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ABSTRACT

Research into both the information needs of engineers engaged in research and development, and the means chosen by engineers to fulfill their information needs are summarized in this condensation of a Master's thesis. Parallel questionnaires were administered in 1981 to 78 engineers at the U.S. Army Corps of Engineers Construction Engineering Research Laboratory (CERL) and to 64 academic scientists in the Department of Civil Engineering at the University of Illinois at Urbana-Champaign. Response rates of 78 and 50 percent respectively were achieved. Questions dealt with types of information needed; sources of information used; utilization of personal resource collections; frequency of use of online searching, reference services, and libraries; and satisfaction with available library collections. Only a portion of the research results are outlined in this publication. It is reported that eight sources of information were found to be commonly used by engineers: books, research journals, colleagues, personal resource collections, regular reading of the literature, technical reports, personal research records, and knowledge transmitted at conferences or meetings. It is also noted that engineering libraries were the primary source for all types of information needs but that the use of library reference staff was significantly lower than use of libraries. A 19-item bibliography is provided. (Author/ESR)

INFORMATION NEEDS AND INFORMATION-GATHERING BEHAVIOR OF RESEARCH ENGINEERS

by

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If one does not understand the non-user, how can one possibly convert him or her . . .?

Margaret Slater [1], page 17

If one does not understand the user, how can one possibly serve him or her . . .?

Judith Siess [2], page 1

Motivation for the Study

The research reported in this paper attempted to discover the needs for information of engineers engaged in research and development and the means they choose to fulfill these needs. The need for information is basic to any engineering or scientific endeavor, but what are these needs? Are they the same for all engineers, or for all engineers doing research, or for all engineers doing research in a specific subject area? Are the techniques developed by engineers to meet these needs identifiable? What implications do information needs and information-gathering behavior have for libraries and information centers?

There has been in recent years an ever-increasing quantity of information made available to scientists and engineers. Consequently, an increasing amount of time is devoted to looking for information, possibly taking one-quarter of the engineer's time. Most of those people studying scientists and engineers feel that engineers do have an information problem and the assumption of this paper is that there is a need to serve the ever-increasing needs for information by engineers in a better, more efficient manner.

A library or information center is only as good as the service it provides. No matter what the concept of service, a library cannot hope to achieve its goals without knowing what the needs of its users are. But how can one ascertain these needs? Both quantitative and qualitative or intuitive analysis are needed and it is anticipated that the needs for information can be identified and systematically analyzed and then filled. In addition, the information needs of potential users must be matched to available information sources and to potential sources. The information process must be a joint effort between librarian and user--the librarian providing the resources, the user the needs.

There is a difference among information needs, information wants, and information demands. A need is not really definable in absolute terms, but can be approximated by actions or demands. Needs are the underlying concept and are usually unexpressed or unperceived. Needs which are demonstrated are called wants, and ideally are the same as the unexpressed needs. This ideal is seldom achieved, however. Demand enters only when needs or wants are made known to those who can fulfill them. User demands are usually much smaller than their needs.

One cannot ascertain a user's information needs simply by asking "what are your information needs?" "There is a strong tendency for a user of an information center to ask, not for what he really wants, but for what he thinks the system may be able to give him" (Lancaster [3], page 72). Thus the library setting influences the demands made upon it, which influence its goals, which influence its service, which influences the expressed needs or demands upon it, ad infinitum.

In much of the literature the terms scientist and engineer are used almost interchangeably, but they are not synonymous. For the purpose of this paper, it is assumed that the engineer is a subset of the body of scientists, that he is more likely to be product- or profit-oriented (rather than involved in "pure" research), and that his primary goal is the production of some kind of a report (including a journal article). The research engineers covered in this study are a hybrid of the scientist and the engineer.

The librarian is hampered in the satisfaction of users' needs by the reluctance of many engineers to use libraries. They may "prefer to rely on the personal judgment and the tribal wisdom of the invisible college whenever they have problems to solve" (Slater [1], page 3). This researcher sees two main types of librarians: book-keepers and information-keepers. Engineers tend to think of librarians as book-keepers when what they really need are information-keepers. A concentration on answers rather than on materials is needed (White [4]).

An additional reason to study information needs of users is to design more relevant and effective information storage and retrieval systems. Also, the contact with users necessary to discern their needs can lead to better rapport with them and, in turn, encourage use of the library.

Methodology

This paper summarizes the research done for an M.S. thesis in Library and Information Science at the University of Illinois at Urbana-Champaign (Siess [2]). The study was conducted during summer and fall 1981 in Champaign-Urbana, Illinois at two research institutions. Parallel questionnaires were administered at the U.S. Army Corps of Engineers Construction Engineering Research Laboratory (CERL) and the Department of Civil Engineering, University of Illinois at Urbana-Champaign (CE).

CERL has a staff of about 200, including civil engineers, architects, urban planners, environmental engineers, biologists, other professionals, and support staff. It is served by a technical library with one full-time professional librarian. The library has about 7,000 catalogued books, 10,000 uncatalogued technical reports, and about 400 journal subscriptions. CERL engineers have a basic goal of producing results for the Corps of Engineers, but since much of their research has broader applications, it cannot be considered only as "applied" research. The questionnaire was sent to 78 project Team Leaders, Principal and Associate Investigators. The response rate was 78 percent.

CE has a staff of 105 academic personnel. The engineers are more closely aligned with the definition of a scientist, but since many also do consulting ("applied" research) they, too, are a hybrid. The Department is served by the Metz Reference Room, staffed by one full-time nonprofessional, and the Engineering Library with two full-time professionals. The Engineering Library has about 175,000 catalogued items and about 3,500 serials, including 1,660 periodical subscriptions. No estimate of the Metz

Reference Room's holdings was available. Questionnaires were distributed to 64 Professors, Associate and Assistant Professors, with a return rate of 50 percent.

There were 7 questions on the questionnaire. Question 1 gathered basic data on the respondents, including field of interest, highest degree attained, and rank. Question 2 listed seven types of information and four potential sources of this information. It was the primary source of data on information needs. The types were: information on new developments in your own field; information on new developments in related fields; previously published research in your own field; previously published research in related fields; specific techniques, processes, products or data; critical or annual reviews; and a search for a known item. The four sources were the library, personal collection, colleagues, and "other."

Question 3 presented the respondent with a list of sources for which he was asked to mark the frequency of use (frequently, occasionally, seldom, or never). The sources were: books, research journals, trade journals, reviews, newspapers, card catalog, colleagues, personal collection, regular reading of the literature, browsing, online searching, catalogs, technical reports, patents, standards and specifications and codes, experts or consultants, personal research records, abstracting or indexing journals, bibliographies, library staff, conferences and meetings, handbooks, and publisher ads.

Question 4 dealt with the contents of the engineer's personal or office collection and Question 5 asked for information about frequency of use and satisfaction with online searching. Question 6 asked for the frequency of use of the library and the library staff. Four frequencies were listed: almost never, once a month, once a week, and once a day. The final question covered several areas. The first part dealt with user satisfaction with the coverage of each library's collection, a second part with how well the library keeps up with new developments in the field, and a third part dealt with the knowledgeability, helpfulness, and courtesy of the library staff.

Findings and Relationship to Other Studies

Since the present study deals only with two populations, three libraries, and one point in time, it is important to look at the results of other studies and compare them to the results of this study to see what common conclusions can be drawn. For reasons of space, only the responses to Questions 2, 3, and 6 will be discussed here.

Information Needs and Information Channels. This study found that the need for information from one's own field is much more important than information outside of one's own field. This corresponds to Shuchman's [5] findings but is contradictory to those of Wood and Hamilton [6]. Need for reviews was quite low and the need for specific data, hypothesized as being of high value, was not very great. The library was the primary source for all types of information needs, followed by personal collection and colleagues (with little statistical difference between them).

Types of Information Sources. A total of fifteen studies[1] found during the literature review dealt with types of information sources. The results of these studies were put into a numerical ranking and a consensus ranking of information sources was developed (see Table 1). This consensus was then compared to the results from the CERL-CE study. For eight information sources the consensus ranking and the CERL-CE ranking coincided. For eight sources there was partial agreement. Five sources had quite different

TABLE 1. Comparison of CERL and CE Rankings of Information Sources with Consensus Ranking of 15 Studies.

Key: 1 = major sources: over 40% response in 15 studies, group 1. (Siess)
2 = intermediate sources: 15-39% response, group 2
3 = minor sources: under 15% response, group 3

Sources	CERL	CE	CONSENSUS
Books	1	1	1
Research Journals	1	1	1
Trade Journals	1	2	1 or 3, neither dominant
Annual/Critical Reviews	3	2	2 or 3, neither dominant
Newspapers	3	3	Not in 15 studies
Card Catalog	2	2	2 or 3, neither dominant
Colleagues	1	1	1
Personal Collection	1	1	1
Regular Reading	1	1	1
Browsing	2	2	1 or 2, neither dominant
Online Searching	2	2	1
Catalogs	3	-	3
Technical Reports	1	1	1, 2, or 3, 1 dominant
Patents	3	3	3
Standards/Specs/Codes	3	2	1, 2, or 3, 1 dominant
Experts/Consultants	1	2	2 or 3, neither dominant
Personal Research	1	1	Not in 15 studies
Abstracts/Indexes	3	2	1, 2, or 3, none dominant
Bibliographies	2	1	1 or 3, neither dominant
Library Staff	1	3	2
Conferences/Meetings	1	1	1 or 3, 1 dominant
Handbooks	2	2	1
Publisher Ads	3	3	3

TABLE 2. Use of Library and Library Staff.

	Almost Never	Once a Month	Once a Week	Once a Day
		(Percent)		
CERL				
Library	0	21	69	10
Staff	7	66	28	0
Engineering				
Library	16	50	34	0
Staff	61	36	3	0
Metz				
Library	36	48	16	0
Staff	45	45	10	0

rankings and two sources from the CERL-CE study were not discussed in the literature. From these rankings the following groupings could be made:

group 1 (most frequently used)

books, research journals, colleagues, personal collection, regular reading of the literature, technical reports, conferences and meetings

group 1 or 2

browsing, online searching, handbooks

group 2 (intermediate use)

card catalog, experts or consultants

group 2 or 3

critical or annual reviews

group 3 (least used)

catalogs, patents, publisher ads

Seven sources (newspapers, personal research records, bibliographies, standards and specifications and codes, abstracting and indexing journals, library staff, and trade journals) were not assigned ranks because of inconclusive results. Further research, concentrating on these seven sources, is recommended.

Use of the Library and Library Staff. There was a statistically significant difference in frequency of use of the three libraries, with the following order: CERL, Engineering, Metz. Once a week was the most frequent category checked for CERL, while once a month predominated for Engineering and Metz. The use of the library staff was significantly lower than the use of the library. The most frequent response was once a month for CERL, almost never for Engineering, and either almost never or once a month for Metz. No respondents consulted the library staff on a daily basis. (See Table 2.)

Implications and Suggestions for Further Research

There are three key factors in changing engineers' attitudes about and their use of libraries: how engineers use information, their perceptions of libraries and librarians, and increased awareness of library services. Various researchers have found the engineer's attitude toward libraries to be different from that of other scientists. It may be difficult to change his information-gathering patterns. It falls to the librarian or information professional to "sell themselves as well as their services to potential users" (Wood [8], page 20).

Non-use or under-use of libraries is of serious concern and future research should attempt to discover its cause. Slater [1] presents two types of non-users: those in awe of the library (usually new or younger staff) and the loner or do-it-yourselfer who prefers to search on his own. The effects of non-use include lower overall efficiency of non-users, waste of time due to needless duplication of effort (although not all duplication of effort is counter-productive; it is useful to at least know of other studies that have been or are being done), and missing information or

receiving inaccurate or inadequate information. A science consultant [18] writes: "More often than not we use limited and dated sources of information in our engineering work, with the result that we are constantly reinventing the wheel, . . . To remedy these shortcomings, there has to be a reassessment of priorities and a switch from an object-centered approach to a dynamic knowledge-based perspective" (page 54, emphasis added). The library or information center would be well-advised to consider its role in this reassessment.

The other major area of research that is needed is why scientists and engineers use information as they do. The issue has been raised (but not answered) by several researchers. Shuchman's study [5] is one that attempted to produce a profile of information actually used by engineers. However, one cannot ascertain engineers' needs for information by observing their information-gathering behavior or even by interviews. It must be done by working with them and seeing the problems, the genesis of needs for information, and the solutions firsthand. Perhaps the anthropological research method of the participant-observer[2] is the key to the discovery of the engineer's information needs. This might be the first step toward the restructuring of libraries and information centers so that they serve the engineer's needs, not merely his demands, and thus improving engineers' perceptions of the library and the librarian.

NOTES

1. The studies include those reported by Wood and Hamilton [6], Gralewska-Vickery [7], Wood [8], Herner [9], Slater [10], David [11], Bishop and Clayton [12], Kremer [13], Line [14], Anthony et al. [15], Robertson [16], and Maizell [17].

2. "Participant-observer techniques [call] for objective and penetrating observation and interviewing, empathetic rapport . . ., and accurate reporting" often assuming living or working closely with those studied (Hoebel [19], page 6).

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