

Patterns of Information Use, Avoidance and Evaluation in a Corporate Engineering Environment

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Abstract

This study reports on an investigation of the communication and information use environment of a corporate engineering community. In this research, questions have been asked about typical work practices of members of this community, the accessibility of a variety of communication and information resources, the frequency of their use, and satisfaction with their use in seeking information. An interesting finding of the investigation is the discovery of two multidimensional patterns of behavior in the information resource environment; one in which there are various discrepancies between accessibility, frequency of use and satisfaction; and one in which these three dimensions are on par with one another. Further exploration of these patterns is explained in the paper. The influence of trust and credibility in the use of both the World Wide Web (WWW) and human resources is also discussed within this framework.

INTRODUCTION

Within any organizational environment, people are exposed to, and make use of, a variety of information resources in support of their daily work. Over the past several years, there has been a tremendous increase in the amount and type of communication and information resources available to support people in their work related activities. Today, most organizational environments can be characterized as “information rich” with respect to the resources available to people working within them, containing a variety of items and resources, in multiple media or digital form. These will include human resources, various information retrieval systems and mechanisms, along with textual resources such as books, periodicals, manuals, and other technical documentation that people typically consult in their routine work. The information resource environments in which people increasingly work and interact will typically contain various tools to facilitate computer mediated communication, such as email, groupware and video telephony, which enable collaboration and communication among work group members separated by physical distance. More recently, the World Wide Web (WWW) presents another potentially useful resource in organizational work environments. An interesting and important question at this time concerns the extent to which the resources in these information rich environments are used by people in their work and how effectively they support people in their work related tasks, goals and information interactions.

The information and communication resources described above constitute part of what Taylor (1991) long ago termed the “information use environment.” Taylor coined this phrase to describe the context of elements that influence the presence and use of information items within an organizational or institutional setting, and which also affect the value assigned to these information resources by members of the communities exposed to them (Taylor, 1986; 1991). Taylor’s early writings have been important in directing our attention to the social context within which the information resource environment is embedded. Rosenbaum (1993; 1996) has extended Taylor’s early thinking by applying Giddens’ (1984) structuration theory to explain some of the dynamics between an information use environment and the information behaviors that take place within it, and how information behaviors within the organization are reflective of the social practices of members of the work community and at the same time influenced by normative constraints on information utilization imposed by the organization itself.

In general, attention to social context in studies of information behaviors has now become rather commonplace. However, while the importance of studying information behaviors in context is now pretty much taken for granted, at this time the information and communication resources available within any given organizational context are changing, along with the norms of their use, raising new questions about people’s acceptance and adaptations to these

new information environments (Kraut, Rice, Cool and Fish, 1998). Additionally, it has now been recognized that people often engage in multiple information seeking strategies in order to address a variety of information related tasks, goals and intentions which may change over the course of single or multiple information seeking episodes (Belkin, Marchetti & Cool, 1993; Xie, 2000). Behaviors within an information resource environment and the design requirements for information retrieval systems that effectively support a variety of information uses are becoming increasingly complex.

FOCUS OF THIS INVESTIGATION

We believe that in order to design information retrieval systems that effectively support people in their information seeking behaviors, we need to take as our starting point the study of the work practices people engage in, the information and communication resources available to them, and the uses they make of them in support of their work related tasks and goals. This study investigates the information use environment of a corporate engineering community. In particular, we investigated the communication and information resources available to members of this community; with particular questions about the degree of uses and evaluation of these information items. A central focus of the study is on the exploration of the multiple patterns of information use, avoidance and evaluation of information items within a context of varying accessibility to a range of information and communication resources.

RESEARCH QUESTIONS

The research reported in this paper is based upon an in-depth field study of the work practices, information uses and information seeking behaviors of members at a large aerospace engineering corporation in Seattle, Washington. The larger study from which these results are a subset was designed to investigate the multiple information seeking strategies people engage in as they pursue a variety of tasks and goals, and the variety of information behaviors associated with them. That larger study is fully described in Belkin and Carballo (1998). A more narrow focus is taken in this paper, in which the following research questions are addressed:

1. What information and communication resources are available to the members of the corporate community, and what is the frequency of their use?
2. How satisfied or dissatisfied are people with these resources?
3. What are some of the reasons for frequency of use and satisfaction with the information and communication resources typically used?
4. What are relationships among *accessibility* of information resources, *frequency* of use, and *satisfaction* with their use?

RELATED LITERATURE

The study of information use environments has been approached from a number of perspectives. One approach looks at the relationship between information use behavior and a person's task environment. For example, the relationship between work tasks and information behaviors has been investigated by Algon (1999) in a longitudinal study of work group members within a pharmaceutical organization. Allen (1996) considers task analysis to be central to a well formed user-centered model of information design, although he cautions against adopting an overly rational model of information behaviors in organizations. He offers as a general design principle, the statement "People can, and frequently do, engage in information avoidance (p.119)." Furthermore, "Organizations are frequently equally irrational in their collection, processing, and use of information." In earlier writing about the normative aspects of information and communication behaviors of engineers, T.J. Allen (1977) found that the typical exchange of information between engineers took place through interpersonal communication channels rather than literature searches. According to Allen, engineers prefer to talk to colleagues and others who share common background knowledge, and as a result, communication is generally restricted to colleagues within the organization. The proprietary nature of engineering projects is one reason for this behavior. Particularly interesting, in terms of information use behaviors, is the finding by Allen, Taylor (1991) and others that librarians are infrequently consulted and often only as a last resort.

More recently, Soveral-Dias, Correlá and Wilson (1994) report the results of a pilot study of information use and dissemination among aeronautical and aerospace professionals, finding that talking to colleagues ranked lower in importance than using literature sources for solving technical problems. In this particular study, a majority of respondents reported that electronic networks were either “important” or “very important” in their work. The importance of electronic communication in engineering work has also been reported earlier by Bishop (1992).

In studies conducted in other information use environments, researchers have looked more closely at the particular problems associated with accessibility and use of particular types of information resources or tools in work settings. Smith (1999) conducted a survey of the use of business information in the UK, and found that while World Wide Web sites are now commonly relied upon for business information, the problem of “information overload” was mentioned by half of the respondents. In an earlier study, the problem of increasing awareness among corporate employees of the information resources available to them inside and outside of the company is discussed by Ferguson and Bjorner (1993). A similar theme is present in the case study reported by Sanz and Rubio (1993), who studied the information needs and information uses of several corporations in Indiana. They discovered that company employees often have limited access to the large range of information sources they need, and furthermore, they have limited knowledge about how to obtain this access.

The problem of providing effective access and promoting use of the increasing array of electronic resources is the subject of several other recent studies. Fidel and Efthimiadis (1999) report on the Web searching behaviors of Boeing engineers. User perceptions of the effectiveness of a filtering system to provide relevant access to business reports to corporate employees is the subject of another study, by Fidel and Crandall (1998). A variety of evaluation criteria associated with the filtering system are identified. Crandall (1998a) describes the efforts of the Boeing Company Libraries to provide electronic library services to their employees, and some of the problems associated with employees’ lack of information retrieval skills. In another recent article, Crandall (1998b) presents a case study of the Boeing company Intranet, and in particular, the problems associated with a lack of standards for the organization of material now available to company employees.

These studies illustrate a variety of approaches to the study of communication and information resource use among members of various work group environments. One of the themes in this literature is that in order to understand information behaviors within organizational settings, researchers need to take into account the social context of the information use environment, including the variety of work roles and identities, tasks and goals, availability and accessibility of information and communication tools, and people’s perceptions about the uses and usefulness of these resources. In such an environment, we feel that there is a need for additional research to investigate ways to better design information and communication systems to support people in their desired information behaviors.

RESEARCH METHODS

This investigation represents a small case study conducted within one corporate aerospace engineering environment. Our intention in this paper is to explore various patterns of information behaviors among members of the community we studied. As in any case study, we do not generalize our results beyond this particular organization. Fourteen participants were chosen to represent a range of technical and engineering positions within the company, and they were: 6 managers, 3 team leaders, and 5 members of technical staff. Three of them were female and 11 were male.

Multiple methods were used in our data collection protocol, including the use of work activity logs, questionnaire and interview data. The following data collection procedures were employed:

1. Each participant was instructed to keep a diary of his or her work activities over the course of one work day, noting the time of the activity. This “activity log” was constructed as a recording sheet to keep track of the specific time an activity took place, the location/device/resource used, and the activity itself. An example entry is the following: Time: 12:39pm; Location: desktop computer; Activity: search Web.
2. Each participant completed a self-administered questionnaire that included questions about the Accessibility, Frequency of Use, and Satisfaction with Use of a list of information and communication resources. This list included human, textual and electronic resources, described in Results section. This questionnaire is referred to hereafter as the Information Resource Questionnaire.

- Each participant was also interviewed about the information behaviors associated with the work activities recorded in the diary; about the reasons for their degree of use information and communication resources as reported in the Information Resource Questionnaire; and about the reasons for satisfaction or lack of satisfaction with these information and communication resources. This interview was open-ended, transcribed and later subject to content analysis.

In order to address the research questions posed above, this study relies primarily on an analysis of the Information Resource Questionnaire along with corroborating interview data. In the analysis presented here, descriptive statistics are used to represent the Information Resource Questionnaire data. Qualitative content analysis of the interview transcripts is used to better understand the reasons that people gave for their information behaviors and evaluations (Weber, 1990).

RESULTS

Table 1 illustrates the “information rich” environment of the corporate community studied, consisting of a variety of human, electronic and other types of information and communication resources. For example, human resources include librarians and information specialists, work group and project team members, along with other people in the employees’ division or department and company as a whole. The resource environment also contains a variety of other human resources and experts, both inside and outside of the company, with whom the employees collaborate. A variety of textual resources are available to the participants in this study. These include books, periodicals, manuals and other technical documents. Electronic access systems include external computerized database systems, such as Dialog, Lexis-Nexis, etc., while in-house database systems contain proprietary information. The array of other electronic resources available to these participants includes electronic access to the library catalog, a variety of CD-ROM systems, web browsers to connect to the World Wide Web, email, groupware such as Lotus Notes, and basic telephony.

Table 1. Available Information Resources

Human information resources	Other Information resources	Electronic access system	Electronic resources
Information specialists/librarians	Books	External computerized database systems	Computerized library catalogs
People on your project team	Periodicals	In-house computerized database systems	CD-ROM systems
People in your work group	Manuals		Web browsers
People in department /division	Technical memos		Email
People in your company	Equipment catalogs		Groupware
People outside of your company that you collaborate with	Standard documents		Telephony
People outside of your company that you do not collaborate with	Specification documents		
Experts in the field that are in your company			
Experts in the field that are outside company			

Relationship between Accessibility, Use and Satisfaction

Table 2 gives us a more detailed look at the information use environment of this corporate engineering environment. Here, we take a look at the array of information and communication resources, and for each we compare its *accessibility*, *frequency* of use, and user *satisfaction*. For the individual resources presented in Table 1, our participants were asked to indicate, on a 1-5 scale, in which 1=None, and 5=A Great Deal, how accessible the resource is; how frequently it is used; and how satisfied the person is with the resource when seeking information. Participants were given the five-point scale to mark, with the end points labeled in order to clarify the response choices. Mean scores were calculated for each of the resources, as presented in the table below.

Table 2. Accessibility, Frequency of Use, and Satisfaction of Information Resources
(N = 14)

	Accessibility	Frequency of use	Satisfaction
Information Resource	Mean Accessibility Score	Mean Frequency Score	Mean Satisfaction Score
Human information resources	4.08	2.54	4.08
Info specialists/librarians			
People on your project team	4.15	4.15	4.23
People in your work group	4.31	3.46	3.69
People in department/division	3.79	3.36	3.64
People in your company	3.77	3.36	3.71
People outside of your company that you collaborate with	2.92	2.38	3.09
People outside of your company that you do not collaborate with	2.60	1.89	2.44
Experts in the field that are in your company	3.69	3.07	3.54
Experts in the field that are outside your company	3.08	2.46	3.17
Other Information resources	4.46	3.77	3.69
Books			
Periodicals	4.43	3.86	3.86
Manuals	3.67	2.85	3.00
Technical memos	3.70	2.70	3.30
Equipment catalogs	3.00	2.67	3.00
Standard documents	3.85	3.23	3.54
Specification documents	3.17	2.15	3.00
Electronic access system	3.55	2.23	3.50
External computerized database systems			
In-house computerized database systems	3.86	3.64	3.64
Electronic resources	4.17	2.69	3.83
Computerized library catalogs			
CD-ROM systems	4.27	2.54	3.20
Web browsers	5.00	4.86	3.93
Email	5.00	4.93	4.14
Groupware	3.45	2.00	3.09
telephone/voice mail	4.93	4.43	4.14

As we can see in Table 2, Web browsers and email are the most highly *accessible* resources in this environment, as they are available to everyone. At the other extreme, is the generally low accessibility of human resources outside of the company. Participants had very low ($\bar{x} = 2.92$) access to people outside of the company with whom they collaborate, and even lower ($\bar{x} = 2.60$) access to people outside of the company with whom they did not work. In contrast, accessibility to people in the company generally, is, on average, 3.77.

Table 2 further indicates that the information resource environment of the employees studied here is relatively rich in terms of accessibility to print media. The accessibility of books, periodicals, manuals and other print media is all above

the midpoint on our mean scale. Of interest is the relatively high degree of accessibility of librarians (mean=4.08) and Online Public Access Catalogue (OPACS) ($\bar{x} = 4.17$).

The resources *used* most frequently are email and web browsers, followed by people on the project team. Resources associated with the corporate library are used less frequently, such as librarians and information specialists ($\bar{x} = 2.54$), external computerized databases ($\bar{x} = 2.23$) and OPACs ($\bar{x} = 2.69$). By far, the resource our participants use least frequently is people outside of the company that they don't collaborate with ($\bar{x} = 1.89$). These findings corroborate the earlier findings of Taylor (1991) and Allen (1977) about some of the communication norms of members of the engineering community.

Looking at levels of *satisfaction* with the information resources they have available to them, Table 2 indicates that our participants are most satisfied with using people on their project team when they are searching for information ($\bar{x} = 4.23$). Although used infrequently, librarians and information specialists also meet with high satisfaction ($\bar{x} = 4.08$). In general, these respondents are reasonably happy with books and other text based resources, with all of the mean scores here falling at or above the midpoint on our scale.

Dynamics of the Information Use Environment: Multidimensional patterns of behavior

Further examination of the data in Table 2 reveals some interesting dynamics in the relationship between accessibility, frequency of use, and satisfaction with information resources. As mentioned, librarians and information specialists are highly accessible, yet used infrequently ($\bar{x} = 2.54$), while at the same time these resources receive quite high satisfaction scores. In this section, we further explore some of these dynamics. We find that several other resources are also reportedly used relatively infrequently, while at the same time they are described as being relatively accessible. Our analysis of these multidimensional patterns of behavior, leads us to a characterization of two major dynamics in the relationship between information resource accessibility, use and satisfaction. These are the following:

Patterns of Information Use Behavior

Type 1: In this pattern, we observe a noticeable discrepancy between Accessibility, Use, and Satisfaction base upon the comparison of the mean scores, as represented in Table 2. Here, we find three predominant patterns, which can be characterized as:

- a. High accessibility, low frequency of use, and high satisfaction with the resource
- b. High accessibility, high frequency of use, and low satisfaction with the resource
- c. Low accessibility, low frequency of use, and higher satisfaction with the resource

Type 2: In this pattern, we observe only marginal differences between Accessibility, Use and Satisfaction with the resource. In other words, what we see here is a pattern in which accessibility, use and satisfaction are on par with one another.

The resources associated with these patterns of information use are illustrated in Table 3, below.

Table 3. Resources Associated with Patterns of Information Use Behavior

Type 1			Type 2
Type 1a	Type 1b	Type 1c	
Librarians/information specialists	Web browsers	People outside of your company that you collaborate with	People on the project team
Computerized catalogues	E-mail	Experts in the field that are outside your company	In-house computerized database systems
CD-ROM systems			Books
External computerized database systems			Periodicals
			Equipment catalogs
			Standard documents

The following are some interesting examples of these patterns. Type 1a, characterized by high accessibility, low frequency of use, and high satisfaction, is illustrated quite clearly by the following resources: librarians/information specialists; computerized library catalogues; CD-ROM systems; and to a somewhat lesser extent external computerized database systems. Type 1b, characterized by high accessibility, high frequency of use, and low satisfaction is illustrated most strikingly by web browsers and to a somewhat lesser extent, email. We further discuss this pattern below.

One other “discrepant” pattern, which doesn’t fit either Type 1a or 1b, is Type 1c that is illustrated in the example of people outside of the company, with whom our participants do collaborate and experts in the field that are outside the company. In these two examples, we see a pattern of low accessibility, low frequency of use, and higher satisfaction.

The pattern identified above as Type 2, characterized by marginal difference between accessibility, frequency of use and satisfaction, is illustrated in several resources. This pattern is seen most strongly in the example of other people on the project team, where accessibility ($\bar{x} = 4.15$), frequency of use ($\bar{x} = 4.15$) and satisfaction ($\bar{x} = 4.08$) are pretty much identical. All of the textual information resources fit this pattern as well; along with in-house computerized database systems.

Having identified these patterns of information behaviors, we might now ask why they occur. In particular, we are interested in understanding the reasons for the behavioral pattern characterized above as discrepant with respect to accessibility, frequency of use, and satisfaction. Some of these reasons are revealed in the interview data, in which our participants discussed the reasons for their uses and non-uses of the information resources discussed above. Explanations for these patterns of information use, avoidance and satisfaction are presented below, based upon our content analysis of the interview transcripts.

Explanations for Low Use, When There is High Accessibility and High Satisfaction (Type 1a)

This category in our data analysis is most clearly characterized by patterns associated with use of librarians and information specialists. If the participants in our study have relatively high accessibility to these human resources, and they say that they are highly satisfied with their services when it comes to searching for information, then why don’t they use them more frequently?

Based upon our interview data, it seems as if the reason for relatively infrequent use of librarians and information specialists has little to do with the evaluation of the expertise embodied in these resources, and more to do with the social and work environment. Consistent with some of the literature cited above, many of the corporate employees in

our study stated that the reason that they did not frequently use the resources of the library was because someone on their staff would typically interact with the librarian for them, or because they maintained their own personal library in their office. At the same time, they valued the services of the library and the library staff. As one participant told us:

“I must confess several years back I tried doing some research on some subject, and I think it was moderate, mediocre. Really, I had access to all the research I needed more immediately (in my office) than just going to the library, going to the technical library and finding something off the shelf.”

Another respondent told us why he valued the library, even though he seldom used it personally:

“As for articles, we have people on the research staff who conduct the research and get a number of articles.”

These comments echoed the theme we have seen in the literature about librarians are being consulted as a resource of last resort.

Explanations for Low Satisfaction, Where There is High Accessibility and High Use (Type 1b)

This category is most clearly characterized by the patterns associated with the use of web browsers and Internet resources in general. In this study, all of the participants had access to web browsers and the WWW. Most of the employees used the WWW frequently, yet there was an expression of dissatisfaction in their evaluation of it. A predominant theme in the interviews about use and nonuse of information resources had to do with confidence and trust in these sources. For many, the WWW is a resource that is hard to evaluate adequately in terms of *credibility* and *trustworthiness*. This made it difficult to rely on for work purposes. One of the participants expressed these feelings this way:

“I go on the web to look at technical notes for system administrators, fixes, and virus notices...there’s quite an information exchange out there. I don’t do a lot with newsgroups. These typically will be sites or places that in my world have credibility that will maintain servers and information like that.”

Another person described the usefulness of the web in providing access to very new material for work, but the problems in evaluating the credibility of this material:

“The web is usually the best place to get this information, because usually it’s so new. There are a lot of books out now on web design and html. It’s not easy to know which ones are good. Usually if I’m in a bookstore and I want to buy a book on web design, I’ll go through and I’ll look for things and I’ll look up a topic that I know something about and see whether this person knows what they’re talking about. With the books on the web, it’s different. I can’t open that book and see how well it’s written.”

Explanation for High Satisfaction, When There is Low Accessibility and Low Frequency of Use (Type 1c)

This pattern is most clearly illustrated in the nature of our participants’ interactions with experts in the field outside of the company, and with people outside of the company with whom they collaborate. In general, the members of this community valued the expertise and advice of colleagues and other human resources. Members of project teams were valued for their degree of shared knowledge, and their general accessibility in the work environment. This finding is consistent with results reported in the literature cited earlier. Using experts or other people outside of the company was problematic for these employees, for two reasons. The first had to do with general accessibility. Here, lack of accessibility was attributable to problems of identifying appropriate experts in the field, and then being able to locate them. The following participant explains her infrequent use of experts outside of the company:

“Well, their accessibility, it’s the accessibility to them. I don’t have quick access. I have a few key ones that I can get a hold of right away, but it’s interesting, that’s a funny group of people. If you take the philosophy that the dissemination of knowledge is power, empowering the people, we have a large number of people that we pay to gather knowledge about technical issues and they don’t publish their phone numbers because they don’t want anyone to call them...I happen to have some pipelines that I can get to direct, but I’ve worked the system, I’ve become good at that. Anybody that’s good at this job has learned to work the system.”

This quote describes some of the problems and frustrations associated with gaining access to outside experts, whose knowledge is respected and potentially useful to employees in our study. Our next example is a slightly different situation, in which our participants collaborate with people outside of the company, and are generally satisfied with the interaction, yet, they use this type of resource infrequently. From the interview data, it appears as if level of accessibility is less important in determining frequency of use of these outside collaborators than the corporate *trust*. Employees in the highly competitive engineering community are concerned about revealing too much about their corporate strategies and product developments, through interactions with outside collaborators. For example:

“I’m hesitant to call outside experts - they’re all competitors. I can consult them anonymously by looking at their website; look at what’s posted but not reveal myself.”

This next person comments on the use of collaborators outside of the company; in particular members of another aerospace company that her company was about to merge with at the time of this study:

“The nature of our work is such that if we share it, we lose our profit. We can’t share company secrets, so I can’t call you at (competitor location) and say ‘I’ve got a problem, can you help me fix it?’ because that means giving away a secret; they know that I have a problem. Outside people in our field are our competitors.”

This person later admitted that the information received from people outside of the company was very valuable. Furthermore, this person was satisfied with it, as long as control over the information transaction was maintained.

SUMMARY AND CONCLUSIONS

This study has investigated the information use environment of one particular population - that of a corporate engineering community. In this research, questions have been asked about the accessibility of a variety of information resources, the frequency of their use, and satisfaction with their use in seeking information. One of the findings of the study is that in the engineering community studied here, people make different uses of information and communication resources, regardless of their accessibility. Confirming previous studies, our results indicate the strong importance of colleagues and work group members as information providers. Librarians and information specialists are somewhat distant members of the human resources relied upon by members of this corporate community. Our results also suggest several new multidimensional patterns of information behaviors.

A particularly interesting result of this study concerns the patterns between information accessibility, use and satisfaction. In the case of high access, low use and high satisfaction, as characterized by librarians and library resources in general, we suggest that social and environmental factors, along with work group norms contribute to this pattern, rather than a negative evaluation of librarians themselves as important resources. In the example of resource use characterized by high access, high use and low satisfaction, the WWW is the strongest example of a resource fitting this pattern. In our study, reasons for high use of the web included quick access to new materials. Reasons for low levels of satisfaction, or poor evaluations, of the web included a lack of trust and uncertainty about credibility. In the example of the resource pattern in which we find high satisfaction, but relatively low accessibility and low use, several dynamics have been identified. Here, again, social factors play a primary role. Most importantly, employees seem to maintain a sense of company loyalty in their use of human resources outside of the company; viewing them with some level of competitive mistrust, even though they value the knowledge these outsiders have.

The results of this study suggest the need for attention to some aspects of information systems that might better support people in environments such as the one we studied. Future research will further investigate the relationship among accessibility, use and satisfaction with newer information and communication technologies, in a variety of organizational environments, and offer more practical suggestions for IR system design.

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