks where all information types were needed.

Table 6.6: Typical sources of information types

Information sources	Task information	Domain information	Task-solving information
People concerned	X		
Experts	(X)	X	X
Meetings	(X)	X	X
Literature		X	
Official documents	X		
Registers	X		

Documentary sources seem to be most used in the acquisition of task information (Table 6.6). Their share of all sources decreased when other information types were also needed. In the light of the results, *official documents are typical task information sources*. Their share decreased as more information types were acquired, and their absolute numbers were fairly constant in tasks where task information was needed. *Literature seems to be connected to domain information*. Its shares and absolute numbers were constant in the two last task categories where domain information was acquired. Thus, the use of literature did not increase when task-solving information was also needed. *Registers seem to be used for acquisition of task information*, although their use was infrequent, the stability of the absolute numbers despite the information types needed clearly implies this.

In sum, official documents, registers and people concerned seem to be mostly used to acquire task information. However, experts and meetings may also be used

to acquire task information. The only typical source for domain information is the literature, but domain information is also available from experts and in meetings. No source type appears to be exclusively used for acquisition of task-solving information, since this information type is acquired from experts and in meetings.

6.3. RELATIONSHIPS BETWEEN TASK COMPLEXITY, TYPES OF INFORMATION AND INFORMATION SOURCES

6.3.1. Task complexity and need for information types

Task complexity was in systematical connection with the need for information types (Fig. 6.7). *The more complex the task, the more information types were needed and thus, the more useful to several tasks the information acquired was*. The officials were able to complete most of the automatic information processing tasks (AIPTs) without acquiring any information at all. If any information was required it was most likely exclusively related to the task in hand, i.e., task information. Accordingly, the complexity value for information needed was low (0.6).

Information with wider usefulness, i.e., domain information and task-solving information, became more important in normal information processing tasks (NIPTs) and decision tasks (DTs). Even though most of the NIPTs could be completed through the acquisition of task information only, many of them also required domain information. The complexity value for information needed was clearly higher for NIPTs (1.7) than it was for AIPTs.

The importance of domain and task-solving information was greatest in DTs. There were only a few tasks where only task information was sufficient. Nearly eighty per cent of DTs involved either domain information or both domain and task-solving information. Accordingly, the complexity value for information needed for DTs was rather high (3.2). Thus, there emerged a clear and almost linear rise of the complexity values for information between the three task complexity categories.

Some aspects related to task complexity, i.e., task duration, subject expertise, task ambition and frequency of similar tasks, were also considered in connection with the need for information types. These relationships were very similar to those between task complexity and information types (Fig. 6.7). The longer the task duration, the more information types were needed. The lower the subject expertise, the more information types were needed. The higher the task ambition, the more information types were needed. The lower the frequency of similar tasks attended, the more information types were needed. Accordingly, task complexity may be seen to represent these related aspects well.

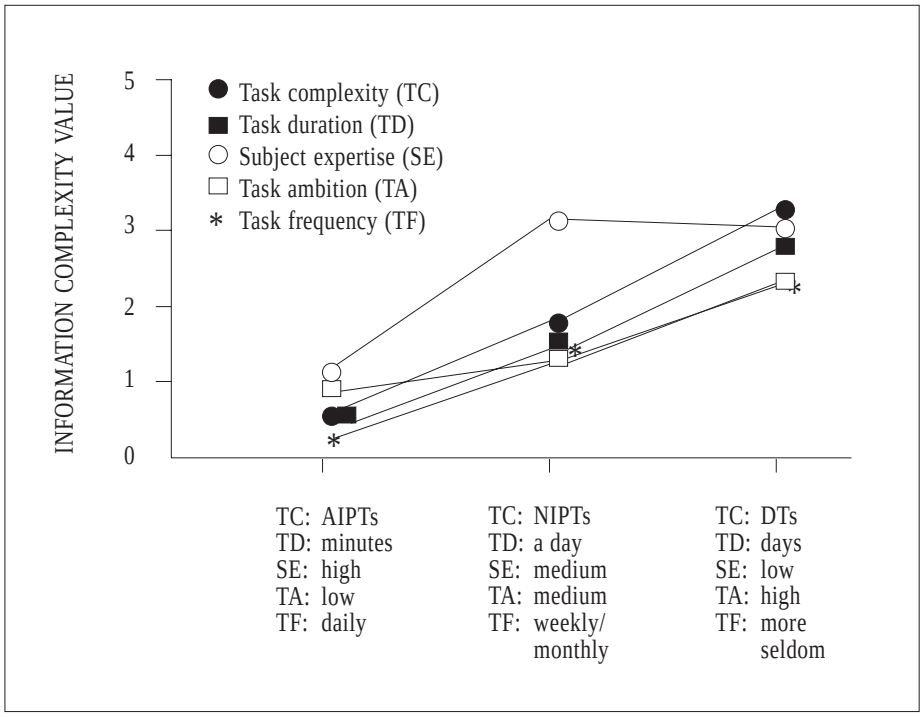

Figure 6.7: Information types and task complexity and some other related aspects

6.3.2. Task complexity and information source use

The use of people as sources increased with task complexity (Table 6.7)[4] . Documentary sources (65 %) were clearly the most used sources in tasks of least complexity (AIPTs). The single, most used source type was official documents that were passively obtained, that is, as a part of the initiating documents of the matter. There was a considerable difference between those and the other source types. Occasionally, internal meetings, people concerned from outside the organization, experts inside the organization, and other internal official documents were consulted.

People as sources were clearly more used than documentary sources in NIPTs (58 % and 39 %, respectively). However, official documents and experts that were

[4] A similar analysis was conducted for the aspects related to task complexity, i.e., task duration, task ambition, frequency of similar tasks, and subject expertise. The information source use was similarly distributed in connection with the related aspects as to task complexity. These analyses are available in Appendix 4.

Table 6.7: Task complexity and source use

TYPES OF INFORMATION SOURCES used	TASK CATEGORY AIPTs (source n = 57; task n = 26)	NIPTs (source n = 295; task n = 35)	DTs (source n = 156; task n = 17)
People as information sources	*31 %*	*58 %*	*72 %*
int.	61 %	69 %	86 %
use per task	0.7	4.9	6.7
People concerned	9 %	18 %	5 %
int.	0 %	23 %	50 %
use per task	0.2	1.5	0.5
Experts	10 %	26 %	42 %
int.	83 %	86 %	89 %
use per task	0.2	2.2	3.9
Meetings	12 %	14 %	25 %
int.*	86 %	95 %	90 %
use per task	0.3	1.2	2.3
Documentary sources	*65 %*	*39 %*	*25 %*
int.	100 %	92 %	87 %
use per task	1.4	3.3	2.2
Literature	5 %	8 %	9 %
int.	100 %	88 %	86 %
use per task	0.1	0.7	0.8
Official documents	56 %	27 %	15 %
int.	100 %	92 %	87 %
use per task	1.2	2.2	1.3
Registers	4 %	4 %	1 %
use per task	0.1	0.3	0.1
Visits as information sources	*4 %*	*3 %*	*3 %*
use per task	0.1	0.3	0.3
Total	*100 %*	*100 %*	*100 %*
int.	84 %	76 %	83 %
use per task	2.2	8.4	9.2

Legend: *External, if people from outside the organization participate.
Int. stands for the internality within the given source type.

the most used sources, were used equally much (27 % and 26 %, respectively), but about one half of official documents was passively obtained. Nevertheless, official documents were used in more tasks than experts were in this category (Table 6.8). The overall popularity of people depended on the frequent use of both people concerned and meetings which both were used more often than the remaining two types of documentary sources (literature and registers).

Table 6.8: Share of tasks where particular sources were used

TYPES OF INFORMATION SOURCES used in tasks	TASK CATEGORY AIPTs share of tasks where used (n = 26)	NIPTs share of tasks where used (n = 35)	DTs share of tasks where used (n = 17)
People as information sources	*23%*	*86 %*	*100 %*
People concerned	15 %	49 %	35 %
Experts	12 %	69 %	94 %
Meetings	8 %	23 %	47 %
Documentary sources	*100 %*	*91 %*	*82 %*
Literature	8 %	17 %	47 %
Official documents	100 %	91 %	71 %
Registers	8 %	23 %	6 %
Visits as information sources	*4 %*	*20 %*	*24 %*
Total internal*	100 %	100 %	94 %
external**	19 %	60 %	65 %

* the share of tasks where internal sources have been used
** the share of tasks where external sources have been used

People as sources were overwhelmingly more popular than documentary sources in DTs (Table 6.7). Experts inside the organization alone were more popular than all documentary sources. Furthermore, meetings were as popular as all documentary sources (25 %). People concerned were consulted only occasionally (5 %); both official documents and literature were used more often.

Task complexity emerged to be related to the number of sources used as well as their location, i.e., internality or externality for the organization (Table 6.7). The number of sources used increased drastically from AIPTs (2.2) to NIPTs (8.4), but the average number of sources used in DTs (9.2) was only somewhat higher than in NIPTs. In general, the share of internal information sources throughout all task

complexity categories was about eighty per cent. However, opposite trends emerged in the use of main source types, i.e., people as sources and documentary sources (Table 6.7). *The internality of people as sources increased with task complexity*. The relation was *the opposite in the use of documentary sources*.

Table 6.9: Task complexity and the use of fact-oriented, task-oriented and general-purpose sources

TYPES OF INFORMATION SOURCES used	TASK CATEGORY AIPTs (source n = 57; task n = 26)	NIPTs (source n = 295; task n = 35)	DTs (source n = 156; task n = 17)
General-purpose sources	*28 %*	*49 %*	*76 %*
int.	88 %	89 %	88 %
use per task	0.5	4.1	7.0
Task-oriented sources	*68 %*	*47 %*	*23 %*
int.	82 %	60 %	67 %
use per task	1.5	4.0	2.1
*Fact-oriented sources**	*4 %*	*4 %*	*1 %*
use per task	0.1	0.3	0.1
Total	*100 %*	*100 %*	*100 %*
int.	81 %	75 %	83 %
use per task	2.2	8.4	9.2

* fact-oriented sources (i.e., registers) were always internal in the present sample.
Int. stands for the internality within the given source type.

Source use was also considered in terms of fact-oriented, task-oriented and general-purpose sources (Table 6.9). The increasing share of general-purpose sources and the decreasing share of task-oriented sources were clearly related to the increase of task complexity. The use of pure fact-oriented sources was very limited. The internality of sources was both high and constant among general-purpose sources, whereas it was both lower and more varied among task-oriented sources. The internality of task-oriented sources was highest in the category for the simplest tasks (AIPTs) and lowest in the middle task category (NIPTs). The number of general-purpose sources used per task in each task category increased constantly with task complexity. Again, the number of task-oriented sources was more varied.

In absolute numbers, the use of task-oriented sources was lowest in AIPTs and highest in next task category (NIPTs), whereas it stayed in between in the most complex tasks in the sample (DTs).

6.3.3. Task complexity, need for information types and information source use

To elaborate the relationships between all three main characteristics the tasks were divided into groups according to the information types needed within different task complexity categories (Table 6.10). In five sub-categories, the number of tasks was close to ten or more. Four of them formed two comparable pairs, that is, tasks of different levels of complexity with a need for the same type(s) of information. The first pair was ten AIPTs and twenty NIPTs where sole task information was needed, and the second pair was eleven NIPTs and nine DTs where both task and domain information were needed. The additional one sub-category was fourteen AIPTs with no information acquisition. The remaining seven sub-categories consisted of only a few tasks. The lack of tasks in these sub-categories was consistent with the level of task complexity.

It seemed that more information types were anticipated than actually were acquired at the low level of complexity, and vice versa at the high level of complexity. The analysis shows that need for task information was anticipated in most AIPTs, but that many of them did not actually lead to any information seeking at all. In most NIPTs, the information anticipated was also acquired. The multiple information types were usually anticipated from the beginning in DTs, and they were acquired even more often.

On the basis of the sub-categories that included about ten or more tasks, *the number of sources used seems for the most part be systematically increasing from the least complex tasks with no information acquisition to the most complex tasks where all three information types were required*. Thus, it appears that both task complexity and the need for information types increase the number of sources used. The otherwise clear trend is contradicted by DTs where both task and domain information were needed. In these tasks, fewer sources were used compared with NIPTs where similar information was needed. On the other hand, NIPTs with a need for both task and domain information yielded a voluminous source use. No evident reason for this emerged.

The use of internal sources was overwhelming in all sub-categories. Contrary to expectations, *it seems that task complexity or information types do not evoke any general effects on the internality and externality of source use*. The shares of internal sources were fairly constant throughout all tasks. This might partly depend of the large size of the organization with a lot of expertise in various subjects located within it. Consideration of typical sources shows that *experts inside the organization are*

Table 6.10: Task complexity, need for information types and source use

EFFECTS OF TASK COMPLEXITY on	TASK CATEGORY AIPTs -	T	TD*	TDTS	NIPTs -*	T	TD	TDTS*	DTs -	T**	TD	TDTS
Shares of tasks (%)												
– anticipated	0	**88**	12	0	0	**60**	**31**	9	0	22	**56**	22
– acquireed	54	**38**	8	0	6	**57**	**31**	6	0	21	**47**	32
Number of sources used	1.2	**3.6**	2.0	-	1.5	**6.7**	**13.1**	7.5	-	5.0	**8.7**	14.5
Internality of sources	94	**81**	75	-	66	**78**	**83**	47	-	85	**81**	86
Typical source	POD	**POD**	POD	-	POD	**IE/POD**	**IE**	EE	-	IE	**IE**	IE
Source type (%)												
– people	6	**44**	25	-	33	**58**	**60**	47	-	70	**69**	77
– documentary	94	**50**	75	-	67	**41**	**36**	40	-	25	**27**	21
– visits	0	**6**	0	-	0	**1**	**4**	13	-	5	**4**	2
Source type (%)												
– fact-oriented	0	**6**	0	-	0	**5**	**3**	0	-	0	**0**	2
– task-oriented	100	**53**	75	-	100	**57**	**35**	73	-	40	**28**	10
– general-purpose	0	**41**	25	-	0	**38**	**62**	27	-	60	**72**	88

Legend: Sub-categories with nine or more tasks in bold face.
- = no information acquired; T = only task information acquired; TD = task and domain information acquired; TDTS = task and/or domain and task-solving information acquired; POD = internal passively obtained official documents; IE/EE = internal/external experts
* based on only two tasks; ** based on only four tasks

typical sources in more complex tasks, whereas *passively obtained internal official documents are common in simple tasks*. It seems that task complexity does partly determine the type of sources used independent of the need for information type(s). Passively obtained, internal official documents were the most used specific source type in AIPTs with the need for only task information. In NIPTs with the need for the same type of information, internal official documents were used to the same extent as experts inside the organization. These experts then turn out to be the most consulted source type in the rest of the sub-categories where multiple information types were needed.

Two parallel analyses were conducted in relation to source use (Table 6.10). The first of them is based on main source types, i.e., people as sources, documentary sources and visits as sources[5] . In accordance with the previous analysis of typical source type, *increasing task complexity leads to increasing use of people as sources*. This more specific analysis confirms that task complexity directly affects source use. The use of people increased from AIPTs with no information acquisition to DTs that required all three information types. Thus, the importance of people as sources was higher in NIPTs than in AIPTs, where only task information was sufficient. It was also higher in DTs than in NIPTs where both task and domain information were needed. A corresponding decrease took place in relation to the shares of documentary sources. The use of visits as sources is so scarce that their relation to sub-categories remains indifferent.

The second analysis of source use is based on general source types in terms of fact-oriented, task-oriented and general-purpose sources (Table 6.10). This examination did not indicate any distinct trend, but some directions emerged. Again, in accordance with the analysis of the typical source type, *the use of task-oriented sources decreased and the use of general-purpose sources increased in tasks of greater complexity*. However, the share of general-purpose sources was marginally higher in AIPTs than in NIPTs when only task information was needed. Thereafter the trend again favours the general-purpose sources in the sub-categories. Like visits above, the use of fact-oriented sources remained indifferent.

6.3.4. Summary: the effects of task complexity on information source use mediated by information types

When task complexity was added to the examination, it seemed to affect the information activities (in terms of need for information types and source use) related to the performance of tasks in several ways. On the basis of the findings in a local

[5] There is also a more detailed analysis conducted on the basis of the specific source types. This is available in Appendix 5.

Table 6.11: A typical AIPT, NIPT and DT

Characteristics	*Typical Automatic Information-Processing Task*	*Typical Normal Information-Processing Task*	*Typical Decision Task*
Task complexity	Task performer knows from the beginning how the task is going to proceed to completion.	Task performer is fairly confident about the progress of the task, but some task-based consideration is involved.	Task performer has clearly several alternatives to proceed, but there are still certain regulations to follow.
Ambition	The task will at most involve a moderate level of ambition.	The task may even involve a high level of ambition.	The task is likely to involve a high level of ambition.
Subject expertise	The task performer is familiar with the matter in hand.	The task performer is fairly familiar with the matter in hand.	The task performer is unlikely to be thoroughly familiar with the matter in hand.
Task frequency	Similar tasks are performed almost daily by the task performer.	Task performer attends to similar tasks on a less than monthly basis.	Task performer attends to similar tasks on a less than monthly basis.
Information needed	Only task information is usually expected to be needed and also acquired, although sometimes no information at all need to be acquired.	Task information will probably be sufficient, although task domain information may also be needed.	A combined need for both task and domain information is probable, but the task may well also require task-solving information.
Information sources used	Only few sources are used. They are usually internal documentary sources, which are received without any effort by the task performer.	Numerous information sources are used, some even outside the work organization. Experts and official documents are most likely information sources.	Numerous information sources are needed. The internal experts are heavily utilised.
Duration	Task performance only takes some half hour.	Task will be completed within one working day.	Task performance requires several days.
Task complexity alterations	Personal task complexity estimation will remain the same both before and after task performance.	Initial task complexity estimation is unlikely to alter after task performance.	Task complexity may well be considered to be higher or lower after the task performance than at the beginning.

government setting, a typical task for each task complexity category may be defined (Table 6.11).

An automatic information processing task (AIPT) is usually completed within a half an hour and similar tasks are performed on a daily basis. The subject of the task is familiar to its performer, who either is pleased with a fair result or wants to achieve a good result. Normally the task is expected to be completed with only task information. This is also the information type that is usually needed, if any information acquisition at all is necessary. If information is acquired, only few sources are used. Documentary sources are more usual compared to people as sources. The sources used are also likely to be internal. As a rule, an official document, which is passively acquired as part of the initiating documents of the matter, is a primary source of information. This explains why some tasks did not cause any information need: information that was necessary for task completion was already included in the initiating documents of the matter.

A normal information processing task (NIPT) takes typically about a day to complete and similar tasks are performed on a less than monthly basis. The subject of the task is usually somewhat less familiar than in AIPTs, and ambition is either to achieve a good result or a very good result. Like the typical AIPT, so only task information is anticipated in the typical NIPT, although occasionally a need for domain information may be recognised. The information expected to be needed in most cases is also acquired. On the average, the typical NIPT leads to the use of about eight sources. Two of them are probably external. People as sources are used more than documentary sources. Official documents and experts, especially inside the organization, are the most important source types. People concerned from outside the organization and internal meetings are also fairly frequently used sources.

A decision task (DT) usually requires several days to complete and the frequency of similar tasks is less than once a month. The task performer's familiarity with the subject matter is less than in AIPTs and NIPTs. The task performer often strives to achieve a very good result. A need for a combination of task and domain information is commonly anticipated. Sometimes, the information need may also include task-solving information. Somewhat more sources are required for a typical DT than in a typical NIPT. People as sources are used far more than documentary sources, experts inside the organization being the single most important source type. Internal meetings where participants are often experts are also well utilised sources.

The comparison of the task complexity categories with each other illuminated several relationships between task complexity and information activities studied. Even though the results reveal certain relationships, their total causality remains open. This is mainly because the study has been conducted in a naturalistic setting where it is difficult to include all preceding relevant aspects in the consideration (cf. Chapter 4). For instance, it is possible – and even likely – that previous successes and failures to acquire certain information may affect the perceived level of task complexity, or that information resources available alter the perceived need for

information types. Thus, even though an information need is traditionally understood as, in principle, a precedent to information seeking, this relationship may be much more intertwined in practice. This said, a list of emerging relationships between task complexity and information activities in the studied setting follows:

1. The more complex the task, the more information types are required, that is, the more complex and the more useful for several similar tasks the information sought is[6].
2. The information anticipated to be needed is usually more comprehensive than the information actually acquired at the low level of complexity, and vice versa at the high level of complexity.
3. The use of people as sources increases with task complexity, mostly because of the information types needed, but also independent of them.
4. Generally, the use of task-oriented sources decreases and the use of general-purpose sources increases in tasks of greater complexity, mostly because of the information types needed, but also independent of them.
5. Experts inside the organization are typical sources in more complex tasks, where several information types are required. Passively obtained internal official documents are common in simple tasks where usually only task information is needed.
6. The effects of task complexity on internality/externality of sources are more subtle than expected. The overall shares of external and internal sources are rather constant throughout all tasks despite task complexity and information types needed. However, the use of people inside the organization increases with task complexity and the need for multiple information types, whereas the direction is the opposite in relation to documentary sources.
7. The number of sources used increases as more information types are needed and with increasing task complexity. However, the number of sources increases more constantly in connection with information types than with task complexity.

In the light of the results of the study, task complexity, the need for information types and source use seem to be clearly linked together. *The complexity of tasks evokes a need for certain information types. This mainly determines the source use, but task complexity also modifies it directly.*

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[6] However, the information is likely to be less *directly* applicable (i.e., be in a suitable form) to the task when its complexity increases (cf. Byström & Järvelin, 1995; Studies I and II). In other words, the more useful information is in several tasks, the more general is its form, whereas the more directly applicable information is to a particular task, the more specific is its form.

Chapter 7

Discussion and conclusions

7.1. EMPIRICAL DISCUSSION: RESULTS OF THE CASE-STUDY

This research elaborated *the relationships between perceived task complexity, the need for information types and the use of sources*. The findings corroborate that task complexity evokes a need to acquire certain information types, and that this leads to the use of certain source types. Moreover, there was evidence that task complexity also directly affects the source use. This is a general result from the empirical study in a Finnish local governmental setting. For the most part the findings are in line with the earlier theoretical and empirical findings (e.g., Studies I–III; Byström & Järvelin, 1995; Järvelin, 1986, 1987; Gorman, 1995; Tiamiyu, 1992; Culnan, 1983, Pinelli et al., 1993; Vakkari & Kuokkanen, 1997; Vakkari, 1998). However, they both clarify and extend some of them. The specific findings are discussed below.

7.1.1. Information types needed and information sources used

The anticipated relationships between information types and source types (cf. Chapter 4.1.1., p. 53) were in general confirmed. As Järvelin (1986; 1987) proposed, particular information types were acquired from certain source types. Additionally, the results show that experts and meetings were extremely useful sources of all information types (the relationships a, b, and c in Fig. 7.1). There were several kinds of sources for task information. As expected, official documents, registers and people concerned were typical sources of task information in the present setting. Moreover, task information was also obtained from experts and meetings. As expected, literature was particularly connected with domain information, but generally this information type was acquired from experts and meetings. Finally, as expected, methodological/instructional task-solving information was typically available from knowledgeable persons, since experts and meetings were its main sources. These

findings are clearly in line with findings in medicine (cf. Gorman, 1995). This indicates that the classifications of both information types and sources as well as the relationships between the information types and their sources may well be generally valid in other professional contexts, too.

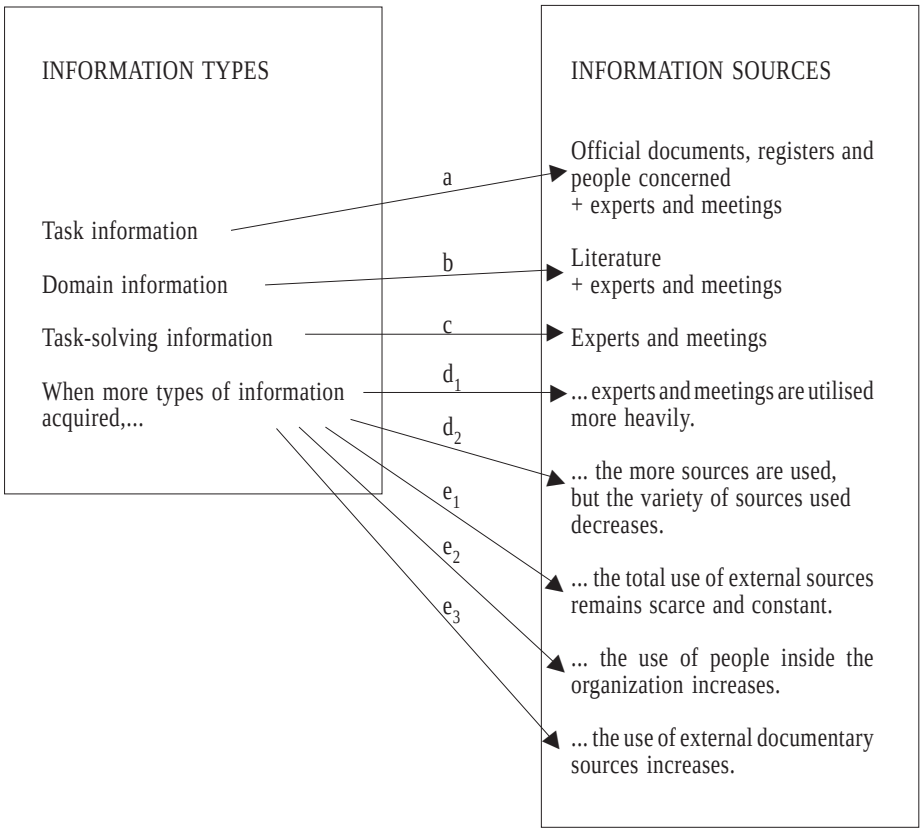

Figure 7.1: Information types and their sources in a local-governmental setting

Similarly, as expected, the number of sources used increased as more information types were needed (the relationship d_1 in Fig. 7.1). However, the use of all types of sources did not increase evenly. The use of experts and meetings *increased constantly* as more information types were acquired. The sources used mainly to gather task and domain information were used fairly consistently throughout all tasks where these information types were needed.

People were clearly more used than documentary sources regardless of information types needed. This result is well in line with a number of studies where human contacts have been found to be the most important sources (e.g., Grosser, 1991; Gorman, 1995; Baldwin & Rice, 1997; Zeffane & Cheek, 1995). However, the present study revealed that whereas the use of people as sources is clearly more voluminous, the documentary sources are more evenly used throughout all tasks. Indeed, the use of a documentary source is more probable than consultation with a person during any given task performance in the present setting.

Only few source types were utilised in two opposite groups of tasks. The small variation in sources used is not surprising in tasks where documents following with the initiation of the case included all necessary information. It is clearly more surprising in tasks where all information types were needed (the relationship d_2 in Fig. 7.1). The shares of different source types give an impression of little use of other sources than experts and meetings. However, the examination of absolute numbers shows a fairly consistent use of these other sources whereas the number of experts and meetings clearly increases.

Rather surprisingly, the use of external sources did not increase when several information types were needed (the relationship e_1 in Fig. 7.1). Less surprisingly, the use of internal sources was overwhelming in the present study. As a rule derived from the literature, internal sources are generally more used than external ones in several organizational settings (e.g., Keegan, 1974; Tushman, 1978; Tiamiyu, 1992; Correia & Wilson, 1996). Some reasons for their dominance are their easy availability, content suitability and tendency to prevent conflicts (e.g., Daft & Lengel, 1986; Trevino & Webster, 1995). Additional reasons for this vast internality in the present setting might be the large size of the organizations (not only in terms of the number of employees, but also in terms of the diverse field of activities) and both the nature (public administration) and the long history of the organizations. Thus, there is a lot of expertise accumulated within them. First, they have a well-developed and voluminous documentation about past cases. Second, the employees are working in a diversity of fields, which they are thoroughly familiar with. In this light, the intensive use of internal experts, meetings and official documents is logical.

There emerged marginal, yet distinct trends concerning the internality of people and documentary sources (the relationships e_2 and e_3 in Fig. 7.1). People inside the organization were increasingly utilised as more information types were needed. More exactly, the use of experts inside the organization and internal meetings increased (i.e., sources for all information types). By contrast, the use of people concerned (i.e., sources of task information) – typically people outside the organization – remained fairly constant as long as task information was needed. Thus, it seems that domain and task-solving information is best obtained from internal sources (cf. Gorman, 1995). This makes sense, since task-solving information especially is closely connected with the organizational practices.

On the other hand, the shares of external documentary sources increased as more information types were needed. People as sources are flexible and able to alter their knowledge base. By contrast, the content of documentary sources is normally unchanging. This content stability of documentary sources may be the reason why they more often need to be supplemented with sources from outside the organization.

7.1.2. Task complexity, information types needed and information sources used

The core of the study was to analyse the effects of task complexity on the basic relationship between information types and sources. Principally, task complexity affected the need for information types, which further directed the use of sources. Moreover, the results also show a direct relationship between task complexity and source use.

First of all, the more complex the tasks, the more information types were needed (the relationship a_1 in Fig. 7.2). The simplest tasks required only task information. Often this information was already obtained together with the initiating documents of a matter. Thus, in routine task, only information specific to the matter was considered necessary. General aspects of these tasks and ways to perform them were already familiar to task performers. Thus, there was no need for domain or task-solving information. The more complex tasks involved several information types. Not only was information specific for the matter at hand necessary, but the general aspects of the task and occasionally the ways to perform it also needed to be clarified. Consequently, task and domain information or even all three information types were more often needed.

Task complexity seemed not only to lead to the need for several information types, it was also related to uncertainty about the information needed (cf. Kuhlthau, 1997). Task performers were able to anticipate more certainly the information types needed in simple tasks than in more complex tasks (the relationship b in Fig. 7.2). Whereas an information type was more likely to be left unobtained on the low level of task complexity, an additional information type was obtained on the high level of task complexity.

The generally acknowledged relation between the increasing number of sources used and increasing task complexity was supported by the findings of the present study (e.g., Tiamiyu, 1992; Culnan, 1983; Vakkari, 1998) (the relationship a_2 in Fig. 7.2). However, whereas the number of sources used increased notably from the least complex tasks to the next (i.e., from tasks where no information or only task information was needed to tasks with a need for at least task information and sometimes also domain information), only a small increase took place between the two highest levels of task complexity in the present study (i.e., to tasks with a need for at least task and domain information and sometimes also task-solving information).

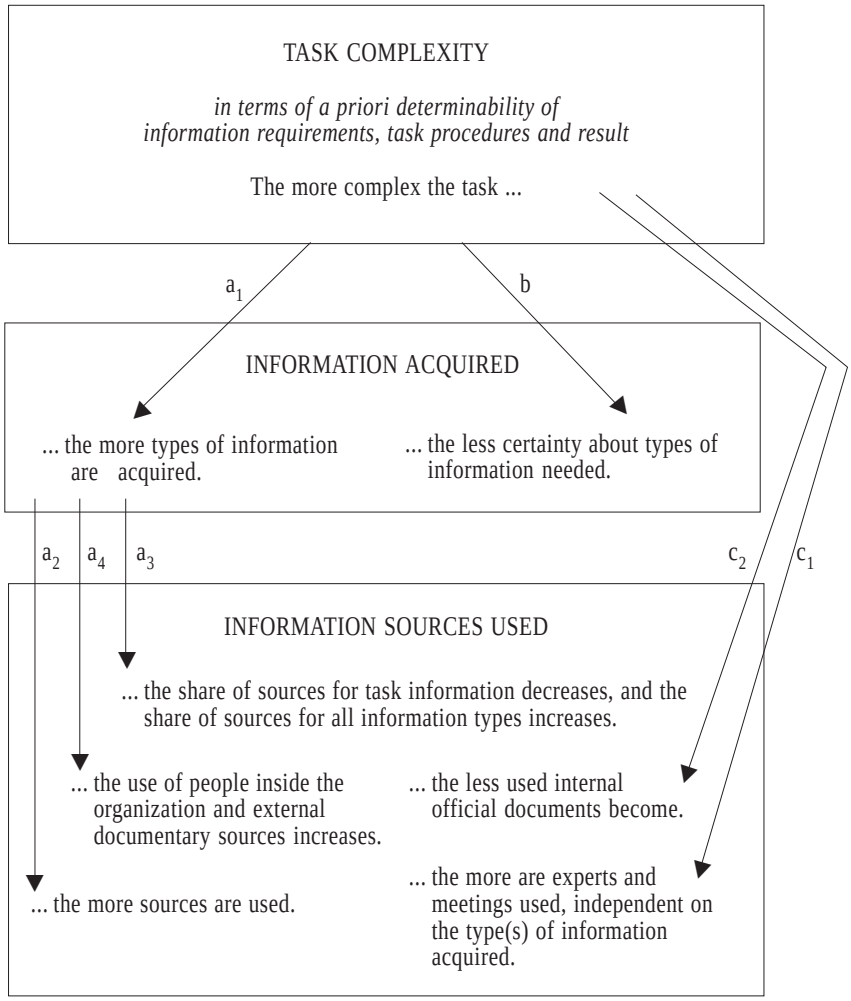

Figure 7.2: Task complexity, information types and sources in a local-governmental setting

Thus, it seems that differences in source use between the higher levels of task complexity are more closely related to the selection of source types than simply to the number of sources used.

Source use was basically related to the need for information types (the relationship a_3 in Fig. 7.2). Sources of task information were most popular in the simplest tasks (i.e., official documents and people concerned), and sources of domain and task-solving information (i.e., experts and meetings and literature) became relatively more popular as task complexity increased and several information types were

needed. This finding is in line with media richness literature, where it is commonly stated that text-based media are connected with routine tasks, whereas media that appear more flexible (e.g., face-to-face, video conferencing and telephone) are better suited to complex tasks (e.g., Daft & Lengel, 1984; Hart & Rice, 1991).

Even though the internality of sources was constantly high despite task complexity, it yielded inverse trends in relation to people as sources and documentary sources (the relationship a_4 in Fig. 7.2). Generally, the more complex the task, the more information types were needed, and the more persons inside the organization and the more external documentary sources were used. Moreover, increasing task complexity was directly related to increasing use of experts inside the organization and meetings (the relationship c_1 in Fig. 7.2). These sources were used clearly more to acquire even the same type(s) of information in more complex tasks. Simultaneously, internal official documents were put to less use (the relationship c_2 in Fig. 7.2). *This implies that high task complexity – almost in spite of the information types required – is best managed with flexible sources*. It is likely that the experts inside the organization are able to orientate their prior knowledge to the more complex matters, whereas the less flexible documentary sources cannot adapt to the same extent, leading to acquisition of new documentary sources.

The conclusion above is strengthened when the variation of sources used is considered in relation to task complexity. Unchangeable official documents were the single most used source type in the simplest tasks, where only task information was needed. The source type variance was highest on the next level of task complexity, where either task information alone or together with domain information was needed. However, on the highest level of complexity source use concentrated on flexible sources, such as experts and meetings. Thus, Tiamiyu's (1992) finding that internal files were inversely related to increasing task complexity is supported. However, Tiamiyu (1992) did not find any connection to the consultation of people who work within the organization. The absence of this relationship is clearly contradictory to the findings of the present study. Furthermore, the result of the present study does not support the claim that task complexity is related to the increasing use of nearly all kinds of sources (e.g., Culnan, 1983). Although this is the case in the initial increase of task complexity, the relative importance of flexible sources becomes clearly more distinct as task complexity increases further.

7.2. METHODOLOGICAL DISCUSSION: EVALUATION OF THE RESEARCH METHOD

All methodological decisions can be traced back to the decision to conduct the study in a real-life work context. This decision was taken, not only because it allowed an examination of everyday work-related information activities, but also because it allowed those activities to be seen as a part of another action, *(work) task performance*.

Although task-based scrutiny of human behaviour has been a normal procedure for studies in laboratory settings, it has been much more rare in examinations of information activities in real-life settings. Instead, many studies have focused on work-based information activities at the level of individual jobs (cf. organizational studies and information seeking studies). This change of the level of analysis proved to be one of the main advantages of the present study, since it provided a more concrete and precise context for the information activities studied.

Although the perspective chosen was that of professionals performing their tasks, the observation unit was a task. Thus, an action-centred perspective was emphasised as in contrast to both person and context-centred approaches. Even though task performance is seen to depend on the performer and her understanding of the task, neither the performer nor her perceptions and actions are free from her social environment (e.g., organization) (e.g., Salancik & Pfeffer, 1978; Giddens 1979, 1984; Rosenbaum, 1993; Wilson, 1997a, 1997b). Thus, it is plausible to expect that many tasks in a specific work environment are more or less similarly perceived, and also so performed regardless of the task performer, as long as a necessary level of competence is maintained. The aspects of competence (e.g., education and experience) are normally considered by the work organization when a person is employed. Thus, by taking tasks as a starting point, it was possible to study the everyday information activities of a particular type of professionals, Finnish municipal administrators.

Although action, task performance, was emphasised, the empirical part of the study was not as process sensitive as was afterwards considered optimal. This was unfortunate, since this type of analysis ought to have provided an even more profound understanding of the effects of task complexity on the information activities studied. On the other hand, the present empirical findings complement the knowledge about the relationships studied, and provide a sound basis for adding true process thinking to following empirical studies.

The most problematic methodological decision concerned the classification of tasks into different complexity categories. Fundamentally, this difficulty was a consequence of the inexactness of the concept of task complexity itself. The varying amount of subjectivity that is embedded in work led to the preference for the perceptions of task performers about task complexity. Even if a detailed, formal task description is delivered to a task performer, which is improbable in real-life settings, or if there is an intuitively shared description of the task among people performing similar tasks, the actual task performance is still based on a particular task performer's perception of it. Since the information activities focused on in the present study are seen as a part of the task performance processes, it also makes the information activities accordingly dependent on that perception.

The operational aspects of the chosen task categorisation were problematic. First of all, the classification criteria connected with the task categorisation are universal, which makes the categorisation attractive for several domains. But as

such it offers only general guidelines for classification. It was possible to create more exact criteria by focusing on the *a priori* determinability of tasks. In order to capture the subjectivity and simultaneously be able to create a collectively representative task sample, the ideas of triangulation were utilised (e.g., Denzin, 1989; cf. Lincoln & Guba, 1989). First, tasks were classified by their performers. Second, the task performers were asked to describe their tasks in detail, so that the researcher was able to make her estimation about the task category. Third, the participants considered several related aspects that could be measured. These measurements were then compared with the classifications of task performers. As a result, only three classifications of the total of 80 tasks were altered. Thus, the task classifications by task performers themselves were considered to be highly valid and consistent. This may depend to large extent on the fairly long experience of nearly all participants.

There are also a few more technical aspects that ought to be discussed. The second part of the task diaries (Part II, Journal for Progress in the Task) was changed to be less structured compared with the earlier studies by the present author (Studies I–III). In these studies the participants filled in columns for channels and sources used as well as the success in acquiring the information wanted from a source and its direct applicability to the task. The modification proved to be a less fortunate decision. With the less structured journals it was difficult to keep track of information channels used and the exactness of evaluations considering sources used suffered. The data on these aspects proved to be so poor that they were totally excluded from the final analysis. If the losses of the more exact data considering the above aspects are weighted against the somewhat more exact picture about the steps during task performances, the gain is considered to be less valuable with the less structured journals used in the present study. With the experience gained, it seems to be more fruitful to use more structured journals and conduct less structured subsequent interviews to capture the vivacity of the task performance processes.

Another aspect concerned the recording of situational factors. A frequently mentioned situational factor in other studies, lack of time, was not raised except in a few cases in the present study. Although lack of time was, according to the questionnaire results, clearly the most often mentioned negative aspect of the work of municipal administrators, it was not mentioned in the task diaries or in the following interviews. This is difficult to explain. It might be that the participants were able to conduct their specific duties without the hindrance of lack of time, whereas the satisfaction of other kinds of information needs (e.g., nutritional or orientative information needs by Feinman et al., 1976) was suffering from the little time available for them.

Finally, the examination concentrating on individual tasks reveals only information activities connected to task performance. It is not realistic to expect that by this type of examination all kinds of information activities, even in relation to

work duties, could be scrutinised. For instance, managers scanning their environment or researchers keeping up with the development in their area of research are not task processes with recognisable beginnings and ends. Such information activities are related to continuous processes, which requires another kind of approach than the used one in this study. However, since a considerable amount of work is performed as task processes, this approach is clearly justified and supported as a method to gain a more comprehensive understanding of work-related information activities.

7.2.1. Task complexity reconsidered

The present study corroborated the finding that task complexity is an important factor for understanding information activities. However, it is a factor that has proved to be difficult to define exactly, and subsequently, it is difficult to operationalise (cf. Wood, 1986; Campbell, 1988). This, or the related aspect of task difficulty, has been used in several studies, especially in psychological and organizational ones. However, its use has often been rather imprecise level (e.g., simple – complex, or easy – difficult) without considerations of comparability outside the individual study. Recently, task complexity has attracted increasing attention within INSU research (e.g., Vakkari, 1998, forthcoming; Kuhlthau, 1997, 1999, forthcoming; Gorman, forthcoming). A reconsidered view on the concept is offered below on the basis of the experiences from this study.

As Campbell (1988) points out, task complexity has generally been considered either as an objective or as a perceived task characteristic. In order to approach task complexity strictly objectively in any research setting, certain preconditions must be fulfilled. Some of them are absolute. At least, complete, exactly measurable criteria of complexity are required. Moreover, complete task descriptions need to be available. These two preconditions alone are problematic. First, there is no complete and common agreement as to which aspects to include in the definition of task complexity as a concept, let alone operationalise it in the required manner. There are *certain aspects* that are *usually* connected to task complexity (e.g., number of requirements, number of possible ways to perform the task, time available, etc.), but they are far from being complete and exactly measurable (e.g., all requirements are not equally significant). Second, complete task descriptions are available in very few field research settings. Moreover, the task descriptions are likely to change over time. Let two examples illustrate the problems of objective task complexity:

> Aspects considered to be objective by Campbell (1988) (e.g., multiple paths, multiple outcomes, and uncertain or probabilistic linkages) or by Wood (1986) (e.g., component complexity, coordinative complexity and dynamic complexity) for a particular astronomical task (e.g., determining the organization of planets

in our solar system) are probably not the same considered at different times (e.g., five hundred years ago vs. today vs. in five hundred years) or in different contexts (e.g., in space research vs. as a school assignment).

Moreover, there is the issue of on whose terms the objective task complexity ought to be determined. Another illustrative example, if an outstanding expert determines a task within the area of his expertise to be a moderately simple one, the question is whether the task is objectively a moderately simple task or one of medium complexity, or perhaps it may even be a moderately complex task.

These two examples show that pure objective determination of task complexity might thus far be a rather impractical starting point to study information activities. Whereas pure objective task complexity seems unattainable (if even desired) at the moment, the perceived task complexity offers various aspects for inclusion and levels of consideration from loosely to specifically determined and operationalised approaches. This view was adopted in the present study. Task complexity was seen as *a priori* determinability of inputs, process, and outcome as perceived by the task performers.

A number of related measurements may be used to increase the comparability of task complexity perceptions. Thus, perceived task complexity is seen to be a unifying characteristic linking the several related aspects together (cf. Campbell & Gingrich, 1986). In the present study, task ambition increased, task duration became longer, frequency of similar tasks performed and subject expertise decreased while task complexity was considered to increase. There are probably other characteristics connected to task complexity, too (e.g., importance of task).

This raises another difficulty concerning task complexity. Sometimes it may be difficult to determine whether a related characteristic is a cause or an effect of task complexity. For instance, uncertainty can in some sense be considered as a synonym for task complexity in terms of *a priori* determinability. But the question is whether it is uncertainty that causes task complexity or task complexity that causes uncertainty. Most researchers are content with stating that there is little uncertainty associated with simple, routine tasks whereas high complexity tasks tend to involve greater uncertainty (e.g., Pinelli et al., 1993; Zeffane & Cheek, 1995; Kuhlthau, 1997, forthcoming; Daft & Macintosh, 1981; Vakkari, 1998). Moreover, other factors than task complexity are also linked to uncertainty (cf. Van Rijsbergen, 1996).

In conclusion to task complexity related INSU research, the perceptions of task performers may be seen as a link between objective task characteristics and information activities. Thus, information activities are probably better understood on the basis of task performers' perceptions of task complexity compared with purely objective task complexity. It may even be that task complexity is a characteristic that by definition includes a certain amount of "non-objectivity". Perhaps it is not a task or a situation as such which includes an exact amount of complexity. Complexity may alternatively be seen as those aspects that are addressed and hence added to the

task or the situation only when a person attends to it (e.g., multiple paths or contradictory goals). Seen in this way, task complexity is also understood to be relative to both time and context.

Since task complexity, uncertainty and a number of other characteristics are linked to both each other and in particular to information activities, the relationships concerning these characteristics are obviously important for INSU research. Although, an objective system of measurement for task complexity might be desired, the phenomenon appears at the moment to be too poorly understood to create this type of reliable scale (cf. Quaid, 1993). Meanwhile, it seems that the most trustworthy research findings on the relationships between task complexity and information activities in real-life contexts are likely to be attained by focusing on the task performer's perceptions instead of relying on inadequately objective measurements. The more thoroughly the perceptions of task complexity are reflected on and classified, the better the effects of task complexity on information activities will be understood.

7.3. THEORETICAL DISCUSSION: GROWTH OF A THEORY

7.3.1. The revised model of task complexity, information types and information sources

The present study has elaborated the model of task complexity, the need for information types and sources used on the basis of fairly extensive empirical data. On the basis of the findings (cf. also Studies I–III), it is possible to confirm, readjust and introduce some specific statements of the model (Fig. 7.3). First, the basic relationship between information types needed and source types used was examined more closely (cf. Byström & Järvelin, 1995; Vakkari & Kuokkanen, 1997). Information types initially determine what source types are used.

Below, eleven statements are presented on the basis of the present as well as other studies. They are offered as empirically derived standpoints on information activities in task performance processes. Future research is recommended to further test and complete them.

Statement 1:
As soon as information acquisition requires an effort people as sources are more popular than documentary sources.

Statement 2:
The more information types are needed, the greater the share of people as sources.

These two first statements are in line with probably the most common finding in information seeking research: people are preferred over documentary sources. In addition to the present study, these statements have been proved to hold in several work-related as well as non-work-related settings. The interactive, flexible nature of people as sources makes them in most cases preferable to the documentary sources (Ginman, 1983; Taylor, 1991). Although this is not a novel finding, it is interesting that in spite of the huge increase of information available in written, electronic form, people are still clearly more used to acquire information.

Statement 3:
The more information types are needed, the greater the share of general-purpose sources and the smaller the share of task-oriented sources.

Statement 3 specifies Statement 2. The use of all people as sources does not increase as more information types are needed. In the present setting, the use of experts and meetings (both general-purpose sources) increased (cf. also Studies I and III), whereas the share of persons whom the matter concerned (typical task-oriented sources) clearly decreased. A similar trend was also visible in a journalistic setting (Study II).

Statement 4:
The more information types are needed, the more sources are used.

Generally, the total number of sources used increases when several information types are needed. However, as the preceding statements imply, the use of all source types does not increase. The sources used to acquire all information types, are likely to increase (e.g., experts and meetings in the present study) (cf. Vakkari & Kuokkanen, 1997). However, use of sources more bound to specific information types, is likely to remain fairly constant in all tasks where that specific information type is needed (e.g., people concerned, literature and registers in the present study). In fact, their use appears to be rather independent of the total number of information types acquired.

Statement 5:
The internality of different source types is loosely connected to the information types.

It seems that people outside the organization and internal documentary sources are used somewhat more for the acquisition of task information than for the acquisition of domain or task-solving information. Instead, the latter information types are more likely to be acquired from people inside the organization and from external documentary sources. However, in general, the internality of sources is

independent of the information types needed. Essentially, most sources used are located inside the organization in several work settings[1] . This makes sense, since these sources are easily available (cf. Taylor, 1991). Moreover, the organizations are likely to facilitate the information seeking of their employees by providing necessary sources at hand in order to increase overall productivity. However, this is probably an aspect where the context (e.g., nature and size of business) is a fairly decisive factor.

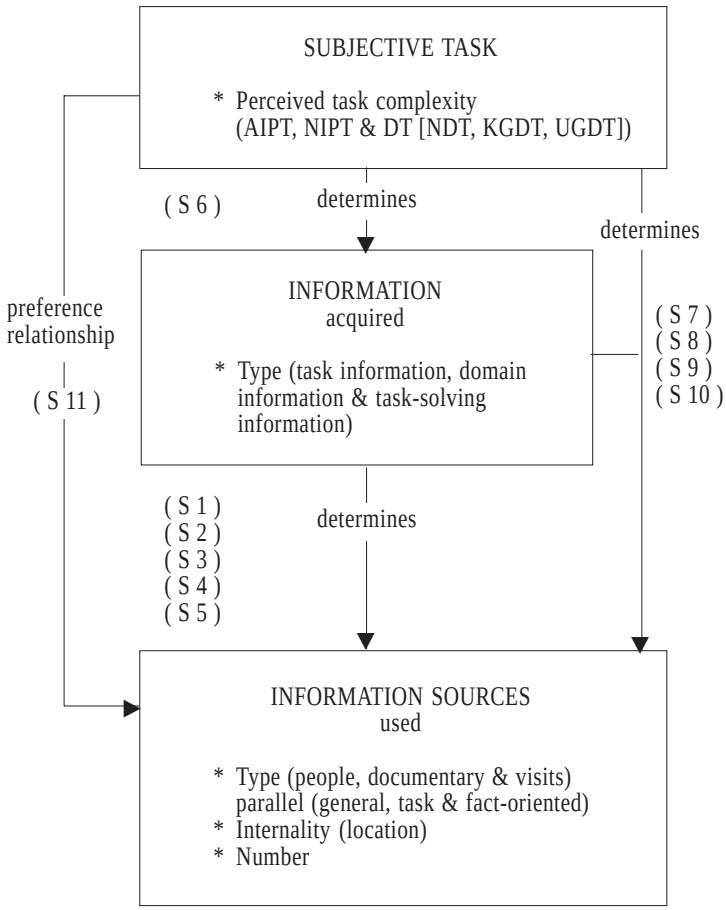

Figure 7.3: The revised model of task complexity, information types and sources

[1] One exception is mass media, whose whole business idea is build around the external sources (e.g., Ginman, 1983; Study II; Byström, 1996).

The basic relationship between the need for information types and sources used is considered below on the basis of task complexity. Most earlier studies link task complexity directly to the use of sources (Vakkari, 1998). In order to create a more comprehensive understanding of the use of certain source types, the need for information types is also included in this model.

Statement 6:
The higher the degree of task complexity, the more probable is the need for multiple information types: first task information, then task and domain information, and finally task, domain and task-solving information.

The first part of Statement 6 has been stated and confirmed in the present as well as in several earlier theoretical and empirical studies (e.g., Järvelin, 1986, 1987; Studies I–III; cf. Byström & Järvelin, 1995; Byström, 1996; Vakkari & Kuokkanen, 1997). Moreover, it seems that the information types occur in a certain order. If task-solving information is needed, both task and domain information are probably also needed, and if domain information is needed task information is also likely to be needed. Although the information types are not imperatively related to task complexity, the following trend emerges: At the lowest level of complexity, the acquisition of only task information or of no information at all is normal. As task complexity increases, acquisition of task information becomes customary. As a next step, domain information also becomes necessary. Finally, as task complexity increases further, the acquisition of all three information types becomes necessary.

Statement 7:
The higher the degree of task complexity, the more information types are needed, and the greater the share of people as sources and the smaller the share of documentary sources.

Statement 8:
The higher the degree of task complexity, the more information types are needed, and the greater the share of general-purpose sources and the smaller the share of task-oriented sources.

The relationship between the need for information types and source use is reflected in different task complexity categories. Thus, task complexity appears to have *a predetermining relationship* with information need and seeking phenomena. Task complexity determines what types of information are needed, and these determine what sources are used. Since not all the simplest tasks necessarily require any active information acquisition, the level of low task complexity may even lead to the dominance of documentary sources (cf. Statement 1). However, most certainly will the task-oriented sources dominate (e.g., official documents in this study, and

people concerned in a journalistic setting). This changes with increasing task complexity and the need for several information types. People and general-purpose sources become more and more important (e.g., experts and meetings in the present setting and experts in a journalistic setting). (cf. Study II; Byström, 1996).

Statement 9:
The higher the degree of task complexity, the more information types are needed, and the higher the number of sources used.

Increasing task complexity leads to increasing number of sources used (cf. Culnan, 1983; Vakkari, 1998) mostly because several information types are needed (cf. Statement 4). Whereas the number of sources clearly increases when the simplest tasks are compared with the most complex tasks, the increase is not necessarily constant between different levels of task complexity. In the present study a remarkable increase occurred between the two lowest levels of task complexity, whereas only a small increase occurred between the two highest levels of task complexity. A similar, although not so remarkable trend was also visible in the earlier study among municipal administrators (Study I and III; cf. Byström & Järvelin, 1995). In the journalistic setting, this was not confirmed, since the sample did not contain these simplest tasks (cf. Byström, 1996). Nevertheless, task complexity and the increasing number of sources consulted are related.

Statement 10:
Task complexity is distinctly related to increasing internality of people as sources and decreasing internality of documentary sources.

The relationship between information types and internality of different source types (Statement 5) is specified when task complexity is also considered. Although the general internality does not seem to be related to task complexity (cf. also Studies I–III; cf. Byström & Järvelin, 1995), people inside the organization appear more important for high than low level of task complexity. Simultaneously, the importance of external documentary sources increases with task complexity. However, this does not hold in a journalistic setting where the use of internal sources is rare (Study II).

Statement 11:
Increasing task complexity fosters the use of people as sources.

Although the effects of task complexity on source use are largely explainable through information types, task complexity seems also to be directly related to people as sources. Irrespective of the need for information types, people are more utilised in more complex tasks. One possible explanation is that task complexity by definition reduces task performers' awareness of information requirements. Thus,

even though the task performer is generally able to indicate what types of information are needed, the difficulty to articulate the specific information need exactly leads to the use of sources which are able to handle even ill-defined questions (cf. Belkin, 1980; Ingwersen, 1996). It is probable that such sources are not only used to get the answer to the ill-defined questions, but also to clarify the questions themselves. Today these sources are still fairly exclusively people. Task complexity might also lead to preference for general-purpose sources at the expense of fact-oriented and task-oriented sources independent of the need for information types. However, these latter modifications were not as clear as those between people and documentary sources.

In conclusion, the findings of the present study corroborate the proposed general model of INSU in task performance (Fig. 3.1, p. 36). It has focused especially on the specific model of relationships between task complexity, information types and their sources (Fig. 7.3). The mediating aspect of information types was introduced to the empirical research by the present author (e.g., Byström & Järvelin, 1995; Vakkari & Kuokkanen, 1997). In the present work, it has been considered on the basis of more extensive research data. Some findings of earlier studies on task complexity and information activities were verified and some others discarded or specified. Above all it provides a useful base for further research.

7.4. PRACTICAL IMPLICATIONS

The findings of the present study have some practical implications for information systems design. Whereas task information is usually well organised in traditional information systems, there is a great need to develop information systems that are fitted for the acquisition of domain and especially task-solving information in work contexts. These information types are nowadays rarely acquired from electronic sources. This is clearly in accordance with the on-going shift of emphasis from *information* management to *knowledge* management. The core implication is that different information types need to be differently facilitated in order to optimalise their usage. As an example, information systems that concentrate on task performance processes instead of providing a specific answer to a specific question are probably most useful in complex tasks where domain and task-solving information are required. This might be a system that traces matters not only backwards but also forwards, i.e., when finding a topic/document in the system, a searcher could see *where the matter has led* as well as what the traced topic/document is a result of. Thus, finding something relevant in the system would lead to the up-to-date view of the subsequent course of documentation.

Another way to acknowledge the differential use of information types is to facilitate the use of different kinds of sources. Since task complexity seems to be best handled by human sources, the systems that facilitate the consultation of people as

sources ought to be considered as a completion for sources of recorded information. Intranets and electronic document/matter handling systems which allow people consulted (inside the organization) to familiarise themselves swiftly with the matter in hand, are a step into this direction. However, it might be necessary to emphasise this aspect more strongly in the existing information systems.

Similarly, task performers' clear preference for easily available internal sources even in complex tasks, ought to be recognised when making information policy decisions. If an organization desires to keep up with the development in its external environment, there is a need for systems that effectively facilitate the distribution of information about and from outside the organization. This might also be arranged as a kind of external quality recheck system. For this purpose, benchmarking ideas (i.e., comparison of processes, products, decisions) may be useful in the creation of this type of internal source for external information.

If the present study and its findings are viewed from a distance, a general practical implication stands out. Namely, the application of findings of INSU studies ought to broaden the focus from the traditional ways of facilitating information access. Indeed, access to information may be facilitated in many ways. Sometimes helping people in different situations to understand their INSU processes is more important than providing a piece of data (cf. Kuhlthau, 1999). Information access may be facilitated by introduction of different ways to organise the information people already possess. Another way to facilitate access to information is to teach people to require that systems suit their practical purposes, not vice versa. Information access may be also facilitated by creation of a concrete and coherent information policy for the organization in question. Ways to facilitate information access in addition to traditional information systems are still to be discovered.

7.5. RELATION TO OTHER THEORIES AND FURTHER RESEARCH TOPICS

The general model of INSU in task performance and the specific model of task complexity related information activities may be modified and specified both theoretically and empirically. For instance, some complementary theoretical constructions have already been made by other researchers (e.g., Vakkari & Kuokkanen, 1997) and the model has been compared with other related studies (Vakkari, 1998). Similarly, they have been tried out and found to be valid in other work-related settings (e.g., journalistic setting: Study II; Byström, 1996; medical care setting: Sundin, 1997). Thus, the development may be both *horizontal*, that is, by considering the model in several settings with several kinds of tasks or different task characteristics, or *vertical*, that is, by specifying the model both empirically and theoretically. Some topics for further research are suggested below.

Task complexity, information types and phases of task performance. Relating the findings of this study to Kuhlthau's ISP (information search process) model (Kuhlthau, 1993a, 1993b, 1999) opens up an interesting research topic. First, ISP indicates that a task performer moves from uncertainty to clarity during ISP. Second, the findings of the present study indicate that information types are used in a certain combination by adding task information first with domain information and later with task-solving information as the task complexity increases. Third, as task performers are less certain of the task performance process ahead, that is, as tasks are perceived to more complex, more information types are needed.

Kuhlthau's ISP is a model of a very complex task, where all three information types must be acquired. It is apparent that most real-life work tasks are not at this level of complexity (cf. Kuhlthau, 1999), usually task performers are fairly confident about task requirements and how to fulfil them (cf. Byström, 1997). They have a clear focus from the beginning. This indicates that in regular work tasks the first four stages of ISP are rather compressed and unproblematic and not connected to dominating feelings of uncertainty.

Since task information is the typical information needed in regular, non-complex work tasks, it seems to be connected to the latter part of ISP (i.e., phases of information collection and presentation) or task performance process (i.e., phases of actual task performance and task completion). Domain information is needed in regular but somewhat more complex tasks, which are less *a priori* determinable and thus involve more feelings of uncertainty. This indicates a more distinct presence of ISP's initial four phases or task construction. Thus, domain information seems to be more connected to the beginning of task performance. As tasks are perceived more complex, task performers' uncertainty about task processes increases, and task-solving information is needed. Thus, task-solving information may be even more closely linked to the beginning of task performance process than domain information.

Several interesting research questions may be derived from the above discussion. For instance, how clearly are the information types linked to the different phases of task performance, and how does task complexity specify these relationships? It seems that task information is more clearly connected to other than the task construction phase (four first stages of Kuhlthau's ISP), whereas the relations between the other two information types are not necessarily as straightforward. Moreover, does task complexity vary at different phases of task performance, and if it does, how does it affect the need for different information types? According to Kuhlthau's ISP it seems obvious that the different phases are not only differently outlined but also of different levels of complexity.

Furthermore, how is task performers' prior knowledge related to information activities during the task performance process? It is obvious that task performers' prior knowledge modifies the level of perceived task complexity and further the need for information types. Highly experienced professionals performed the tasks in this study, whereas the ISP model was initiated in connection with tasks performed

by novices. Unfortunately there is no case in the sample of tasks analysed in this study that matches Kuhlthau's sample in perceived complexity. An additional interesting research question rises: do information activities of novices and experts differ on the same level of *perceived* task complexity or is there a universal way to tackle this complexity? Kuhlthau's longitudinal study (Kuhlthau, 1999) indicates that task complexity is handled differently depending on the task performer's professional experience (i.e., novice vs. expert), but more extensive studies are needed in order to verify this assumption.

Task complexity, task performance and context. An important area of further research is the verification of the proposed model in various professional settings. A highly recommended research approach is comparative studies. Comparative studies between different professional groups are surprisingly rare in information behaviour research in general (for noticeable exceptions see: Taylor, 1991 and Ginman, 1983) and nearly non-existent in connection with information activities related to task complexity.

Comparative studies are important for creating a consistent understanding about information activities and their premises in different settings. One example is the analysis by Vakkari (1998) on the relation between task complexity and information seeking where he compares the theoretical solutions and empirical findings of five conceptually related studies. Comparative studies are important in order to increase the degree of consistency between findings in different settings and consequently theoretical growth. Such studies are probably also a fruitful way to consider the effects of context on information activities. If it can be stated that, in general, people have a consistent practice to manage perceived task complexity, then differences in this practice may depend on the context. Thus, the effects of both task complexity and context would become clearer.

Task complexity and information use. Another challenging topic is to find out how information gathered for tasks of different complexity levels is actually used to complete the task. This type of study will clearly make the proposed model more complete. Although the use of information has for some time been recognised as an important research topic within INSU research, there are still very few studies that actually focus on this topic (Vakkari, 1997). Subsequently, the ways of addressing it are still principally unstructured both theoretically and empirically.

It seems likely that there may be several kinds of information uses related to one task performance. Different uses may be relevant in the different phases of task performance. For instance, "get a position in a picture" may be a primary goal in the task construction phase, whereas "get a verified picture" may appear as a major goal in the completion phase of task performance. Furthermore, task complexity may be related to different types of uses. For instance, increasing task complexity may lead to increasing emphasis on "getting a clearer picture". (uses by Todd, 1997).

Task complexity, information seeking and information retrieval. Perhaps the most interesting future research topic indicated by this study is to examine the

effects of task complexity on information retrieval as a part of information seeking. Since task complexity affects other information source use, it is likely that information retrieval is also affected. For instance, what effects does task complexity have on the design of query statements or questions formed, need for pertinence (or precision and recall), and relevance judgements in relation to the use of electronic and other type of information sources or systems. These are few examples of appropriate sub-topics. Results from such studies may prove valuable for information system design.

These types of studies foster the fusion of information seeking and information retrieval research. This has been sought after for some time in information studies (cf. Belkin, 1993; Ingwersen, 1996; Spink et al., 1998; Vakkari forthcoming). So far these research traditions have been mutually exclusive, especially empirically. This has been mainly due to the lack of common ground that would provide a suitable point of departure for both of these directions. A task-based approach to information activities in real-life situations seems an appropriate perspective for this purpose. It definitely provides a link between information seeking and information retrieval research. How well this link serves, is left for future studies to show.

7.5.1. Concluding words

This study is the latest in a series of studies that has introduced the task-based approach to INSU studies (see also Studies I–III). Other INSU studies have utilised a similar approach, but this is the first attempt to clearly emphasise, both theoretically and empirically, the task-based point of departure in INSU research. Moreover, this study has shown that task complexity is a fruitful dimension to distinguish between tasks. Task complexity regulates information needs, which explains the use of information sources. The type and number of information sources used as well as the externality/internality of certain source types all have systematic connections with task complexity and information types needed.

It is probable that a task-based approach related to task complexity, or another similar task characteristic, will become increasingly utilised in INSU research. The results of this study provide a basis for extension of research on such themes. To make the task-based approach prosperous is a challenge to future INSU studies.

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CONCISE OUTLINE:
ABBREVIATIONS AND CLASSIFICATIONS

INSU = Information needs, seeking and use

Task complexity categorisation
(in terms of *a priori* determination):

AIPTs = Automatic information-processing tasks (the most simple tasks)
NIPTs = Normal information-processing tasks
DTs = Decision tasks (the most complex tasks in the present study)

DTs consists of:
NDTs = Normal decision tasks
KGDTs = Known-genuine decision tasks

The most complex task category of the classification is
UGDTs = Unknown-genuine decision tasks.
The sample of the present study does not include any task of this type.

Information type classification:

TI = Task information (detail information merely particular for only one task)
DI = Domain information (general information within a particular task domain)
TSI = Task-solving information (instructional information)

Types of information sources:

People as information sources consists of:
- People concerned
- Experts
- Meetings

Documentary sources consists of:
- Literature
- Official documents
- Registers

Visits as information sources

Each category is further divided into internal and external information sources according to the location of the source.

Parallel information source type classification:

Fact-oriented sources = registers (in the present study)
Task-oriented sources = people concerned, official documents and visits as information sources (in the present study)
General-purpose sources = experts, meetings and literature (in the present study)

Subject expertise
(based on a scale from one to ten):

Extremely low = level 1
Low = levels 2–3
Medium = levels 4–7
High = levels 8–9
Extremely high = level 10

Task duration:

Minutes = within a half of an hour
A day = more than a half of an hour, but within eight (8) hours
Days = more than eight (8) hours

The levels of knowledge about information requirements and task processes, the amount of discretion, and perceived complexity

Extremely low = ten per cent or less ($\leq$ 10 %)
Low = more than ten per cent but at most thirty per cent (10 % < x $\leq$ 30 %)
Medium = more than thirty per cent but less than seventy per cent (30 % < x < 70 %)
High = Seventy per cent or more but less than ninety per cent (70 % $\leq$ x < 90 %)
Extremely high = Ninety per cent or more ($\geq$ 90 %)

The information complexity value

An index between zero (0) and five (5) indication the involved types of information. The higher the index, the more information types are involved.

Education:

Academic degree (at least a bachelor's degree)
College level education (a degree from polytechnic or commercial college etc.)
Lesser education

Experience:

Five years or less ($\leq$ 5 years)
More than five years but at most ten (5 < x $\leq$ 10 years)
More than ten years but at most fifteen (10 < x $\leq$ 15 years)
More than fifteen years (> 15 years)

LIST OF FIGURES AND TABLES

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Appendix 1

TASK DIARY

PART I ASSESSMENT OF THE INITIAL SITUATION
(Please fill in at the beginning of the task performance)

1. Describe the case under preparation for decision-making: _____

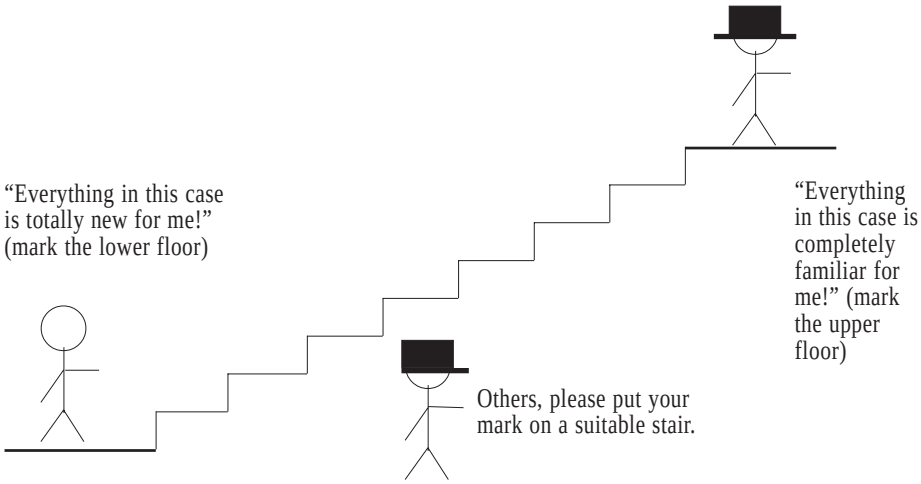
   What is your task in the handling of the case? _____

   Estimate how prepared the case was when you received it (%) _____

2. How often do you prepare cases *like this* for decision-making?

   ( ) daily ( ) weekly ( ) monthly ( ) less than monthly

   Estimate your level of expertise in this case:



Please tick the alternative that best describes your ambition level:
( ) "I'm pleased just to get this matter over with."
( ) "I want to get this done well."
( ) "Only a very good result will satisfy me."
( ) "None of the previous alternatives match, instead _____

3. Estimate how well you can describe the progress of your task at the beginning:

"I don't even know how to begin with."

"I can describe the whole progress in detail."

25 50 75

(Please shade in – from left to right – the further, the better you believe you are able to describe the task progress in detail.)

Estimate how well you can describe the information required for your task (irrespective whether you have the information or not at the moment):

"I don't have any idea what information will be needed."

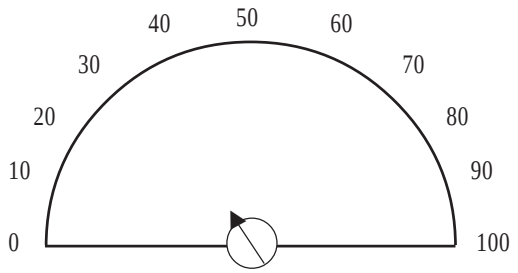
"I believe that I'm aware of all information required for this task."

25 50 75

(Please shade in – from left to right – the further, the better you believe you are able to describe the information requirements.)

Describe the result to-come as well as possible: _____

4. In your opinion, how complex the task seems to be?



"Simple!" "Impossible!"

(Please point the arrow to an appropriate level.)

5. Describe eventual additional factors that may affect your handling of the case (e.g. delicacy of the matter): _____

6. What information do you need to cope with your task? _____

   What ways to gather that information do you recognise? _____

PART II JOURNAL FOR THE PROGRESS ON THE TASK
(Please fill in during task performance)

7. Describe different stages of task performance.

   Record your contacts with people and your use of written material (both in paper and in electronic form).

   Mark the people consulted and the written material used with
   -, if you did not receive the information you expected,
   +, if you did receive the information that you expected, or
   ++, if you got more information than you expected.

   Record also emerged situational factors that might have an effect on your work (e.g. need to hurry, continuing interruptions). Any other observations around the subject are welcome, too.

   As finished, are you satisfied with the result.

DATE / STAGE / SITUATIONAL FACTORS / OTHER OBSERVATIONS	PEOPLE CONTACTED / WRITTEN MATERIAL USED Record also: - persons remained unattainable - meetings	Mind the plusses and minuses

Thank You!

Legend: Word within *stars* are added after the pilot study. The original task diaries were clearly more spatious than the example above.

APPENDIX 2

E-MAIL QUESTIONNAIRE (translation, original in Finnish)

HELLO,

You do remember the Information needs and information seeking study, which you have participated during the last year and half, don't you. Some eighty tasks where cases were prepared to decision-making bodies were recorded on task diaries. Now I have analysed this main material, but I do need some additional information to support it. Will you kindly answer the questions below, and send your answer to me shortly.

Best wishes,

Katriina Byström

PS. As a tip, if you haven't noticed yet: you can deftly reply to this message by choosing Replay-function and including the original message to it. Now it's easy to add your own answers to the questionnaire text.

BACK GROUND:

1. What is your official title?

2. What kind of education do you have?

   basic education:
   occupational education:

3. How long have you been working in your present position?

4. Was the preparatory work included into your present position unfamiliar for you as you started in this position? If not, tell me about your previous experience.

OWN WORK

5. What is your area of responsibility?

6. How large part of it is preparatory work for decision making?
   Tick the most suitable alternative.

   all of it
   nearly all of it
   a bit more than a half of it
   about one half

a bit less than a half of it
small part
gets on my way only very seldom

7. Is your work – generally – in your opinion: (Tick the most suitable alternative)

   very easy
   easy
   somewhere in between
   difficult
   very difficult

8. How varying your work tasks are? (Tick the most suitable alternative)

   very similar
   similar
   variable
   very variable

9. How have your work changed over time?

10. What are the best aspects of your work?

11. What are the worst aspects of your work?

12. How do you think your work will alter in future?

INFORMATION

13. What kind of information is most / least useful in your work?

    most:
    least:

14. In what form information is most important for you in work preparatory for decision making: electronic, paper-form, or conversational?
    Rank them from I–III where I is the most important.

    I
    II
    III
    Comments?

15. What quality requirements do you have for information to be used by you?

INFORMATION SEEKING

16. Record three persons who you use most regularly to acquire information. Write down their official titles and the department where they work. If you cannot decide the rank on a scale where I is most regularly used,write the names down on the same row.

    I
    II
    III
    Comments?

17. Record three sources of written information that you use most regularly. Write down whether they are in electronic or in paper form. If you cannot decide the rank on a scale where I is most regularly used, write the sources down on the same row.

    I
    II
    III
    Comments?

18. What kind of information is most difficult to get hold of?

19. Have you yourself done some arrangements to facilitate information acquisition?

    If yes, what?

20. How often do you acquire information for a specific preparatory task for decision making that becomes useful in some other tasks later. Tick the most suitable alternative.

    always
    very often
    often
    seldom
    very seldom
    never

INFORMATION USE

21. How large part of information you acquire becomes useful by becoming actually used? Tick the most suitable alternative.

    all of it
    nearly all of it
    a bit more than a half of it
    about one half
    a bit less than a half of it
    small part
    none of it

OTHER COMMENTS?

THESE WERE MY QUESTIONS. MANY THANKS FOR YOUR ANSWER!

APPENDIX 3

E-MAIL QUESTIONNAIRE RESULTS

(Answers not possible to present in a compressed form excluded)

BACK GROUND:

2. What kind of education do you have? (N=38)

   Academic degree: seventeen (17) participants
   College level education: nineteen (19) participants
   Lesser education: two (2) participants

3. How long have you been working in your present position? (N = 38)

   Five years or less (£ 5 years): nine (9) participants
   More than five years but at most ten (5 < x £ 10 years): three (3) participants
   More than ten years but at most fifteen (10 < x £ 15 years): seven (7) participants
   More than fifteen years (> 15 years): nineteen (19) participants

4. Was the preparatory work included into your present position unfamiliar for you as you started in this position? If not, tell me about your previous experience.
   (Included accordingly to the above result)

OWN WORK

6. How large part of it is preparatory work for decision making? (N = 38)

   all of it: one (1) participant
   nearly all of it: eleven (11) participants
   a bit more than a half of it: seven (7) participants
   about one half: seven (7) participants
   a bit less than a half of it: five (5) participants
   small part: seven (7) participants
   gets on my way only very seldom: zero (0) participants

7. Is your work -generally- in your opinion: (N = 38)

   very easy: one (1) participant
   easy: three (3) participants
   somewhere in between: seventeen (17) participants
   difficult: seventeen (17) participants
   very difficult: zero (0) participants

8. How varying your work tasks are? (N = 38)

   very similar: zero (0) participants
   similar: three (3) participants
   variable: twenty-three (23) participants
   very variable: twelve (12) participants

10. What are the best aspects of your work? (N = 38)

    The thirty-eight (38) participants listed all together seventy-two (72) positive aspects of their work. Four aspects raised above others:
    – variability: twenty-three (23) participants
    – independency: fourteen (14) participants
    – challenging: twelve (12) participants
    – human contacts: nine (9) participants

11. What are the worst aspects of your work? (N = 38)

    The thirty-eight (38) participants listed all together thirty-nine (39) negative aspects of their work. One aspect raised above others:
    – the lack of time: nineteen (19) participants

INFORMATION

13. What kind of information is most / least useful in your work? (N = 39)

    most: The thirty-nine (39) participants listed all together forty-seven (47) useful kind of information. Three aspects raised above others:
    – factual information: seventeen (17) participants
    – professional knowledge / skills: ten (10) participants
    – condensed overviews: six (6) participants

    least: The thirty-nine (39) participants listed all together twenty-five (25) useful kind of information. One aspect raised above others:
    – inaccurate information: eight (8) participants

14. In what form information is most important for you in work preparatory for decision making: electronic, paper-form, or conversational? (N = 32)

    I paper: nineteen (19) participants
    conversational: seven (7) participants
    electronic: six (6) participants

    II conversational: seventeen (17) participants
    paper: ten (10) participants
    electronic: five (5) participants

    III electronic: twenty-one (21) participants
    conversational: eight (8) participants
    paper: three (3) participants

15. What quality requirements do you have for information to be used by you? (N = 36)

    The thirty-six (36) participants listed all together sixty-nine (69) different quality requirements. Three related aspects raised clearly above others:
    – reliability: twenty-two (22) participants
    – accuracy: twelve (12) participants
    – true: eight (8) participants

INFORMATION SEEKING

16. Record three persons who you use most regularly to acquire information. (N = 34)

I – colleagues (same department): nineteen (19) participants
– colleagues (other department): thirteen (13) participants

17. Record three sources of written information that you use most regularly. (N = 37)

I – legal texts: fifteen (15) participants
– official documents: ten (10) participants
– graphical information: eight (8) participants

18. What kind of information is most difficult to get hold of? (N = 29)

The twenty-nine (29) participants listed all together thirty-three (33) different types of information. Three aspects raised above others:
– electronic information: seven (7) participants
– under preparatory work: five (5) participants
– old documents: five (5) participants

19. Have you yourself done some arrangements to facilitate information acquisition? (N = 38)

yes: twenty-three (23) participants
no: fifteen (15) participants

20. How often do you acquire information for a specific preparatory task for decision making that becomes useful in some other tasks later. (N = 38)

always: two (2) participants
very often: fifteen (15) participants
often: eighteen (18) participants
seldom: three (3) participants
very seldom: zero (0) participants
never: zero (0) participants

INFORMATION USE

21. How large part of information you acquire becomes useful by becoming actually used? (N = 38)

all of it: zero (0) participants
nearly all of it: twenty (20) participants
a bit more than a half of it: eight (8) participants
about one half: six (6) participants
a bit less than a half of it: two (2) participants
small part: two (2) participants
none of it: zero (0) participants

APPENDIX 4

TYPES OF INFORMATION SOURCES RELATED TO SUBJECT EXPERTISE, FREQUENCY OF SIMILAR TASKS, TASK DURATION, AND TASK AMBITION

Subject expertise. *The use of* people as *sources* increased as subject expertise decreased (Table A4.1). When task performer's subject expertise was high or medium, she already favoured people over documentary sources. The overall division to people and documentary sources was the same at these levels of subject expertise (56 % and 41 %, respectively). However, sources of both task and domain information were more used at the medium level of subject expertise, whereas sources for task information only were more typical for high level of subject expertise. At the medium level of expertise, the share of experts and meetings increased whereas the share of people concerned decreased. Similarly, official documents were the most used source type at the high level of subject expertise, but at the medium level their share decreased and the share of literature increased. The popularity of people as sources grew more noticeable in tasks where officials' subject expertise was low (people 80 % and documentary sources 13 %). Experts were heavily used whereas the use of official documents decreased further. The frequent use of (internal) meetings strengthened the importance of experts. The share of people concerned decreased to zero, and the share of literature also decreased markedly at the lowest level of subject expertise.

The number of sources used increased steadily from tasks where task performers had high subject expertise to tasks performed by officials with low subject expertise. The use of experts and meetings especially increased steadily. However, other source types were either used as much or increased as subject expertise decreased from high level to medium, but then decreased when subject expertise was lowest. The overall *source internality* increased as task performers' subject expertise decreased. However, this mostly depended on people as sources, whereas documentary sources, and particularly official documents, reacted in an opposite way.

Frequency of similar tasks. *The use of* people as *sources* increased as frequency of similar tasks decreased (Table A4.2). Only every fourth source consulted was a person when similar tasks were performed every day. Official documents (64 %), of which nearly all were passively obtained, were by far the most popular sources in this task category. No literature or meetings were utilised at all. When the frequency of similar tasks was about once a week, the use of people and documentary sources was equal. Official documents were the most used source type followed by experts. People were clearly more used than documentary sources when tasks were performed monthly (55 % and 42 %, respectively). They were even more used in tasks performed at less than monthly intervals (63 % and 33 %, respectively). Both experts and meetings were more popular sources compared with official documents, most of which were now actively obtained. Use of literature increased distinctly, and it was used slightly more than people concerned.

The number of sources used increased throughout all source types except registers as the frequency of similar tasks decreased. The use of registers was about the same and mainly indifferent in all tasks independent of their frequency. The overall *source internality* was high and fairly constant in all tasks independent of their frequency. The internality of people as sources increased from about thirty to eighty per cent as the frequency of similar tasks decreased. Simultaneously, the internality of documentary sources actually decreased although not as intensely as the internality of people increased.

Table A4.1: Source use and subject expertise

TYPES OF INFORMATION SOURCES used	SUBJECT EXPERTISE High (source n = 296)	Medium (source n = 142)	Low (source n = 68)
People as information sources	*56 %*	*56 %*	*80 %*
int.	67 %	83 %	91 %
use per task	3.0	6.7	10.8
People concerned	18 %	8 %	0 %
int.	23 %	36 %	0 %
use per task	1.0	0.9	0
Experts	25 %	32 %	43 %
int.	89 %	85 %	83 %
use per task	1.3	3.8	5.8
Meetings	13 %	16 %	37 %
int. *	83 %	100 %	100 %
use per task	0.7	1.9	5.0
Documentary sources	*41 %*	*41 %*	*13 %*
int.	97 %	90 %	44 %
use per task	2.2	4.8	1.8
Literature	5 %	18 %	1 %
int.	87 %	92 %	0 %
use per task	0.3	2.1	0.2
Official documents	32 %	21 %	12 %
int.	98 %	87 %	50 %
use per task	1.7	2.5	1.6
Registers	4 %	2 %	0 %
use per task	0.2	0.3	0
Visits as information sources	*3 %*	*3 %*	*7 %*
use per task	0.1	0.3	1.0
Total	*100 %*	*100 %*	*100 %*
int.	77 %	83 %	88 %
use per task	5.3	11.8	13.6

Legend: *External, if people from outside the organization participate.
Int. stands for the internality within the given source type.

Table A4.2: Source use and frequency of similar tasks

TYPES OF INFORMATION SOURCES used	FREQUENCY OF SIMILAR TASKS PERFORMED			
	Daily (source n = 28)	Weekly (source n = 62)	Monthly (source n = 81)	Less than monthly (source n = 284)
People as information sources	*25 %*	*50 %*	*55 %*	*63 %*
int.	29 %	65 %	73 %	78 %
use per task	0.5	1.9	2.8	6.9
People concerned	11 %	10 %	21 %	10 %
int.	0 %	0 %	35 %	3 %
use per task	0.2	0.4	1.1	1.1
Experts	14 %	29 %	23 %	30 %
int.	50 %	84 %	95 %	87 %
use per task	0.3	1.1	1.2	3.3
Meetings	0 %	11 %	11 %	23 %
int.*	0 %	71 %	100 %	99 %
use per task	0	0.4	0.6	2.5
Documentary sources	*71 %*	*47 %*	*42 %*	*33 %*
int.	100 %	97 %	94 %	91 %
use per task	1.5	1.8	2.1	3.6
Literature	0 %	2 %	1 %	11 %
int.	0 %	100 %	0 %	90 %
use per task	0	0.1	0.1	1.2
Official documents	64 %	37 %	37 %	20 %
int.	100 %	96 %	97 %	91 %
use per task	1.4	1.4	1.9	2.2
Registers	7 %	8 %	4 %	2 %
use per task	0.2	0.3	0.2	0.2
Visits as information sources	*4 %*	*3 %*	*3 %*	*4 %*
use per task	0.1	0.1	0.1	0.4
Total	*100 %*	*100 %*	*100 %*	*100 %*
int.	79 %	77 %	80 %	79 %
use per task	2.2	3.9	5.1	10.9

Legend: *External, if people from outside the organization participate.
Int. stands for the internality within the given source type.

Table A4.3: Source use and task duration

TYPES OF INFORMATION SOURCES used	TASK DURATION: Minutes (source n = 30)	A day (source n = 119)	Days (source n = 247)
People as information sources	*10 %*	*46 %*	*70 %*
int.	0 %	46 %	86 %
use per task	0.1	3.2	9.6
People concerned	7 %	24 %	8 %
int.	0 %	11 %	16 %
use per task	0.1	1.7	1.1
Experts	3 %	21 %	30 %
int.	0 %	85 %	91 %
use per task	0.1	1.5	4.2
Meetings	0 %	1 %	32 %
int.*	0 %	0 %	98 %
use per task	0	0.1	4.4
Documentary sources	*90 %*	*50 %*	*26 %*
int.	100 %	97 %	86 %
use per task	1.2	3.5	3.6
Literature	0 %	7 %	8 %
int.	0 %	88 %	86 %
use per task	0	0.5	1.2
Official documents	83 %	39 %	16 %
int.	100 %	98 %	85 %
use per task	1.1	2.7	2.2
Registers	7 %	4 %	2 %
use per task	0.1	0.3	0.2
Visits as information sources	*0 %*	*4 %*	*4 %*
use per task	0	0.3	0.6
Total	*100 %*	*100 %*	*100 %*
int.	90 %	69 %	82 %
use per task	1.4	7.0	13.7

Legend: *External, if people from outside the organization participate.
Int. stands for the internality within the given source type.

Table A4.4. Source use and task ambition (Note that task performers' own descriptions for most part are comparable with the high level of ambition.)

TYPES OF INFORMATION SOURCES used	TASK AMBITION Low (source n = 36)	Medium (source n = 179)	High (source n = 168)	Own description (source n = 121)
People as information sources	*31 %*	*61 %*	*65 %*	*58 %*
int.	73 %	82 %	78 %	60 %
use per task	0.9	2.9	6.4	7.8
People concerned	8 %	13 %	7 %	21 %
int.	0 %	38 %	25 %	16 %
use per task	0.2	0.6	0.7	2.8
Experts	6 %	30 %	38 %	24 %
int.	100 %	93 %	86 %	76 %
use per task	0.2	1.4	3.8	3.2
Meetings	17 %	18 %	20 %	13 %
int.*	100 %	97 %	82 %	100 %
use per task	0.5	0.8	2.0	1.8
Documentary sources	*67 %*	*34 %*	*33 %*	*40 %*
int.	100 %	93 %	93 %	88 %
use per task	1.9	1.6	3.2	5.3
Literature	0 %	3 %	14 %	10 %
int.	0 %	80 %	96 %	75 %
use per task	0	0.1	1.4	1.3
Official documents	56 %	28 %	18 %	26 %
int.	100 %	94 %	90 %	90 %
use per task	1.5	1.3	1.8	3.4
Registers	11 %	3 %	1 %	4 %
use per task	0.3	0.1	0.1	0.6
Visits as information sources	*2 %*	*5 %*	*2 %*	*2 %*
use per task	0.1	0.2	0.2	0.3
Total	*100 %*	*100 %*	*100 %*	*100 %*
int.	89 %	82 %	82 %	69 %
use per task	2.8	4.7	9.9	13.4

Legend: *External, if people from outside the organization participate.
Int. stands for the internality within the given source type.

Task duration. *The use of* people as *sources* increased as task duration increased (Table A4.3). There was an immense prepomderance of documentary sources over people when task performance took only a few minutes (90 % and 10 %, respectively). As much as eighty per cent of all sources used were passively obtained official documents. All other source types were rather irrelevant. Documentary sources were still somewhat more popular than people (50 % and 46 %, respectively) when task performance took from half an hour to a day (8 hours). Official documents, mostly passively obtained, were the most used source type. People became more popular sources in tasks that took days to complete (70 %). Internal meetings were the most popular source type, although the difference with experts inside the organization was not big. The third most used source type, internal official documents, was clearly less utilised.

The number of sources used increased from tasks with short duration to tasks with longer duration. However, not all source types were increasingly utilised. The number of both people concerned and official documents first increased from tasks taking minutes to perform to task taking days, but then their use decreased in tasks taking days to complete. The overall *source internality* does not seem to follow any trend and varies greatly between task categories. The source internality is highest in tasks that only take minutes to perform (90 %), it is lowest in tasks taking about a day to complete (69 %), and it is in-between in tasks requiring days to complete (82 %). However, the internality of people as sources increased markedly from a zero level to eighty-six per cent as task duration increased. Simultaneously, the internality of documentary sources decreased although less markedly.

Task ambition. *The use of* people as *sources* increased as task ambition increased (Table A4.4). Documentary sources were clearly more used than people (67 % and 31 %, respectively) when the ambition level was low. Official documents were clearly the most used sources (56 %). The trend shifted to favour people over documentary sources in tasks where the medium level of ambition was recognised (61 % and 34 %, respectively). This direction was somewhat strengthened in tasks with the highest level of ambition. Experts, especially inside the organization, became the by far most utilised source type whereas the share of official documents decreased markedly.

The number of sources used increased as task ambition increased. The use of all types of sources increased except the use of documentary sources whose use remained about the same in tasks with low and medium level of ambition. The overall *source internality* decreased, although only slightly, as task ambition increased (if implications of own descriptions are included). The internality of people as sources first increased as task ambition rose from low to medium level, but then decreased as task ambition rised further. Surprisingly, the internality of experts and meetings decreased, the higher the task ambition rised. The internality of documentary sources decreased as task ambition rose.

APPENDIX 5

THE SPECIFIC TYPES OF INFORMATION SOURCES USED ACCORDING TO BOTH TASK COMPLEXITYAND INFORMATION TYPES ACQUIRED

Table A5.1

TYPES OF INFORMATION SOURCES used	TASK CATEGORY AIPTs Task n = 14 - sn = 17	10 T sn = 36	2 TD sn = 4	0 TDTS sn = 0	NIPTs Task n = 2 - sn = 3	20 T sn = 133	11 TD sn = 144	2 TDTS sn = 15	DTs Task n = 0 - sn = 0	4 T sn = 20	9 TD sn = 78	4 TDTS sn = 58
People as information sources	*6 %*	*44 %*	*25 %*	-	*33 %*	*58 %*	*60 %*	*47 %*	-	*70 %*	*69 %*	*77 %*
int.	0 %	69 %	0 %	-	0 %	68 %	84 %	43 %	-	86 %	85 %	87 %
use	0.1	1.6	0.5	-	0.5	3.9	7.9	3.5	-	3.5	6.0	11.3
People concerned	6 %	8 %	25 %	-	33 %	21 %	14 %	27 %	-	10 %	8 %	0 %
int.	0 %	0 %	0 %	-	0 %	29 %	70 %	100 %	-	0 %	67 %	0 %
use	0.1	0.3	0.5	-	0.5	1.4	1.8	2.0	-	0.5	0.7	0
Experts	0 %	17 %	0 %	-	0 %	26 %	28 %	20 %	-	55 %	38 %	43 %
int.	0 %	83 %	0 %	-	0 %	91 %	80 %	100 %	-	100 %	80 %	92 %
use	0	0.6	0	-	0	1.7	3.6	1.5	-	2.8	3.3	6.3
Meetings	0 %	19 %	0 %	-	0 %	11 %	18 %	0 %	-	5 %	23 %	34 %
int.**	0 %	86 %	0 %	-	0 %	87 %	100 %	0 %	-	100 %	100 %	80 %
use	0	0.7	0	-	0	0.8	2.5	0	-	0.3	2.0	5.0

Table A5.1...

Table A5.1...												
Documentary sources	*94 %*	*50 %*	*75 %*	-	*67 %*	*41 %*	*36 %*	*40 %*	-	*25 %*	*27 %*	*21 %*
int.	100 %	100 %	100 %	-	100 %	96 %	90 %	67 %	-	100 %	77 %	92 %
use	1.1	1.8	1.5	-	1.0	2.7	4.7	3.0	-	1.3	2.3	3.0
Literature	0 %	6 %	25 %	-	0 %	1 %	15 %	7 %	-	0 %	10 %	10 %
int.	0 %	100 %	100 %	-	0 %	0 %	91 %	100 %	-	0 %	88 %	83 %
use	0	0.2	0.5	-	0	0.5	2.0	0.5	-	0	0.9	1.5
Official documents	94 %	38 %	50 %	-	67 %	35 %	17 %	33 %	-	25 %	17 %	9 %
int.	100 %	100 %	100 %	-	100 %	98 %	88 %	60 %	-	100 %	77 %	100 %
use	1.1	1.4	1.0	-	1.0	2.3	2.3	2.5	-	1.3	1.4	1.3
Registers	0 %	6 %	0 %	-	0 %	5 %	4 %	0 %	-	0 %	0 %	2 %
use	0	0.2	0	-	0	0.4	0.5	0	-	0	0	0.2
Visits as information sources	*0 %*	*6 %*	*0 %*	-	*0 %*	*1 %*	*4 %*	*13 %*	-	*5 %*	*4 %*	*2 %*
use	0	0.2	0	-	0	0.1	0.5	1.0	-	0.3	0.3	0.2
Total	*100 %*	*100 %*	*100 %*	-	*100 %*	*100 %*	*100 %*	*100 %*	-	*100 %*	*100 %*	*100 %*
int.	94 %	81 %	75 %	-	67 %	78 %	83 %	47 %	-	85 %	81 %	86 %
use	1.2	3.6	2.0	-	1.5	6.7	13.1	7.5	-	5.0	8.7	14.5

Legend:
sn = the total number of sources used;
int. = internality of the given source type; use = use of source type per task; - = no information acquired; T = sole task information acquired; TD = task and domain information acquired; TDTS = task and/or domain and task-solving information acquired; ** External, if people from outside the organization participate
NOTE: the integral numbers show the share of information source types used;