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The Relationship Between Seven Variables and the Use of U.S. Government Technical Reports by U.S. Aerospace Engineers and Scientists

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Thomas E. Pinelli
NASA Langley Research Center

Rebecca O. Barclay
Rensselaer Polytechnic Institute

John M. Kennedy
Indiana University

Nanci Glassman
Continental Research

Loren Demerath
Indiana University

NASA
National Aeronautics and Space Administration

Department of Defense

INDIANA UNIVERSITY

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Thomas E. Pinelli
NASA Langley Research Center
Hampton, VA 23665

Rebecca O. Barclay
Department of Language, Literature, and Communication
Rensselar Polytechnic Institute
Troy, NY 12180

John M. Kennedy
Center for Survey Research
Indiana University
Bloomington, IN 47405

Nanci A. Glassman
Continental Research
Norfolk, VA 23508

Loren Demerath
Department of Sociology
Indiana University
Bloomington, IN 47405

ABSTRACT

A study was undertaken that investigated the relationship between the use of U.S. government technical reports by U.S. aerospace engineers and scientists and seven selected sociometric variables. Data were collected by means of a self-administered mail survey which was distributed to a randomly drawn sample of AIAA (American Institute of Aeronautics and Astronautics) members. Two research questions concerning the use of conference-meeting papers, journal articles, in-house technical reports, and U.S. government technical reports were investigated. Relevance, technical quality, and accessibility were found to be more important determinants of the overall extent to which U.S. government technical reports and the three other information products were used by U.S. aerospace engineers and scientists.

INTRODUCTION

When aerospace engineers and scientists need or want technical information, they have two basic alternatives. According to Orr [11], they can obtain it through observation and experimentation or they can obtain it from a variety of existing information products. The rules used to make that decision are complex. Furthermore, the decision to choose from the two alternatives is assumed to be influenced by a variety of factors. Assuming that rational behavior serves as the basis for decision making, the selection of observation/experimentation or an existing information product will depend on a subjective perception of the likelihood of success in acquiring the desired information within an acceptable or allowable time period and on the perception of the relative "cost" of these alternatives. In addition, if a decision is made to use an existing information product, the user typically recognizes that more than one product may yield the information. At this point, theory holds that the decision becomes a choice between perceived "cost," in terms of physical effort or time expended, and perceived "benefit," the likelihood that the information obtained is the information needed or wanted. [1]

BACKGROUND

The **NASA/DoD Aerospace Knowledge Diffusion Research Project** is sponsored by the NASA, Director of the Scientific and Technical Information Division (Code NTT), and the DoD, Office of the Assistant Secretary of the Air Force, Deputy for Scientific and Technical Information. This research project is a joint effort of the Indiana University Center for Survey Research and the NASA Langley Research Center. This four-phase project focuses on the information channels and the members of the social system associated with the aerospace knowledge diffusion process and provides a basis for understanding the aerospace knowledge diffusion process at the individual, organizational, national, and international levels. [14]

The NASA/DoD Aerospace Knowledge Diffusion Research Project is based on three assumptions: (1) that knowledge production, transfer, and utilization are equally important components of the aerospace R&D process, (2) that the diffusion of knowledge resulting from federally funded aerospace R&D is indispensable in maintaining the vitality and international competitiveness of the U.S. aerospace industry, and (3) that the U.S. government technical report plays an important, but as yet undefined, role in the aerospace knowledge diffusion process.

The research reported herein is a **Phase 1** activity. It is concerned with the information-seeking behavior of U.S. aerospace engineers and scientists; the relationship between seven variables (accessibility, ease of use, expense, familiarity/experience, technical quality, comprehensiveness, and relevance); and the use of U.S. government technical reports. The 1989 membership list of the American Institute of Aeronautics and Astronautics (AIAA) (approximately 34 000 members) served as the study population. The sample frame consisted of 6,781 (1 out of 5) who reside in the U.S. and who were mostly employed in academia, government, and industry. Random sampling was used to select 3,298 members from the sample frame. The adjusted response rate for the survey was 70 percent. The survey was conducted during the summer and fall of 1989. [13]

A self-administered mail questionnaire was used to collect information on the use of conference-meeting papers, journal articles, in-house technical reports, and U.S. government technical reports in a 6-month period. Using a 5-point scale, survey participants were asked to indicate the extent to which their use of four information products was influenced by seven variables. The responses, which are placed within the context of four information products, were used to determine the extent to which the seven variables influence the use of U.S. government technical reports by U.S. aerospace engineers and scientists. This paper presents an analysis and discussion of these data.

CONCEPTUAL FRAMEWORK

To describe, understand, and eventually predict the information-seeking behavior of U.S. aerospace engineers and scientists, it is useful and perhaps necessary to plan and conduct "user" studies within a conceptual framework. According to Mick [10], a conceptual

framework is needed to "develop theories that explain and predict information-seeking behavior and that can be applied to problems involving either the management of information work or the design of information products, services, and systems."

Several schema specifically concerned with information-seeking behavior have been advanced through the years. Notable examples include the work by Paisley [12], Orr [11], Allen [1], and Mick [10]. Paisley, who focuses on information-seeking behavior at the individual level, defines a number of systems within which the engineer or scientist operates. Allen focuses on the information-seeking behavior of engineers in work groups conducting mission-oriented research. Orr concentrates on the engineer-scientist as an information processor. Mick's work centers on information behavior within a corporate-work structure and emphasizes a more policy-oriented approach to user behavior.

The conceptual framework for this research, shown in figure 1, is based on the work of Paisley, Allen, and Mick and represents an extension of Orr's scheme of the engineer-scientist as an information processor. The framework for this research focuses on information seeking and assumes that, individual differences notwithstanding, an internal, consistent logic governs the information-seeking behavior of U.S. aerospace engineers and scientists.

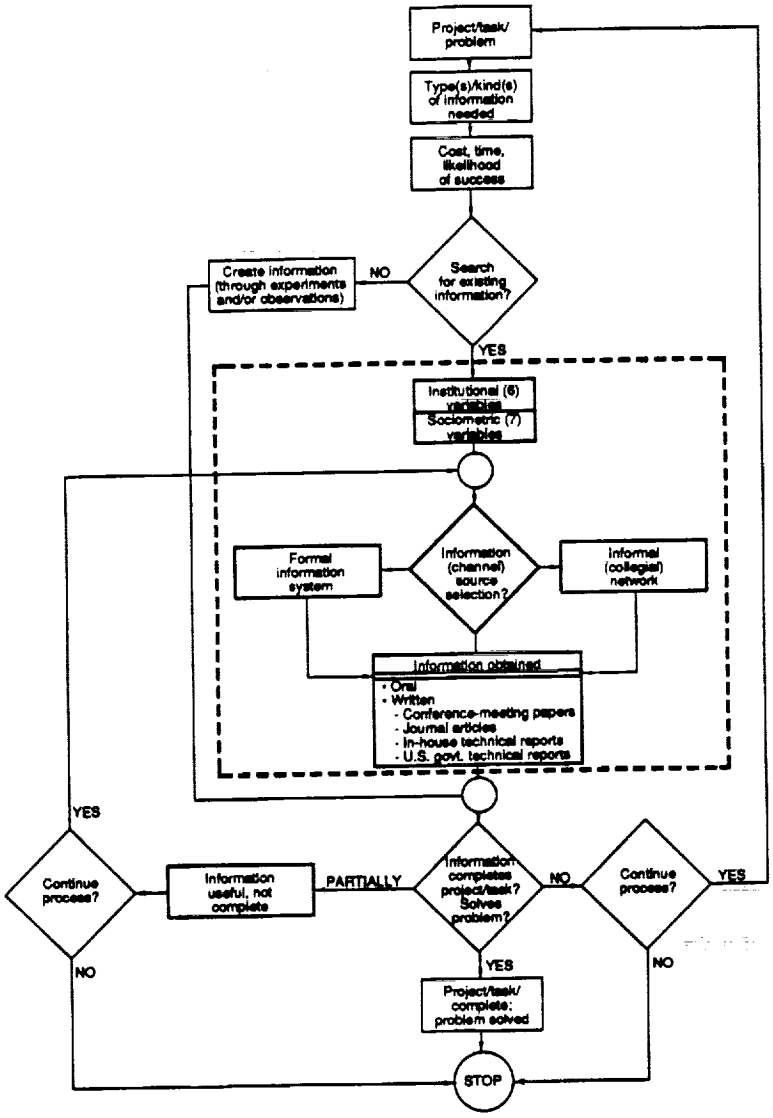

Figure 1. The U.S. Aerospace Engineer and Scientist as an Information Processor: A Structured Analysis With Data on Variables Relating to Information-Seeking Behavior.

The Engineer as an Information Processor

As Paisley [12] points out, the engineer-scientist can be viewed at the center of many systems. The selection of a particular system or systems depends on a number of considerations. For purposes of this research, U.S. aerospace engineers and scientists are placed at the center of the following four systems: **the political system**, because the study is concerned with the diffusion of federally funded aerospace knowledge; **the formal**

organization, because the information-seeking habits and practices of U.S. aerospace engineers and scientists are viewed in terms of academic, government, and industry affiliation; **the reference group**, because the study focuses on those U.S. aerospace engineers and scientists whose duties are primarily or exclusively research; and **the formal information system**, because the study is concerned with the role of formal information systems in the diffusion of federally funded R&D. However, because the study also attempts to explore, describe, and explain the use of U.S. government technical reports, U.S. aerospace engineers and scientists are viewed as information processors within a conceptual framework of information seeking.

A project, task, or problem that precipitates a need for information is central to the conceptual framework for this research. This need for information may, in turn, be **internally** or **externally** induced and is referred to by Orr [11] as **inputs** or **outputs**, respectively. Inputs originate within the mind of the individual engineer-scientist and include information needed to keep up with advances in one's profession, to perform one's professional duties [17, 9] to interact with peers, colleagues, and coworkers, and to obtain stimulation and feedback from them. [16, 7]

Outputs frequently, but not exclusively, result from an external stimulus or impetus. Outputs serve a variety of functions, including responding to a request for information from a supervisor, coworker, peer, or colleague; reporting progress; providing advice; reacting to inquiries; defending; advocating; and proposing. Inputs and outputs require the use of specific kinds and types of information.

The conceptual framework for this research assumes that, in response to a project, task, or problem, a specific kind(s) or type(s) of information is needed. In response to this scenario, U.S. aerospace engineers and scientists are confronted with two basic alternatives: they can create the information through experimentation or observation or they can search the existing information. If they act rationally, the decision to "make or buy" the information will depend upon their subjective perception of the relative likelihood of success in acquiring the desired information by these two alternatives within an acceptable time, and on their perception of the relative cost [money and/or effort] of these alternatives. [13]

If a decision is made to search the existing information, U.S. aerospace engineers and scientists must choose between two information channels. One is the **informal or collegial network**, which is characterized by interpersonal (oral) communications with peers, coworkers, colleagues, gatekeepers, vendors, consultants, "key" personnel, and supervisors and by personal collections of information. The other is the **formal information system**, which includes libraries, technical information centers, librarians and technical information specialists, information products and services, and information storage and retrieval systems. It is assumed that the decision to choose a particular information channel is influenced by institutional and sociometric variables operating within the previously identified systems. [13] Gerstberger and Allen [6], Rosenberg [15], and Orr [11] theorize that certain sociometric variables influence information source and product selection.

The resulting information is subjectively evaluated. The information processor is faced with three possible courses of action. **First**, if the acquired-obtained information completes the project or task or solves the problem, the process is successfully terminated. **Second**, if the acquired-obtained information is useful but only partially completes the project or task or solves the problem, a decision is made either to continue the process by reevaluating the information source selection or to terminate the process. **Third**, if the acquired-obtained information is not applicable to or does not complete the project or task or solve the problem, a decision is made either to continue the process by redefining the project, task, or problem or to terminate the process. [13]

Because the broader purpose of the study is to provide insight regarding the information-seeking habits and practices of U.S. aerospace engineers and scientists, the study is cast within a conceptual framework that focuses on information seeking. However, since the immediate purpose of the study is to provide an empirical basis for understanding the role of the U.S. government technical report in the diffusion of knowledge resulting from federally funded aerospace R&D, the conceptual framework is investigated but not validated. Instead, the study focuses on the information acquired or obtained through the source selection process and the institutional and sociometric variables associated with that portion of the conceptual framework. (The dotted line portion of figure 1.) [13]

Dependent and Independent Variables

Our research examined the impact of six institutional and seven sociometric variables on the use of four information products by U.S. aerospace engineers and scientists. The four information products–**conference-meeting papers, journal articles, in-house technical reports, and U.S. government technical reports–serve as dependent variables.**

Six institutional and seven sociometric variables serve as **independent** variables (figure 1). The six institutional variables include **level of education**, operationally defined as the presence or absence of a graduate degree; **educational preparation**, operationally defined as either engineer or scientist; **years of professional work experience**, operationally defined as 0 to 15 years or 16 years and over, **organizational affiliation**, operationally defined as academic, government, or industry; **primary professional duties**, operationally defined as management or nonmanagement; and **technical discipline**, operationally defined as engineering or nonengineering. Mention of the six institutional variables is made only to explain the conceptual framework. The impact of the institutional variables on the use of the four information products is not reported in this paper.

The seven sociometric variables include **accessibility**, operationally defined as the ease of getting to an information source; **ease of use**, operationally defined as the ease of understanding, comprehending, or utilizing the information source; **expense**, operationally defined as low cost in comparison to another information source; **familiarity or experience**, operationally defined as prior knowledge or previous use of an information source; **technical quality or reliability**, operationally defined as the expectation that the information source would be the best in terms of

Table 1. Technical Information Products Used

Information product	Percentage using product in —			Overall percentage using product[a] (n = 1839)
	Academia (n = 341)	Government (n = 454)	Industry (n = 1044)	
Conference-meeting papers	99.4	99.1	95.5	97.1
Journal articles	99.4	97.4	95.5	96.7
In-house technical reports	97.9	99.6	98.8	98.8
U.S. Government technical reports	98.9	99.1	96.6	96.6

[a]177 of the 2016 total respondents were not included because 149 did not specify the type of organization where they worked and 28 were retired or unemployed.

quality; **comprehensiveness**, operationally defined as the expectation that the information source would provide broad coverage of the available knowledge; and **relevance**, the expectation that a high percentage of the information acquired or obtained from the source would be useful.

In this paper, we focus our analysis on one **dependent** variable, U.S. government technical reports, and the seven (sociometric) **independent** variables. To establish a perspective, our analysis is placed within the context of three additional information products. The unit of analysis for the dependent variable is the number of times a U.S. government technical report was used in a 6-month period. Six months was chosen as the recall period because we felt that use of information sources may vary by month but remain relatively stable over a somewhat longer period. The fundamental assumption underlying the measurement of the dependent variables is that the numbers of times an information product was used in the previous six months can be successfully recalled by the respondents.

Relevant Research

In this paper, our research is concerned with the extent to which the seven **independent** sociometric variables influence the use of conference/meeting papers, journal articles, in-house technical reports, and U.S. government technical reports by U.S. aerospace engineers and scientists. This paper focuses on the relationship between seven variables and the use of U.S. government technical reports by U.S. aerospace engineers and scientists.

The relevant literature overwhelmingly favors accessibility as the single most important (variable) determinant of use. Buckland [5] cited accessibility as an area for "potentially productive future research in order to better understand the dynamics of why and how information services come to be used." Gerstberger and Allen [6] reported that among R&D engineers, accessibility rather than technical quality influenced use. Allen [1] stated, "There is apparently some relationship between their perceptions of technical quality and channel accessibility, but it is the accessibility component that almost exclusively determines frequency of use." Rosenberg [15], in a study of research and nonresearch personnel in industry and government, found that both groups exhibited similar information-seeking behavior. Of the eight variables investigated by Rosenberg [15], both groups indicated that accessibility had the greatest influence on information use.

Orr [11], on the other hand, disagreed, stating that quality of information was the most important consideration in selecting an information product, service, or source. Although this proposition has not been subjected to empirical verification, some evidence supports Orr's position. In his study of the use of technical information in engineering problem solving, Kaufman [8] reported that engineers identified **technical quality** or **reliability** followed by **relevance** as the criteria for selecting the most useful information source. However, **accessibility** appears to be the most frequently used factor in selecting an information source **even if that source proved to be the least useful**.

PRESENTATION OF THE DATA

Survey respondents were asked to indicate their use of and the importance of four information products and the approximate number of times they had used each product during the past 6 months in performing their present professional duties. While this paper does not focus on the impact of the institutional variables, the data presented in Tables 1–6 are differentiated by organizational affiliation (academia, government, and industry). We present these distributions to illustrate the difficulty of explaining the decision processes involved in the choice of a information product. The data further demonstrate that it is not safe to assume, as previous researchers have done, that all aerospace engineers and scientists have the same information needs and make decisions on information sources using the same factors.

As table 1 shows, almost all the U.S. aerospace engineers and scientists in this study use the four information products in performing their present professional duties. There is no statistical difference in usage among the respondents.

Survey participants were asked to rate the importance of conference-meeting papers, journal articles, in-house technical reports, and U.S. government technical reports (table 2). The rating of 1- to 5-points (very important to very unimportant) used in the

Table 2. Importance of Technical Information Products

Information product	Average [a](mean) importance rating in —			Overall average (mean) importance rating (n = 1839)	Total respondents
	Academia (n = 341)	Government (n = 454)	Industry (n = 1044)		
Conference-meeting papers	4.04	3.64	3.31	3.53	1777
Journal articles	4.35	3.49	3.26	3.52	1775
In-house technical reports	3.02	3.98	4.05	3.84	1766
U.S. Government technical reports	3.45	3.73	3.44	3.51	1778

[a] A 1- to 5-point scale was used to measure importance with "1" being the lowest possible importance and "5" being the highest possible importance. Hence, the higher the average (mean), the greater the importance of the product.

Table 3. Frequency of Use of Technical Information Products

Information product	Average number of times (median) product used in 6-month period for respondents in —			Overall average number of times (median) product used (n = 1839)	Total respondents
	Academia (n = 341)	Government (n = 454)	Industry (n = 1044)		
Conference-meeting papers	17.98 (7.00)	13.41 (4.00)	9.23 (4.00)	12.02 (4.00)	1527
Journal articles	26.60 (10.00)	15.41 (5.00)	9.99 (4.00)	14.74 (5.00)	1503
In-house technical reports	9.22 (5.00)	17.91 (6.00)	23.91 (8.00)	20.30 (6.00)	1535
U.S. Government technical reports	10.01 (5.00)	12.41 (5.00)	11.49 (4.00)	11.45 (5.00)	1495

survey instrument was reversed for purposes of data analysis and presentation. For the four information products, the overall highest mean importance rating for in-house technical reports reflects the composition of the sample which is mostly industry-affiliated U.S. aerospace engineers and scientists. The overall mean importance rating, although lower, does not differ considerably for conference-meeting papers, journal articles, and U.S. government technical reports. Academically-affiliated respondents attributed higher importance to conference-meeting papers and journal articles. Both government- and industry-affiliated respondents rate in-house technical reports highly. Government-affiliated respondents attribute the highest importance to U.S. government technical reports.

Survey participants were asked to indicate the number of times they had used each of the four information products in a 6-month period in performing their professional duties (table 3). On the average, in-house technical reports were used to a much greater extent than were the other three information products. Conference-meeting papers and journal articles were used to a far greater extent by academically-affiliated participants than by the government- and industry-affiliated respondents. In-house technical reports were used to a far greater extent by government- and industry-affiliated participants than by the academically-affiliated respondents. The use of U.S. government technical reports was about equal for all three groups.

Survey participants who used the four information products were asked to indicate the extent to which seven sociometric factors influenced their use of these products (table 4). Overall, it appears that relevance has the greatest influence on the use of conference papers, followed by accessibility and technical quality or reliability. Expense has the least influence on use. The users' organizational affiliation made no difference regarding these same three factors.

Overall, technical quality or reliability appears to have the greatest influence on the use of journal articles, followed by accessibility and relevance (table 5). Expense appears to have the least influence on use. Also noteworthy is the influence of comprehensiveness, familiarity, and ease of use on the use of journal articles.

In terms of organizational affiliation, technical quality or reliability accounted for the greatest influence on journal article use by academics, followed by relevance, and accessibility. These three factors also had the greatest influence on journal article use by government- and industry-affiliated U.S. aerospace engineers and scientists, although not in the same order.

Table 4. Factors Affecting the Use of Conference Papers

Selection factor	Average[a] (mean) influence of factor on use for respondents in —			Overall average (mean) influence of factor (n = 1839)	Total respondents[b]
	Academia (n = 341)	Government (n = 454)	Industry (n = 1044)		
Accessibility	3.94	3.82	3.71	3.79	1551
Ease of use	3.43	3.55	3.37	3.43	1548
Expense	2.63	2.42	2.48	2.50	1547
Familiarity or experience	3.71	3.52	3.52	3.56	1551
Technical quality or reliability	3.84	3.71	3.71	3.74	1552
Comprehensiveness	3.50	3.42	3.32	3.38	1545
Relevance	4.12	4.01	3.90	3.97	1547

[a] A 1- to 5-point scale was used to measure influence with "1" being the lowest possible influence and "5" being the highest possible influence. Hence, the higher the average (mean), the greater the influence of the factor. [b] Note that 53 individuals did not use conference papers.

Table 5. Factors Affecting the Use of Journal Articles

Selection factor	Average[a] (mean) influence of factor on use for respondents in —			Overall average (mean) influence of factor (n = 1839)	Total respondents[b]
	Academia (n = 341)	Government (n = 454)	Industry (n = 1044)		
Accessibility	4.13	3.86	3.79	3.88	1483
Ease of use	3.68	3.59	3.40	3.51	1503
Expense	2.68	2.58	2.61	2.64	1507
Familiarity or experience	3.86	3.55	3.48	3.58	1509
Technical quality or reliability	4.39	4.04	3.88	4.03	1512
Comprehensiveness	3.93	3.64	3.44	3.59	1504
Relevance	4.15	3.92	3.75	3.87	1505

[a] A 1- to 5-point scale was used to measure influence with "1" being the lowest possible influence and "5" being the highest possible influence. Hence, the higher the average (mean), the greater the influence of the factor. [b] Note that 61 individuals did not use journal articles.

Relevance appears to have the greatest influence overall on the use of in-house technical reports by U.S. aerospace engineers and scientists, followed by accessibility, and familiarity or experience (table 6). Of the seven socimetric variables, expense appears to have the least influence on use.

In terms of organizational affiliation, accessibility appears to have the greatest influence on the use of in-house technical reports by academics, followed by relevance and familiarity or experience. Relevance, accessibility, and technical quality or reliability have the greatest influence on the use of in-house technical reports by government-affiliated respondents. Relevance, accessibility, and familiarity or experience have the greatest influence on the use of in-house technical reports by industry-affiliated respondents.

Relevance has the greatest influence overall on the use of U.S. government technical reports by U.S. aerospace engineers and scientists, followed by technical quality or reliability, and accessibility (table 7). In terms of organizational affiliation, relevance appears to have the greatest influence on the use of U.S. government technical reports by academics, followed by technical quality or reliability, and accessibility. Relevance, accessibility, and technical quality or reliability have the greatest influence on the use of U.S. government technical reports by government-affiliated U.S. aerospace engineers and scientists. Relevance, technical quality or reliability, and accessibility exerted the greatest influence on industry-affiliated survey respondents.

DISCUSSION OF THE RESEARCH QUESTIONS

To what extent do the seven **independent** (sociometric) variables influence U.S. aerospace engineers' and scientists' use of conference/meeting papers, journal articles, in-house technical reports, and U.S. government technical reports? Relevance, accessibility, and technical quality are the factors which appear to influence the use of the four information products. As indicated by the survey data, relevance has

Table 6. Factors Affecting the Use of In-House Technical Reports

Selection factor	Average[a] (mean) influence of factor on use for respondents in —			Overall average (mean) influence of factor (n = 1839)	Total respondents[b]
	Academia (n = 341)	Government (n = 454)	Industry (n = 1044)		
Accessibility	3.99	4.05	4.00	4.01	1538
Ease of use	3.59	3.74	3.55	3.61	1537
Expense	2.44	2.52	2.50	2.50	1534
Familiarity or experience	3.69	3.81	3.78	3.78	1536
Technical quality or reliability	3.64	3.87	3.76	3.77	1603
Comprehensiveness	3.46	3.65	3.47	3.51	1600
Relevance	3.87	4.22	4.20	4.15	1597

[a] A 1- to 5-point scale was used to measure influence with "1" being the lowest possible influence and "5" being the highest possible influence. Hence, the higher the average (mean), the greater the influence of the selection factor. [b] Note that 22 individuals did not use in-house technical reports.

Table 7. Factors Affecting the Use of U.S. Government Technical Reports

Selection factor	Average[a] (mean) influence of factor on use for respondents in -			Overall average (mean) influence of factor (n = 1839)	Total respondents[b]
	Academia (n = 341)	Government (n = 454)	Industry (n = 1044)		
Accessibility	3.72	3.81	3.54	3.65	1576
Ease of use	3.36	3.58	3.28	3.38	1573
Expense	2.72	2.47	2.45	2.51	1569
Familiarity or experience	3.62	3.64	3.42	3.52	1575
Technical quality or reliability	3.80	3.77	3.68	3.73	1581
Comprehensiveness	3.57	3.65	3.49	3.55	1514
Relevance	3.87	4.03	3.84	3.90	1577

[a] A 1 to 5 point scale was used to measure influence with "1" being the lowest possible influence and "5" being the highest possible influence. Hence, the higher the average (mean), the greater the influence of the selection factor. [b] Note that 44 individuals did not use U.S. Government technical reports.

the greatest influence on the use of in-house technical reports ($\bar{X}$=4.15), U.S. government technical reports ($\bar{X}$=3.90), and conference-meeting papers ($\bar{X}$=3.97). Journal article use appears to be influenced by technical quality ($\bar{X}$=4.03).

Of the seven variables, which appears to influence the use of U.S. government technical reports by U.S. aerospace engineers and scientists? The influence of the seven sociometric variables on the use of U.S. government technical reports by academic-, government-, and industry-affiliated respondents was tested using a one-way ANOVA. In previous research, significant differences were found among the three groups for six of the sociometric variables. [13, p.208] No statistical difference was found, however, between each group and the influence of technical quality on their use of U.S. government technical reports. This would seem to indicate that all three groups rate the technical quality of U.S. government technical reports high.

Statistically significant differences were found between government- and industry-affiliated respondents, and government- and academic-affiliated respondents regarding the influence of accessibility, ease of use, and familiarity on U.S. government technical report use. Statistically significant differences were found between academic- and industry-affiliated respondents and academically and government-affiliated respondents regarding the influence of expense on U.S. government technical report use. Government-affiliated respondents and industry-affiliated respondents differ significantly regarding the influence of comprehensiveness on U.S. government technical report use. Government-affiliated respondents also differ significantly from academic- and industry-affiliated respondents regarding the influence of relevance on U.S. government technical report use.

Based on these data, accessibility does not appear to be the single most important determinant of the overall extent to which conference-meeting papers, journal articles, and in-house technical reports are used. Relevance, accessibility and technical quality or reli-

ability appear to exert the greatest influence on the use of conference-meeting papers. Technical quality or reliability, accessibility, and relevance appear to exert the greatest influence on journal article use. Relevance, followed by accessibility, exerts the greatest influence on the use of in-house technical reports, and a virtual tie occurs between familiarity or experience and technical quality or reliability. While accessibility does exert influence, **relevance** appears to be the single most important determinant of the overall extent to which U.S. aerospace engineers and scientists use conference/meeting papers, journal articles, and in-house technical reports.

Based on these data, relevance, technical quality or reliability, and accessibility all appear to be important determinants of the overall use of U.S. government technical reports. Of these, relevance, rather than accessibility, appears to be the single most important determinant of the overall extent to which U.S. aerospace engineers and scientists use U.S. government technical reports.

The data presented here show relevance, accessibility, and technical quality to be the most important variables for predicting use. However, it is also apparent that these variables vary in importance relative to each other depending on the particular product and the type of user. This suggests that certain products tend to be used to satisfy certain "work related" needs, and that these needs distinguish types of users. For example, the need of aerospace engineers and scientists in academia for materials of high technical quality may determine their relatively frequent use of journal articles.

It may be possible to indentify the diverse STI needs of aerospace engineers and scientists by viewing simultaneously a number of information choices. In the next step of this research we will perform multivariate analyses of these data. We expect to find the relative contribution of each variable through the use of multiple regression. Further, analysis of LISREL models will be done to determine if there are underlying components of the decision choice that are not apparent from the bivariate analyses. The surprising lack of strong predictive factors, especially those that have been found previously as determinants of use might be related to an underlying association between the variables.

CONCLUDING REMARKS

Phase 1 of the **NASA/DoD Aerospace Knowledge Diffusion Research Project** examines the information-seeking behavior of U.S. aerospace engineers and scientists, placing particular emphasis being placed on their use of federally funded aerospace R&D and their use of U.S. government technical reports. Our concluding remarks are framed within this context.

We spent considerable time trying to figure out why our findings differ so from the conventional wisdom that credits accessibility with significantly influencing the use of information products and services by engineers. The most plausible explanation, however, seems to lie in the passage of time. The related research we cite was conducted almost 25 years ago when the information world was literally a different place, and large-scale data bases such as NASA RECON, were just coming into existence.

According to Atkinson [2], the years 1968–1972 witnessed the expanded use of computer and telecommunications technology in an attempt to make the results of federally funded research and development accessible to both the federal and non-federal research communities. In their study, *Scientific and Technical Information Transfer: Issues and Options*, Bikson, Quint, and Johnson [4] point out that "although the federal government has no coherent, centrally organized, or systematically designed approach to deal with disseminating information, [it] has attempted to increase the flow of scientific and technical information (STI) by improving its availability. In doing so, the federal government, through federal information clearinghouses, has created fully indexed and abstracted bibliographic databases with online search capabilities. While some problems remain in assuring the availability of federally funded STI, federal efforts in this regard have been largely successful. " Thus, we suggest that accessibility is simply not the issue that it apparently was 25 years ago. Quite the contrary, too much information could be the problem today.

Our findings may have direct implications for Federal information programs. Three approaches or models have dominated attempts to facilitate the transfer and utilization of federally funded STI. [3,18] The **appropriability model**, based on neoclassical economics, is built on a "supply-side" approach that emphasizes the production of STI by the Federal government, not its transfer and utilization. This model still dominates many aspects of Federal science and technology (S&T) and scientific and technical information (STI) policy. The **dissemination model** emphasizes the need to transfer the results of federally funded STI to non-Federal users. This model, based on the assumption that production of STI will not ensure its use, emerged in response to concern that federally-produced STI was not being used to its fullest potential. The dissemination model, characterized by the large-scale STI programs operated by the DoD, DoE, and NASA, emphasizes accessibility. These agencies maintain STI systems for acquiring, processing, announcing, and disseminating the results of government-performed and government-sponsored research. Within these systems, the U.S. government technical report is used as a primary means of transferring the results of federally funded R&D. Bikson, et al. [4] have characterized these systems however, as "passive, fragmented, and nonresponsive to the user context."

The **knowledge utilization model** assumes an active approach to linking producers and users of STI and seeks to remove two barriers to the effective transfer of STI: (1) inadequate interpersonal communication between producers and users throughout the production, transfer, and utilization process and (2) organizational barriers. According to Ballard, et al. [3], rather than basing the system on the production and supply of STI (the appropriability model) or focusing on products and services that make STI more accessible (the dissemination model), the knowledge utilization model emphasizes the relationships among all components of the production, transfer, and use process. The assumption is that the results of federally funded R&D will be underutilized unless they are relevant to the needs of users and ongoing relationships are developed among producers and users. The problems associated with this model are twofold: (1) the lack of clear understanding of the information-seeking behavior of engineers and scientists involved in technological innovation and (2) the lack of attention to

characterizing the implications of information-seeking behavior in terms of Federal S&T and STI policy.

Given our findings regarding the extent to which use is influenced by relevance and technical quality, we believe that the accessibility model may not be as relevant in the 1990s. What may be needed is a more active or interactive knowledge utilization model that permits a two-way exchange between the producer and user and emphasizes the relevance and technical quality of information.

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