AD666091

Reproduced by the
CLEARINGHOUSE
for Federal Scientific & Technical
Information Springfield Va 22151

Diffusion of Abstracting and Indexing Services for Government-Sponsored Research

by

Irving M. Klempner
Associate Professor of Library Science
State University of New York at Albany

The Scarecrow Press, Inc.
Metuchen, N. J. 1968

BEST

AVAILABLE

COPY

Copyright 1968 by Irving M. Klempner

L. C. Card No. 67-12065

This book is the result of research supported by the Air Force Office of Scientific Research, Directorate of Information Sciences.

Table of Contents

	Page
Acknowledgments	vii
List of Abbreviations	ix
List of Tables	x
List of Figures	xviii
Introduction	19
Chapter	
1. Background	21
The Problem	22
Related Research	23
Hypotheses	24
Limitations	24
Methodology	25
2. Information as an Economic Resource	32
Expenditures for Research and Development	34
U. S. Federal Support for Research and Development	37
Public vs. Private Support for Research and Development	41
Need for Information Diffusion	41
Summary	46
3. Abstracting and Indexing Services as Diffusion Media	50
Soviet Bloc Exploitation of Abstracting and Indexing Services	54
Poland	54
Czechoslovakia	56
Hungary	57
East Germany	58
Soviet Union	59
Summary	69
4. Diffusion Pattern for NSA, STAR, TAB, and USGRDR	76
Non-Federal U. S. Recipients	80
COSATI Subject Grouping	83
Geographic Distribution	88
Copy Distribution	90
Industry Classification	92
Distribution Pattern by Site	94
Attention Line Distribution	96
STAR Domestic Subscribers	98
Federal Recipients	99
GPO Depository Library Recipients	99

Chapter	Page
Foreign Recipients	100
Summary	101
5. Recipient Population Characteristics and Use Made of NSA, STAR, TAB, and USGRDR	107
Recipient Population Sampling Technique	108
Recipient Questionnaire Mailings	109
Recipient Questionnaire Responses	109
Representativeness of Questionnaire Returns	110
Recipient Questionnaire Analysis	112
Individual Recipient Characteristics	112
Primary Activity of Respondents	112
Subject Specialization of Respondents	115
Scope of Respondent Information Needs	116
Educational Background	116
Individual Publishing and Innovation Record	118
Recipient Organization Environment	120
R & D Performance	122
Publishing and Innovation Record	122
Use of Abstracting and Indexing Services	124
Reasons for Use	130
Types of Information Sought	130
User's Approach	134
Index Usefulness and Frequency of Use	134
Subject Scope Preferences	138
Recipient Organization Library and Information Services	141
Library Facilities, Policies, and Practices	144
Internal Announcement and Distribution	148
Technical Report Holdings	152
Library and Information Center Staffing	154
Summary	158
6. The Nonrecipient Population	162
Directory Analysis	162
Nonrecipient Questionnaire Mailings	165
Nonrecipient Questionnaire Returns	165
Nonrecipient Questionnaire Analysis	166
Individual Nonrecipient Characteristics	166
Nonrecipient Organization Characteristics	167
Nonrecipient Organization R & D Activity	168
Nonrecipient Organization Information Services	172
Familiarity with and Use Made of Abstracting and Indexing Services	173
Types of Information Needs	174
Receipt of Privately Published Abstracting and Indexing Services	178
Summary	178
7. Summary, Conclusions and Recommendations	183

Chapter	Page
Distribution and Use Pattern	184
Recipient Types	185
Abstracting and Indexing Services in Relationship to Other Variables	186
Need for Purposeful Dissemination	188
Factors Inhibiting Dissemination	189
Recommendations	193
Appendices	197-301
A. Tables	197
B. Definitions	278
C. Recipient Questionnaire	281
D. Nonrecipient Questionnaire	295
Bibliography	302
Index	312

Acknowledgments

A researcher completing a study based in large measure on unpublished source materials held exclusively by five Federal agencies, granted a leave-of-absence and the free use of electronic data processing equipment by a private industrial organization, receiving guidance and administrative support from the faculty and staff of a large university, certainly owes a debt of gratitude to many individuals.

Federal agency source materials relating to the national documentation center abstracting and indexing services pertinent to this study were made available by Mr. Thomas W. Laughlin, Chief Document Management Branch, Division of Technical Information Extention, U.S. Atomic Energy Commission, Mr. Carper W. Buckley, Superintendent of Documents, U.S. Government Printing Office, Mr. Bernard M. Fry, formerly Director, Clearinghouse for Federal Scientific and Technical Information, Mr. George Abdian, Deputy Director, Defense Documentation Center, and Mr. John Sherrod, Assistant Director for Systems Development, Division of Technical Information, U.S. Atomic Energy Commission. This study could not have been carried out without their help.

The study was sponsored and, in essence, made possible by the Directorate of Information Sciences, Air Force Office of Scientific Research. Particular thanks go to Mrs. Rowena Swanson, Acting Director, and Dr. Harold Wooster, Director, for their encouragement and sympathetic understanding.

I owe a debt of gratitude to Dr. Maurice F. Tauber, my adviser, as well as to other members of the Columbia University faculty, especially to Dr. Alice Bryan and Dr. Russell Shank for their comments, suggestions and detailed questionnaire critiques, and to Dr. Theodore C. Hines for his overall moral support and frequently priceless sense of humor. The understanding and patience of Mr. Donald N. Bonacci, Director of Personnel, United Nuclear

Corporation, in granting me a leave of absence to carry out this study, is highly appreciated.

A note of thanks must also be expressed here to the approximately 1,500 librarians, scientists, engineers, and administrators who were kind enough to make time in their busy schedules to comment freely and to complete rather lengthy and detailed questionnaires. The efficiency with which the questionnaires were dispatched was in no small measure due to the team effort and expertise displayed by Diane and Mark as envelope stuffers and postal-zone sorters, requiring only occasional assistance from my wife, Miriam. I am indebted to Mrs. Mildred Ballma for her help in the arduous tasks of editing questionnaires, typing notes, and proofreading initial drafts on this study.

List of Abbreviations

AEC	Atomic Energy Commission
CINTE	Central Institute for Scientific and Technical Documentation, Poland
COSATI	Committee on Scientific and Technical Information, Federal Council on Science and Technology
DDC	Defense Documentation Center
DOD	Department of Defense
GNP	Gross National Product
GPO	Government Printing Office
NASA	National Aeronautics and Space Administration
NSA	Nuclear Science Abstracts
R & D	Research and Development
SIC	Standard Industrial Classification
STAR	Scientific and Technical Aerospace Reports
TAB	Technical Abstract Bulletin
USGRDR	U.S. Government Research & Development Reports
VINITI	All-Union Institute of Scientific and Technical Information, USSR

List of Tables

Table	Page
1. Expenditures for Federal Research and Development, and Research and Development Facilities, 1940-1966	38
2. Abstract and Citation Coverage Provided by Selective Abstracting and Indexing Services for the Years 1955 and 1965	52
3. "Referativnyĭ Zhurnal," Abstracts and Citation Coverage, 1953-1959	61
4. Total Recipient File, by Source	79
5. Total Recipient File, by Segment	80
6. Non-Federal U.S. Recipients, by Service and Type of Institution	83
7. Non-Federal U.S. Recipients, by COSATI Subject Field	85
8. Regional Percentage Distribution of Non-Federal U.S. Recipients Compared to Percentage Distribution of Other Variables	90
9. Industrial Recipient Establishments, by Major S.I.C. Groups	94
10. Sites and Combinations of Services Received	95
11. Distribution of Services, by Site	96
12. Attention Line, by Service	97
13. Recipient Questionnaire Respondents, by Service and Type of Institution	111
14. Recipient Questionnaire Respondents, by Broad Institutional Groupings	112
15. Recipient Questionnaire Respondents, by Primary Activity	114
16. Recipient Questionnaire Respondents, R & D Performance	115
17. Recipient Questionnaire Respondents, Percent of Time	

Table | Page

Devoted to R & D Performance 115

18. Recipient Questionnaire Respondents, R & D Performance for Federal Agencies 115

19. Recipient Questionnaire Respondents, by Subject Specialization 117

20. Recipient Questionnaire Respondents, R & D Performance Outside Respondent's Field of Specialization 118

21. Recipient Questionnaire Respondents, Need for Information Outside Respondent's Field of Specialization 118

22. Recipient Questionnaire Respondents, Maintenance of Personal Citation File 118

23. Recipient Questionnaire Respondents, by Highest Degree Earned 119

24. Recipient Questionnaire Respondents, by Year in Which Highest Degree was Earned 119

25. Recipient Questionnaire Respondents, Technical Report Authorship, Coauthorship, or Editorship within 12 Month Period 120

26. Recipient Questionnaire Respondents, Professional Paper Authorship, Coauthorship, or Editorship within 12 Month Period 120

27. Recipient Questionnaire Respondents, Patent Application Submission within 12 Month Period 121

28. Recipient Organizations, by Number of Scientists and Engineers Employed 121

29. Recipient Organizations, Internally-Sponsored R & D 122

30. Recipient Organizations, R & D Performance for Private Companies and Institutions 122

31. Recipient Organizations, R & D Performance for Federal Government Agencies 123

32. Recipient Organizations, Professional Paper Publishing 124

33. Recipient Organizations, Submission of Patent Applications 124

34. Recipient Questionnaire Respondents, Use of Abstracting

Table		Page
	and Indexing Services within Last Six Months	125
35.	Recipient Questionnaire Respondents, Amount of Time Devoted to Scanning a Single Issue of Service	126
36.	Recipient Questionnaire Respondents, Frequency of Use of NSA, STAR, TAB, and USGRDR	128-29
37.	Recipient Questionnaire Respondents, Frequency of Reasons Given for Using NSA, STAR, TAB, and USGRDR	131
38.	Recipient Questionnaire Respondents, Ranking of Reasons for Using NSA, STAR, TAB, and USGRDR	132
39.	Recipient Questionnaire Respondents, by Most Recent Use of Abstracting and Indexing Service	133
40.	Recipient Questionnaire Respondents, Types of Information or Data Sought, by Field Scanned	135
41.	Recipient Questionnaire Respondents, Types of Information or Data Sought, by Frequency of Need	136
42.	Recipient Questionnaire Respondents, Approach to Abstracting and Indexing Services	137
43.	Recipient Questionnaire Respondents, Combinatory Approaches to Using Abstracting and Indexing Services	138
44.	Recipient Questionnaire Respondents, Usefulness of Abstracting and Indexing Service Indexes	139
45.	Recipient Questionnaire Respondents, Frequency of Use of Indexes to Abstracting and Indexing Services	140
46.	Recipient Questionnaire Respondents, Preferences for Subject Scope Coverage for Abstracting and Indexing Services	142
47.	Recipient Questionnaire Respondents, Availability of Libraries or Information Centers	143
48.	Recipient Questionnaire Respondents, Accessibility of Libraries or Information Centers	143
49.	Recipient Questionnaire Respondents, Professional Staffing of Libraries or Information Centers	143

Table | Page

50. Recipient Questionnaire Respondents, Degree of Difficulty in Acquiring Original or Photocopy of Items Cited in Abstracting and Indexing Services 144

51. Recipient Questionnaire Respondents, Disposition of Abstracting and Indexing Services 145

52. Recipient Questionnaire Respondents, Interest in Obtaining Information about Abstracting and Indexing Services 146

53. Recipient Organization Libraries and Information Centers, by Function Performed 147

54. Recipient Organization Libraries and Information Centers, Reasons for Internal Cataloging of Technical Reports 149

55. Recipient Organization Libraries and Information Centers, Frequency of Acquisitions or Announcement Bulletin 150

56. Recipient Organization Libraries and Information Centers, Routing or Circulation Policy for NSA, STAR, TAB, and USGRDR 151

57. Recipient Organization Libraries and Information Centers, Number of Descriptors/Uniterms/Subject Headings Used for Subject Analysis of Technical Reports 152

58. Recipient Organization Libraries and Information Centers, Kinds of Entries Prepared in Descriptive Cataloging of Reports 153

59. Recipient Organization Libraries and Information Centers, Holdings of Technical Report Titles 154

60. Recipient Organization Libraries and Information Centers, by Percent of Federal Agency Technical Report Holdings 155

61. Recipient Organization Libraries and Information Centers, Full Time Professional Employees 156

62. Recipient Organization Libraries and Information Centers, Potential Library/Information Center Clientele - Scientists and Engineers 157

63. Nonrecipient Questionnaire Respondents, by Broad Institutional Groupings 166

Table	Page

64. Nonrecipient Questionnaire Respondents, by Primary Activity 167

65. Nonrecipient Organizations, by Subject Field Specialization 169

66. Nonrecipient Organizations, by Number of Scientists and Engineers Employed 169

67. Nonrecipient Organization, Internally-Sponsored R & D 170

68. Nonrecipient Organizations, R & D Performance for Private Industry 170

69. Nonrecipient Organizations, Federal Agency Contractors 170

70. Nonrecipient Organizations, Percentage Staff Time Devoted to R & D 171

71. Nonrecipient Organizations, Research Undertaken Outside Field of Specialization 171

72. Nonrecipient Organizations, Data or Information Needed from Outside Field of Specialization 171

73. Nonrecipient Organizations, Availability of Library or Information Centers 172

74. Nonrecipient Organizations, Professional Staffing of Library or Information Centers 172

75. Nonrecipient Questionnaire Respondents, Opinion of Degree with Which Scientific and Technical Information Needs are Met in Nonrecipient Companies 173

76. Nonrecipient Questionnaire Respondents, Acquaintance with NSA, STAR, TAB, and USGRDR 173

77. Nonrecipient Questionnaire Respondents, Use Made of NSA, STAR, TAB, and USGRDR 174

78. Nonrecipient Questionnaire Respondents, Interest in Obtaining Information on NSA, STAR, TAB, and USGRDR 174

79. Nonrecipient Questionnaire Respondents, Preference for Subject Scope Coverage for Abstracting and Indexing Services 175

80. Nonrecipient Questionnaire Respondents, Frequency

Table	Page
of Reasons Given for Using Published Materials	176
81. Type of Use Made of Published Materials - Respondent Ranking	177
82. Type of Information Needed and Frequency of Need - Nonrecipient Companies	178
83. Field Scanned for Needed Information	179
84. Receipt of Other Selected Abstracting and Indexing Services	180
List of Tables in Appendix A	
1A Percentage Shares of Various Industries in Total Output of Manufacturing Industry 1899-1959	197
2A Research and Development Expenditure as a Proportion of Net Output and of Sales in Various Industries in Selected Countries, 1958 and 1959	198
3A Research Performed 1949 and 1951, and Rate of Return 1952 by Industries	199
4A Federal Obligations and Expenditures for Research and Development, by Agency: 1960-1966	200
5A Sources of Funds Used for Research and Development by Sector, Distributed by Source: 1954-1964	202
6A Plans for Corporate R & D Expenditure Increases, 1966	204
7A Scope and Circulation Figures of the Czechoslovak Abstract Journal "Prehled Technicke a Hospodarske Literatury"	206
8A "Referativnyĭ Zhurnal," Main Series and Subsections, 1967	207
8B Separately Issued Volumes of "Referativnyĭ Zhurnal"	216
9A Non-Federal U. S. Recipients, by Detailed COSATI Subject Categories (DOD Modified)	219
10A Non-Federal U. S. Recipients, by Type of Institution and COSATI Subject Field	223
11A Non-Federal U. S. Recipients, by Service and COSATI Subject Field	226

Table		Page
12A	Non-Federal U.S. Recipients, by State	228
13A	R & D Contracts, by State	229
14A	Geographic Distribution of Scientists and Engineers, 1960	230
15A	Non-Federal U.S. Recipients, by Type of Institution and State	232
16A	Non-Federal U.S. Recipients, by Service and State	234
17A	Industrial Recipients, by Service and State	236
18A	Educational/Nonprofit Recipients, by Service and State	238
19A	Non-Federal U.S. Recipients, by Region	240
20A	Non-Federal U.S. Recipients, Average Number of Copies Received	241
21A	Non-Federal U.S. Recipients, Number of Copies NSA, TAB, USGRDR, by State	242
22A	Non-Federal U.S. Recipients, Number of Copies NSA, TAB, and USGRDR, by Type of Institution and State	244
23A	Non-Federal U.S. Recipients, Number of Copies, NSA, TAB, and USGRDR, by COSATI Subject Field	246
24A	Industrial Recipient Establishments, by Detailed S.I.C. Groups	247
25A	Funds for R & D Performance, by Industry, 1964	256
26A	Non-Federal U.S. Recipients, by Attention Line and COSATI Subject Field	257
27A	STAR Domestic Subscribers	258
28A	Federal Recipients (Non-Military), by Service and Agency	259
29A	Federal Recipients (Non-Military) - Number of Copies NSA, TAB, and USGRDR, by Service and Agency	260
30A	Federal Recipients (Military), by Service and State	261
31A	Federal Recipients (Military) - Number of Copies NSA, TAB, and USGRDR, by State and Service	262

Table	Page
32A GPO Depository Libraries - Number of Libraries and Number of Recipients, by State	263
33A GPO Depository Library Recipients, by Service and State	264
34A Foreign Recipients, by Country, Service and Source of Receipt	266
35A Foreign Recipients - Number of Copies, by Country, Service and Source of Receipt	270
36A Recipient Questionnaire Respondents, by State	274
37A Total Industrial U.S. Establishments, Nonrecipient Questionnaire Sample and Nonrecipient Questionnaire Returns, by State	276

List of Figures

Figure	Page
1. Research and Development Expenditures as a Percentage of Gross National Product at Market Prices	35
2. Research and Development Expenditures in Relation to Per Capita Gross National Product (GNP)	36
3. Research and Development as Percent of the Gross National Product, 1958-1963	39
4. Trends in Federal Expenditures for Research, Development and R & D Plant, by Agency	40
5. Sources for Research and Development Funds	42
6. Comparison of Growth of R & D Funds with Growth of GNP and Federal Budget	43
7. Number of Scientific Journals and Abstract Journals	51
8. Sample Abstract Card Issued by CIINTE, Poland	55
9. Growth of Selected Series of "Referativnyĭ Zhurnal," 1960-1965	62
10. Federal Obligations for Scientific and Technical Information, by Agency and Performer, 1967 (est.)	77

Introduction

During the last several decades, science and technology have undergone a drastic transformation. The enormity and depth of this transformation can be measured in many ways. It can be measured in terms of the number of students enrolled in graduate and undergraduate schools offering degrees in the physical and applied sciences, in terms of the number of new devices, products and innovations introduced into the military establishment and into the civilian sector of our economy, in terms of the number of scientists and engineers employed by industry and public and private institutions, in terms of the amounts of money expended annually on research and development, in terms of the number of technical reports, books, journals, papers, reprints, and conference proceedings stemming from these expenditures, and in many other ways.

Quantitative measurements alone are insufficient to describe fully the metamorphoses in the scope and practice of scientific and technological disciplines. The analyses of changes that have occurred in the political and physical environments within which modern science pursues its tasks, the socio-economics of support for research and development activity, and such factors as the development and use of computers and new media for scientific and technological communication would probably be just as meaningful as quantitative measures. The lone scientist experimenting in a home-made laboratory and utilizing inexpensive equipment has been replaced, in large measure, by the research team employing complex instrumentation, often beyond the means of any individual. The knowledgeable and frequently sympathetic science-oriented patron upon whose financial support the scientist depended in the past has been supplanted, for the most part, by the Federal agency supplying tax dollars collected from a multitude of remote, somewhat impersonal taxpayers. Team research has given rise to team authorship and, more frequently, to corporate authorship. The fractionalization of scientific disciplines,

the cross-linking of traditional disciplines, the creation of entirely new areas of knowledge have created concurrent demands for highly specialized information and for the more general state-of-the-art review. National security has required the compartmentalization of information. Federal agency reporting requirements, the necessity for speed in communication among a large group of researchers engaged in a motley of research projects, the proliferation and availability of "near-print" and photoreproduction equipment, have resulted in adoption of new methods of communication designed to satisfy new demands. The technical report, an outgrowth of the so-called "Third Revolution," praised by some and derided by others, has succeeded in establishing itself as one of the primary media for scientific and technological communication. A number of computer-produced or semi-automated abstracting and indexing services concern themselves primarily with the literature of technical reports and provide one of the most effective keys to the contents of that literature. These abstracting and indexing services, singled out for study in this report, have their unique place in the process of communicating research results.

Chapter 1

Background

In response to Congressional pressures,[1, 2, 3] National Science Foundation efforts, professional society suggestions, internal or external studies and recommendations,[4, 5, 6, 7] substantial sums have been allotted for the bibliographic control and dissemination of the scientific and technical literature stemming from government-sponsored research. As a result, the mechanized, semi-mechanized or computerized operations within the national documentation centers of the Defense Documentation Center, National Aeronautics and Space Administration, Atomic Energy Commission and Clearinghouse for Federal Scientific and Technical Information have yielded the abstracting and indexing services: Technical Abstract Bulletin (TAB), Scientific and Technical Aerospace Reports (STAR), Nuclear Science Abstracts (NSA), and U. S. Government Research & Development Reports (USGRDR).

These abstracting and indexing services have been compiled and disseminated with a view of fulfilling the functions of both information retrieval and announcement. How effectively these functions have been performed, particularly that of disseminating information about government-sponsored research, is open to question. When serving as Chairman of the Subcommittee on Reorganization and International Organizations, Vice-President Hubert Humphrey noted:

> It is my judgment, the Defense Department and the Office of Technical Services have hardly tapped the surface of transmitting information to the nondefense community.... A sustained, well-coordinated, well-planned effort, must be made by both DOD and NASA to convert military and space scientific and technical findings into civilian technology.[8]

Concentration and utilization of research results primarily within defense-oriented industries have been a matter of concern to the

Background

Department of Commerce, Department of Defense agencies, business leaders and economists. In August 1964, President Johnson signed Public Law 88-444 authorizing the establishment of a National Commission on Technology, Automation and Economic Progress which had as its aim the study of the probable pace of technological change, the problems such change will bring and the means of speeding and increasing the benefits of advancing technology. On September 14, 1965, the President signed the State Technical Services Act designed to facilitate diffusion of information to private industry through state and local organizations. On signing the law, the President noted: "We are committing ourselves to an intelligent and an orderly application of the great technical and scientific breakthroughs of our time."[9]

One of the basic assumptions underlying this study is that the utilization of technical information can be accelerated and intensified through the purposeful exploitation of national documentation center abstracting and indexing services; such services need to be considered more than reference tools confined primarily to the library reference room and utilized, for the most part, by the librarian for information retrieval purposes. These services need to be made accessible to more than a fraction of potential research-oriented organizations. If imaginatively distributed and used, the services can, in effect, act as social instruments capable of promoting national technological, economic and social goals.[10]

The Problem

What, then, is the present distribution pattern for the abstracting and indexing services of NSA, STAR, TAB, and USGRDR which were designed to meet the interlocking, mission-oriented interests of the Department of Defense, National Aeronautics and Space Administration, Atomic Energy Commission, and the Department of Commerce? How effective is this distribution pattern in terms of support of national technological, economic and social goals? Which research-oriented organizations currently receive these services? What are the characteristics of the recipients of these services? For what purposes and with what frequency are the services being

used? Is there a discernible geographic, institutional, industrial or subject discipline distribution pattern that is characteristic for these services? Is there a relationship, for example, between the geographic distribution of these abstracting and indexing services and the geographic distribution of research and development funds? Can we identify the research-oriented organizations and institutions that currently receive none of the services? If so, what are some of the characteristics of the nonrecipient population? Can we determine whether the nonrecipient population is aware of the availability of the services? Can we pinpoint national documentation center policies which would tend to enhance or impede the dissemination of these services to the segments of the scientific and technological community which are capable of fostering innovation or of applying R & D results?

Related Research

A number of studies relate tangentially to the problem outlined above. Some of the studies bear on the scientific and technological information needs and uses of specific clienteles.[11, 12, 13, 14] Studies frequently reflect the interest of the mission-oriented sponsor.[15, 16, 17] In some instances, abstracting and indexing services covering related subjects have been investigated.[18, 19, 20, 21] More general investigations have been undertaken to determine the purposes for which scientific information is used and the steps that the scientist takes to acquire this information;[22] the information flow pattern among scientists[23] or within an industrial organization;[24] the overall problem of disseminating technical report literature;[25] the speed with which technical report literature is announced;[26] factors influencing the publication and announcement of technical reports;[27] and the use made of technical reports within a specific subject discipline.[28] A study was under way on the use made of Nuclear Science Abstracts by members of a particular professional society,[29] and Phase II of the DOD User Survey relates to Department of Defense contractor acquisition and use of scientific and technical information.[30] A broad investigation to determine the "current status and effectiveness" of some 500 U.S. abstracting and indexing

services has been conducted by the System Development Corporation.[31]

None of the studies cited above deal with the diffusion of STAR, TAB, NSA, and USCTDR. While some of the researchers seek to analyze the use made of specific abstracting and indexing services, none of them applies comparable methodology to the four abstracting and indexing services considered in this study. No investigations were found analyzing the use of these abstracting and indexing services within a broad range of industries, subject disciplines, educational, governmental or private subscriber recipients. Neither have studies been located aiming to indentify and describe the nonrecipient research-oriented industrial or institutional population.

Hypotheses

The hypotheses to be tested are the following:

1. National documentation center abstracting and indexing services are at present inadequately utilized as vehicles for the diffusion of results from government-sponsored research.
2. An economically undesirable pattern exists in the distribution of these abstracting and indexing services in that:
   (a) Industries and institutions having government contracts are the primary recipients of national documentation center abstracting and indexing services.
   (b) Industries and institutions having no government contracts generally do not receive, and frequently are unfamiliar with these abstracting and indexing services.
3. There is a marked correlation between the extent of receipt and utilization of national documentation center abstracting and indexing services within certain geographic regions and industries, and the degree of innovation and economic expansion within these regions and industries.

Limitations

Abstracting and indexing services constitute only one of the media for dissemination of scientific and technological information. Other investigators have concerned themselves with general analyses

of the broader range of media including planned or unplanned communication that takes place outside abstracting and indexing services, outside the library or information center, indeed, outside the literature.[32] This study is limited to analysis of services concerned primarily with abstracting and indexing the technical report literature published as a result of government-sponsored research. It is assumed that a service providing access to abstracts through detailed indexes and allowing a more generalized approach through use of the table of contents is preferable to one providing either indexes without abstracts or abstracts without indexes. Title, brief subject, or keyword-oriented services such as Monthly Catalog of United States Government Publications, and Keywords index to U.S. Government Technical Reports, since they do not provide abstracts, are considered outside the scope of this investigation. Similarly, services such as Fast Announcement Service (Clearinghouse for Federal Scientific and Technical Information), while highly relevant to the general theme of this investigation, are omitted because of their lack of indexes. Limitation of coverage to the technical report literature excludes such services as International Aerospace Abstracts, or Index Medicus, since, for the most part, they cover the open or journal literature. The investigation deals primarily with the analysis of the overall diffusion pattern and the use made by non-Federal, non-military U.S. recipients of Nuclear Science Abstracts (NSA), Scientific and Technical Aerospace Reports (STAR), Technical Abstract Bulletin (TAB), and U.S. Government Research & Development Reports (USGRDR).

The above services are the principal media for disseminating results of research programs sponsored by their respective agencies, and these agencies spend more than 90 percent of the $15 billion currently allocated in Federal research and development funds.

Methodology

The literature bearing upon the economic and social influence of scientific and technological information was examined. National systems for organizing and diffusing technological information, particularly those of Soviet bloc countries, were studied and the

dissemination functions of the abstracting and indexing services of the various national documentation centers were investigated.

Mailing lists for the abstracting and indexing services of NSA, STAR, TAB, and USGRDR, included those for GPO depository libraries, AEC depository libraries, private subscribers, AEC, DOD, or NASA contractors and offical recipients, Smithsonian Institution exchanges, and Library of Congress exchange agreements. These mailing lists were arranged in a single alphabetical file and non-Federal U. S. recipients were assigned codes to denote educational institutions, industrial coporations, state or local government bodies, service received, number of copies, geographic locations, and the prime subject specialty of the individual recipient and his employer.

All coded data were keypunched on standard EAM equipment and were transferred to magnetic tape. A Control Data 1604-A computer was programmed for grouping and permuting the various coded characteristics of the non-Federal U. S. recipients.

A stratified random sample of industrial, institutional and private subscribers was obtained for NSA, STAR, TAB, and USGRDR. Since a great deal was known about the recipients, a statistically significant sample was derived which took into account such factors as geographic distribution, service received, and type of user.

A questionnaire was devised to elicit facts regarding user and institutional background and to determine how the abstracting and indexing services were used once they reached the receiving organization. Information was sought to answer such questions as: What is the recipient's primary activity? What is his subject specialty? What is his publishing or innovation record? To what extent is the recipient's company or institution research-oriented? To what extent does the recipient or his colleagues make use of the abstracting and indexing service mailed to his attention?

The data resulting from the questionnaire were keypunched and converted to magnetic tape. The questions were grouped, tabulated, compared and contrasted with other tabulated relevant questionnaire responses.

The directories, Industrial Research Laboratories of the United

States (Bowker Associates, 1965) containing 3,260 industry listings, Roster of U.S. Government Research and Development Contracts in Aerospace and Defense (Bowker Associates, 1965) containing 1,096 industry and institutional listings, and List of Small Business Concerns Interested in Performing Research and Development (U.S. Small Business Administration, 1963) containing 2,775 companies were searched against the Non-Federal U.S. Recipient File. A statistically significant source file was established for the nonrecipient population representing primarily industrial organizations supposedly receiving none of the services under investigation. A ten percent sample was selected from the nonrecipient file.

A questionnaire for the nonrecipient population was designed to establish the magnitude of R & D activity, company subject interests, the use made of various other abstracting and indexing services and types of approaches utilized in acquiring and using scientific and technological information. A number of questions identical with those in the Recipient Questionnaire were retained in the Nonrecipient Questionnaire. This was done to facilitate comparison between the information gathering patterns among recipients and nonrecipients of the Federal abstracting and indexing services.

The responses to the Nonrecipient Questionnaires were keypunched and transferred to magnetic tape. The responses were compared with those derived from the Recipient Questionnaires.

The various phases of the study have been treated in subsequent chapters as follows:

Chapter II is devoted to national trends in research and development and the economic effects resulting from maximum exploitation of R & D findings. The growth of U.S. Federal research and development support is examined vis-à-vis non-Federal support for research and development. The relationship between research and development expenditures and the need for systematic diffusion of information stemming from these expenditures is discussed.

Chapter III examines the use of abstracting and indexing services for the communication of research results. Since the abstract has been purposefully and extensively used in Soviet bloc countries

as the official communication medium in this field, the information service environment and use made of abstracts in Poland, Czechoslovakia, Hungary, East Germany, and the Soviet Union was investigated.

Chapter IV presents the U.S. diffusion pattern for the abstracting and indexing services of Nuclear Science Abstracts, Scientific and Technical Aerospace Reports, Technical Abstract Bulletin, and U.S. Government Research & Development Reports. Detailed statistical analyses are provided for non-Federal U.S. recipients, who are grouped by subject specialty, type of industry, geographic location, and a number of other variables. More general statistical information is made available for Federal agency recipients, GPO Depository Library recipients, as well as recipients outside the United States and its possessions.

Chapter V describes the sampling method and reports the results of analysis of the Recipient Questionnaire that was sent to a representative group of non-Federal U.S. recipients. Data on individual recipient characteristics as well as information on recipient organization environment were quantified and analyzed. The categories of information sought and data on the actual use made of the abstracting and indexing services are displayed in tabular form. Generalizations are derived on the basis of the quantified data.

Chapter VI is devoted to the identification and analysis of the nonrecipient population. Search results are presented derived from the comparison of the address files of known recipients of the abstracting and indexing services and listings of research-oriented industrial nonrecipient firms and institutions found in a number of specialized directories. Responses to the Nonrecipient Questionnaire are tabulated and analyzed and the data compared with those derived from the Recipient Questionnaire.

Chapter VII summarizes the salient findings relating to the hypotheses tested. Current national policies and practices bearing on the dissemination of federally-sponsored research results are reviewed in light of this and other investigations. Recommendations are made with respect to a national information dissemination policy.

1. U.S. Congress. House. Committee on Science and Astronautics. Dissemination of Scientific Information. Hearings, 86th Cong., 1st Sess., May 25, 26, 28, June 2, and 17, 1959. Washington, D.C., U.S. Govt. Print. Off., 1959.

2. U.S. Congress. Senate. Committee on Government Operations. Documentation, Indexing, and Retrieval of Scientific Information. Washington, D.C., U.S. Govt. Print. Off., 1960.

3. U.S. Congress. Senate. Committee on Government Operations. Subcommittee on Reorganization and International Organizations. Interagency Coordination of Information. Hearings, 87th Cong., 2nd Sess., Sept. 21, 1962, Pt. 1. Washington, D.C., U.S. Govt. Print. Off., 1963.

4. U.S. Task Force to the President's Special Assistant for Science and Technology. Scientific and Technological Communication in the Government. Report. (AD 299 545). Washington, D.C., 1962.

5. U.S. Office of the Director of Defense Research and Engineering. Defense Science Board Subcommittee. Final Report on Scientific and Technical Information. (AD 416 655). Washington, D.C., 1963.

6. U.S. President's Science Advisory Committee. Science, Government, and Information. Report. Washington, D.C., U.S. Govt. Print. Off., 1963.

7. "The Trouble with ASTIA." Sci-Tech News, v. 13, no. 2, Summer 1959, p. 1.

8. U.S. Congress. Senate. Committee on Government Operations. Subcommittee on Reorganization and International Organizations. Defense Department Scientific and Technical Information... and Other Federal Agencies Programs for Scientific and Technical Information.... (Memorandum S-10-1-63). Washington, D.C., October 1963.

9. "President Signs State Technical Services Act." Washington Science Trends, v. 14, no. 25, Sept. 20, 1965, p. 369.

10. Berkov, P.N. Bibliograficheskaia evristika; k teorii i metodike bibliograficheskikh razyskanii. Moskva, Izd-vo Vsesoiuznoi knizhnoi palaty, 1960, p. 5.

11. Gt. Brit. Advisory Council on Scientific Policy. "Survey of Information Needs of Physicists and Chemists." Journal of Documentation, v. 21, no. 2, June 1965, pp. 83-112.

12. Herner, Saul. "The Information-Gathering Habits of American Medical Scientists." In: International Conference on Scientific Information, Washington, D.C., Nov. 16-21, 1958. Proceedings. v. 1. Washington, D.C., National Academy of Sciences, National Research

Council, 1959, pp. 277-285.

13. Scott, Christopher. The Use of Technical Literature by Industrial Technologists: A Study of Technical Information in the Electrical Industry. Rev. ed. London, Central Office of Information, 1960.

14. American Psychological Association. Reports of Project on Scientific Information Exchange in Psychology. v. 2. Washington, D.C., Dec. 1965.

15. Herner, Saul and Herner, Mary. The Use of Atomic Energy Commission Technical Information Tools and Services. Oak Ridge, Tenn., Division of Technical Information, U.S. Atomic Energy Commission, Feb. 1962.

16. U.S. Clearinghouse for Federal Scientific and Technical Information. User Feedback Study of the Utilization of CFSTI Material and Services. Springfield, Va., Aug. 1965.

17. Auerbach Corp. DOD User Needs Study. Final Technical Report 1151-TR-3 Phase I. Submitted to Advanced Research Projects Agency, Department of Defense. 2 vols. (AD 615 501; AD 615 502). Philadelphia, Pa., May 14, 1965.

18. Urquhart, D. J. "Physics Abstracting - Use and Users." Journal of Documentation, v. 21, no. 2, June 1965, pp. 113-21.

19. Glass, Bentley. "Survey of Biological Abstracting." AIBS Bulletin, v. 5, Jan. 1965, pp. 20-24; April 1955, pp. 18-21.

20. American Psychological Association. A Study of the Use and Current Operations of Psychological Abstracts with a View Toward Innovation. (APA-PSIEP Report No. 15). Washington, D.C., Dec. 1965.

21. Gray, Dwight E. "The American Institute of Physics Study of Physics Abstracting." Revue de la Documentation, v. 18, March 31, 1951, pp. 17-20.

22. Voigt, Melvin J. Scientists' Approaches to Information. (ACRL Monograph No. 24). Chicago, American Library Association, 1961.

23. Columbia University. Bureau of Applied Social Research. The Flow of Information Among Scientists. New York, May 1958.

24. McLaughlin, Curtis P., et al. Technology Transfer and the Flow of Technical Information in a Large Industrial Corporation. 2 vols. Sponsored by the Committee on Space, American Academy of Arts and Sciences under NASA Grant NsG-253-62. [Cambridge, Mass., Graduate School of Business Administration, Harvard University] March 1965.

25. Thompson (John I.) and Co. Study of the Federal Government's System for Distributing Its Unclassified R & D Reports. Prepared by T. R. O'Donnell, J. L. Lewis, and J. I. Glendinning under National Science Foundation Contract NSF-C-224. Washington, D.C., June 20, 1962.

26. Herner and Co. Speed of Announcement of United States Government Research Reports in Technical Abstract Bulletin, U.S. Government Research Reports, and Nuclear Science Abstracts, 1961-62. (PB-160556). Prepared by Mary Herner and Barbara Kolber under National Science Foundation Contract NSF-C-213. Washington, D.C., March 1962.

27. Herner and Co. Factors Governing the Announcement and Publication of United States Government Research Reports. (PB-160555). Prepared by Saul and Mary Herner under National Science Foundation Contract NSF-C-153. Washington, D.C., Dec. 1961.

28. American Psychological Association. The Role of the Technical Report in the Dissemination of Scientific Information. (APA-PSIEP Report No. 13). Washington, D.C., April 1965.

29. Private communication, American Nuclear Society, August 1966.

30. North American Aviation, Inc. Autonetics Division. DOD User-Needs Study, Phase II. Flow of Scientific and Technical Information within the Defense Industry. 3 vols. (C6-2442/030). Anaheim, Calif., Nov. 1966.

31. System Development Corp. A System Study of Abstracting and Indexing in the United States. (Technical Memorandum, TM-WD-394; PB 174 249). Falls Church, Va., Dec. 1966.

32. Menzel, Herbert. "The Information Needs of Current Scientific Research." Library Quarterly. v. 34, no. 1, Jan. 1964, pp. 4-19.

Chapter 2

Information as an Economic Resource

A strong U.S. economy is now deemed capable of wielding far greater influence than military force. It needs to be sustained and enriched as a matter of sound strategic policy.[1]

What are the factors that tend to increase productivity? Is an increased rate of economic growth to be attained primarily by substantial investment in capital plant and equipment? What effect do such economy input variables as training and education or research and development have on national economies or individual corporate enterprises?

The effect of human capital on productivity has been largely neglected in the past. Virtually all economic studies have emphasized the role of nonhuman capital. This resulted in the widely held belief that an increase in nonhuman capital per worker would result in a corresponding increase in productivity per worker, which is quite misleading. When applied to economic planning for underdeveloped nations, the simple capital-output ratios proved to be erroneous.[2]

Economic growth is increasingly being considered as the cumulative result of capital investment in machines and labor and of national resources devoted to developing and improving the economy input variables usually grouped under the term technical progress. Recent studies taking into consideration both physical and non-physical capital investments indicate that in mature industrial countries the rise in physical capital accounts for only a fraction of the long-term increase in labor productivity.[3,4] Rather, it is investment in the nonphysical technical progress that accounts for up to 90 percent of the increase in real product per person employed.[5] Specifically, investments in education or in research and devlopment have been shown to lead to improvements in the quality of capital and labor

and thus have resulted in increased productivity. The effect of R & D on productivity can usually, though not immediately, be noted in efficiency of equipment, efficiency of processes and methods, efficiency of products. An increase of $40 to $80 billion of the $365 billion Gross National Product of 1953 was attributable to R & D conducted during the period 1928-53.[6] Fast growing industries, such as the electronics, chemical and aerospace industries, have generally showed a relatively high ratio of R & D expenditure to output, while slow growing industries, such as the textiles, food and lumber industries, usually had a low ratio. This trend has been analyzed by Hoffman[7] and Maizels[8] and is apparent through examination of Tables 1A and 2A, Appendix A.

Investigations of British research-based industries reveal that their output has been growing twice as fast as that of manufacturing industries in general. While British exports have increased by 3.1 percent per year during the past eight years, the annual growth rate of exports for the chemicals industry has been 10.4 percent and for the electronics industry 7.9 percent.[9] A study of five U.S. firms in the drug and pharmaceutical industry and eighteen firms in the chemical and allied products industry established empirically the relationship between R & D expenditures and productivity increase. A number of other input variables were also tested. The basic conclusion of the study is that "beyond a reasonable doubt, causality runs from research and development to productivity, and finally to profitability." It is further noted that

> no other input factor tested (except possibly differential monopoly power whose influence was not fully established) was able to compete effectively with, or even to complement substantially, the relationship found between the above variables.[10]

A detailed study of the chemical, petroleum and steel industries, sponsored by the National Science Foundation, the Ford Foundation and the Cowles Foundation, suggests that the number of significant inventions developed by a firm is highly correlated with the size of its R & D investment.

Although the payout from an individual R & D project

> is obviously very uncertain, it seems that there is a close relationship over the long run between the amount a firm spends on R & D and the total number of important inventions it produces

Other studies have established a [illegible] correlation between the percentage of gross sales spent on R & [illegible] and the return on the stockholders investment (see Table 3A, Appendix A). An investigation of ten chemical companies, covering a 13 year period, revealed that "for each dollar spent on research, a total of 30 dollars of additional sales was generated in the fourth through the 10th year after the end of the research period."[12] Ewell's study indicates that one dollar of research expenditure resulted in at least 25 dollars of added Gross National Product over the following 25 years.[13]

Expenditures for Research and Development

Whether based on demonstrable facts or intuitive knowledge, many industrialized as well as underdeveloped nations have substantially increased their expenditures for research and development. As used in this report, the generic term "research and development" (R & D) encompasses the whole spectrum of activity covered by the terms "basic research," "applied research" and "development." Following definitions used by the National Science Foundation,[14, 15] the specific terms signify the following:

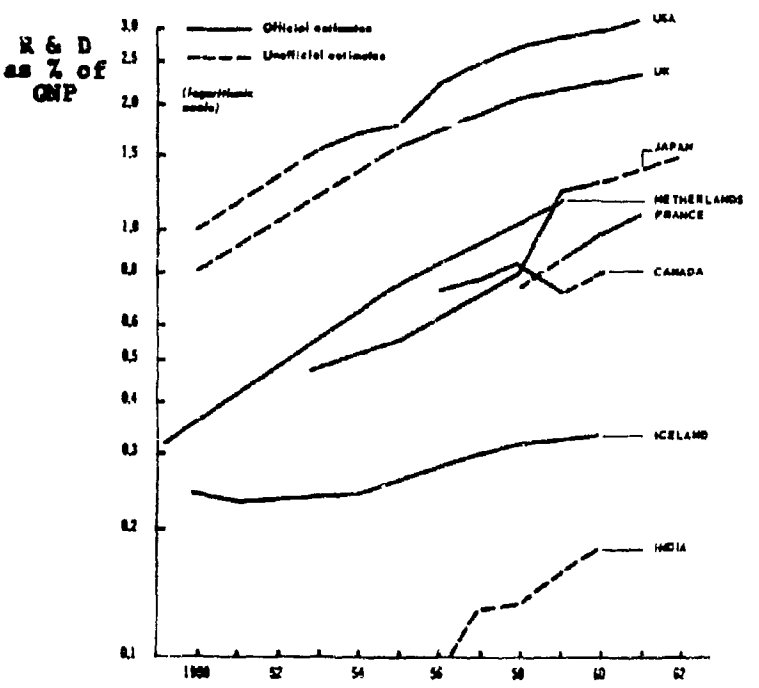
> Basic Research - Research projects which represent original investigation for the advancement of scientific knowledge and do not have specific commercial objectives, although they may be in fields of present or potential interest to the reporting company.
>
> Applied Research - Research projects which represent investigation directed to discovery of new scientific knowledge and which have specific commercial objectives with respect to either products or processes.
>
> Development - Systematic use of scientific knowledge directed toward the production of useful materials, devices, systems or methods, including design and development of prototypes and processes.

While positive efforts have been exerted within recent years to collect statistics on research and development expenditures, many nations as well as individual institutions find this to be a difficult

task. The input data comprising research and development are prone to subjective interpretation and the resultant statistics, even when officially collected, often pose serious problems from the point of

Figure 1

Research and Development Expenditure as a Percentage of Gross National Product at Market Prices

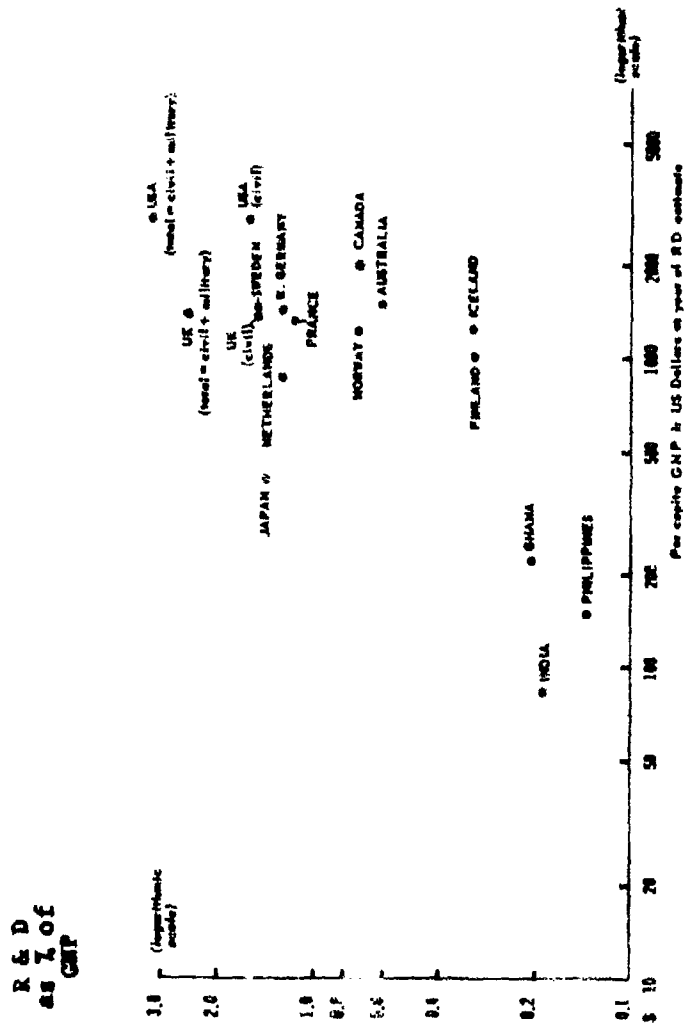


Source: Organization for Economic Cooperation and Development. Science, Economic Growth and Government Policy. Paris, 1963, p. 23.

Figure 2

Research and Development Expenditures in Relation to Per Capita Gross National Product (GNP)

At Market Prices 1961 (or nearest year)



Source: Organization for Economic Cooperation and Development. Science, Economic Growth and Government Policy, Paris, 1963, p. 25.

view of definition and comparability. In spite of these shortcomings, R & D statistics, since they are major constituents of technical progress, provide one of the best indicators available for appraising other than physical capital investments made nationally or by individual industrial enterprises.

Estimates of research and development expenditures for a number of countries have been collected and analyzed by the staff of the Organization for Economic Cooperation and Development. As indicated in Figure 1, the R & D expenditures have been measured against the Gross National Product (GNP) of the respective countries. Ratios between expenditures for research and development and the Gross National Product (the market value of the output and services produced by a nation's economy) indicate the R & D investment trends within the framework of the total national income.

Comparative analyses of countries at varying stages of industrial development indicate, as shown in Figure 2, that the research ratio tends to rise with the growth of the per capita Gross National Product. The inference can thus be made that nations having a high per capita GNP have a substantially higher research ratio than nations having a low per capita GNP. Figure 2 indicates that advanced industrial nations spend more than one percent of their GNP on research and development while underdeveloped countries spend less than 0.25 percent. The share of GNP allocated to research and development in the Soviet Union has been estimated at 2.87 percent for the year 1960.[16]

U.S. Federal Support of Research and Development

The Federal Government has been supporting research since the 19th Century. The Hatch Act of 1887 provided for the establishment of an agricultural experiment station at each state land grant college or university and provided for an annual appropriation for the partial funding of these state experiment stations. This was one of the earliest landmarks of Federal support for research and development programs,[17] but major funding for research and development was not provided by Congress until just before World War II. The end of World War II, with its awesome demonstration of the

application of science and technology for military purposes, brought the realization that the United States could not entrust its security to the scientific progress of a war-shattered Europe. This resulted in Congressional authorization for a number of Executive agencies to undertake research and development in support of their respective missions.

Since the end of World War II, Federal R & D expenditures have risen continuously. Table 1 shows that Federal expenditures for research and development rose from 74 million in the forties to an estimated total of $15.5 billion in 1966.

Table 1

Expenditures for Federal Research and Development, and Research and Development Facilities, 1940-1966

(Millions of Dollars)

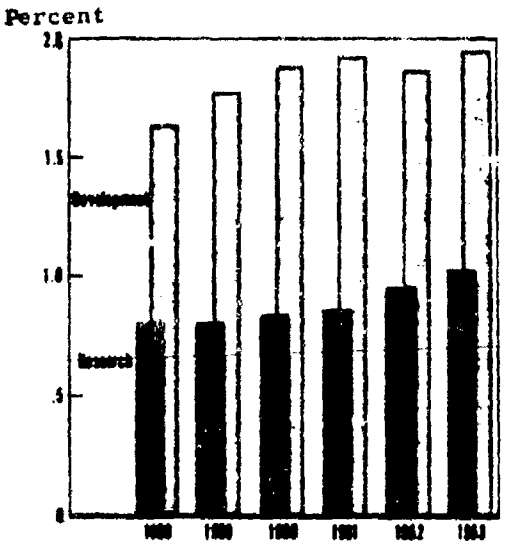
Fiscal Year	Total Budget Expenditures	Total R & D and R & D Facilities Expenditures	Percent of Total Federal Expenditures
1940	9,055	74	0.8
1941	13,255	198	1.5
1942	34,037	280	.8
1943	79,368	602	.8
1944	94,986	1,377	1.4
1945	98,303	1,591	1.6
1946	60,326	918	1.5
1947	38,923	900	2.3
1948	32,955	855	2.6
1949	39,474	1,082	2.7
1950	39,544	1,083	2.7
1951	43,970	1,301	3.0
1952	65,303	1,816	2.8
1953	74,120	3,101	4.2
1954	67,537	3,148	4.7
1955	64,389	3,308	5.1
1956	66,224	3,446	5.2
1957	68,966	4,462	6.5
1958	71,369	4,990	7.0
1959	80,342	5,803	7.2
1960	76,539	7,738	10.1
1961	81,515	9,278	11.4
1962	87,787	10,373	11.8
1963	92,642	11,988	12.9
1964	97,684	14,694	15.0
1965 (estimate)	97,481	15,371	15.8
1966 (estimate)	99,687	15,438	15.5

Source: U.S. National Science Foundation. Federal Funds for Research, Development, and Other Scientific Activities, 1966. (NSF 65-19). Washington, D.C., U.S. Govt. Print. Off., 1966, p. 2.

In 1920 Federal and non-Federal R & D expenditures were 0.09 percent of our Gross National Product; in 1930, 0.14 percent; in 1940, 0.37 percent; in 1950, 1.01 percent and in 1960, 2.78 percent.[18] These figures are essentially in agreement with those provided by the National Science Foundation (Figure 3) for the period 1958-1963.

Figure 3

Research and Development as Percent of the Gross National Product, 1958-63



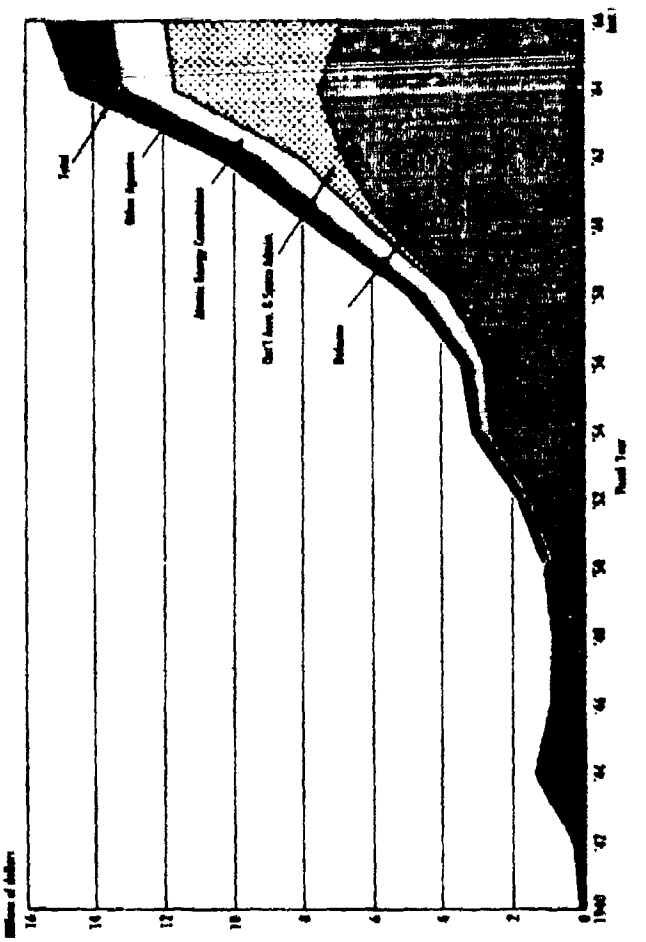
Source: "Research and Development and the Gross National Product." Reviews of Data on Science Resources. v. 1, no. 4, May 1965, p. 9. (NSF 65-11).

Information as an Economic Resource

The proportion of the United States' GNP devoted to R & D increased almost 750 percent during the last two decades and almost 2000 percent over the last three decades. Throughout this period

Figure 4

Trends in Federal Expenditures for Research Development, and R & D Plant, by Agency



Source: U. S. National Science Foundation. Federal Funds for Research, Development and other Scientific Activities: 1966. (NSF-65-19). Washington, D. C., U. S. Govt. Print. Off., 1966, p. 4.

approximately 90 percent of Federal R & D funds were expended by just three agencies: the Department of Defense, National Aeronautics and Space Administration (formerly National Advisory Committee for Aeronautics) and the Atomic Energy Commission. Federal agency R & D expenditures for the period 1940-1966 are presented in Figure 4. (See also Table 4A, Appendix A).

Public vs. Private Support for R & D

While industrial organizations, educational institutions and Federal government agencies have all progressively increased their research and development expenditures (see Table 5A, Appendix A), and although many industrial organizations have indicated further increases in their R & D obligations (see Table 6A, Appendix A), a decided shift has become apparent in the relative amounts of R & D support provided by the Federal government vs. private industrial organizations. To an ever increasing degree, the Federal government has assumed responsibility for funding research and development. The trends of Federal support as compared with industrial and educational or nonprofit institution support for R & D is portrayed in Figure 5. This indicates that since about 1943 the Federal government has been supplying more than half of the money spent on research and development in the United States.

Testifying before the House of Representatives Select Committee on Government Research, Jerome B. Wiesner, Director, Office of Science and Technology, stated:

> As a source of funding for research and development, the Federal government has constantly since World War II been obliged to expand its role as sponsor of scientific and technological activities.... The high percentage attributable to the Federal share... reflects pressing and costly demands of national security, economic welfare and health for the contributions of science and technology, in areas where private institutions cannot recapture sufficient or prompt returns as incentives to investment.[19]

The Federal government will provide sixty-six percent of the approximately $23 billion of R & D funds to be expended by both public and private institutions during fiscal year 1966/67.[20]

Need for Information Diffusion

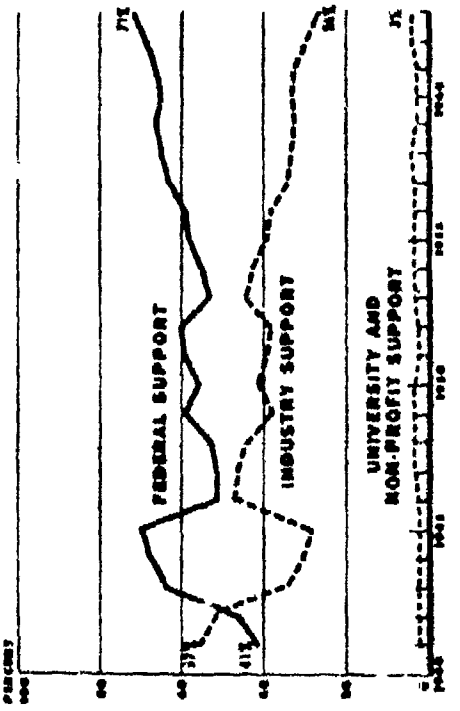
Information as an Economic Resource

What are the implications of these Federal R & D expenditures for the information science profession or, for that matter, for the nation as a whole?

Investment in research and development will not, by itself, contribute to increased productivity. Were economic growth purely a function of R & D investment, the rate of growth of the GNP would bear a strong relationship to the magnitude of R & D investment. As may be seen from Figure 6, this has not been the case. The enormous increases in R & D investments have not been followed by parallel and corresponding increases in the U. S. rate of economic growth. The implication is that application of scientific and technological

Figure 5

Sources for Research and Development Funds



Source: U. S. Congress. Senate. Select Committee on Small Business. The Role and Effect of Technology in the Nation's Economy. Hearings before a Select Sub-committee, 88th Cong., 1st Sess., May 20, 1963. pt. 1. Washington, D. C., U. S. Govt. Print. Off., 1963, p. 33.

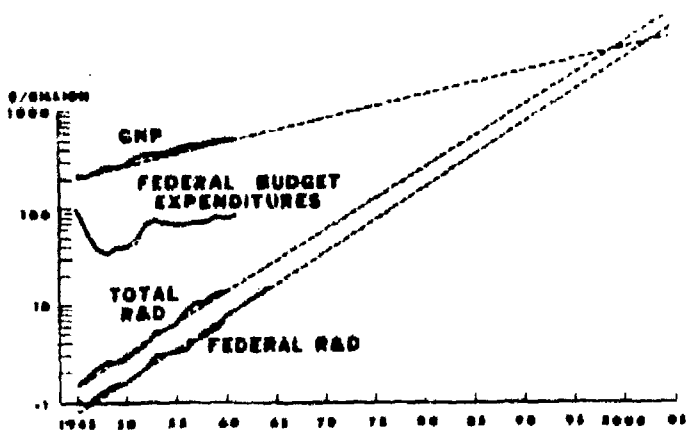
information resulting from research and development activity is crucial to economic growth.[21, 22] Reduction of the time lag between the development of innovations and their wide-spread introduction into industry is also of signal importance.

Discussing the question of science, economic growth, and innovation, Dr. Alexander King, Director of Scientific Affairs, Organization for Economic Cooperation and Development notes:

> ...innovation is the process through which science fosters this [economic] growth and the problem of innovation is the key to the industrial future. Innovation is not a simple matter of technical communication, even when that communication is good, which today it is not. Complex social and economic factors are involved. Innovation depends on government policy, fiscal and other matters and it has a great deal

Figure 6

Comparison of Growth of R&D Funds With Growth of GNP and Federal Budget



Source: Rubel, John H. "Trends and Challenge in Research and Development." In National Security Industrial Association. The Impact of Government Research and Development Expenditures on Industrial Growth. Proceedings of R & D Symposium, 13-14 March 1963. Washington, D. C., 1963, p. 13.

> to do with the policy or lack of policy of firms and industries; it is influenced by problems of depreciation, with the psychology of managers, with their sense of inferiority when faced with complex modern technology, with acceptance of new methods by the workers and their unions and with all the complex difficulties and social consequences of change. Technical information is an element of the whole innovation process, although it may be the most important single factor.[23] [emphasis supplied]

The immediate product of Federally-supported research and development is frequently not hardware, but information--information which is communicated primarily through the technical report. While other communication media may be utilized to disseminate research data, it may be assumed that inefficient utilization of technical report literature tends to reduce the effectiveness of the knowledge derived from the research and development. This was one of the conclusions reached by a number of congressional committees investigating Federal agency practices in organizing and disseminating the results of government-sponsored research.

More than a hundred years ago, in passing the Organic Act establishing the Department of Agriculture, the Congress showed its awareness of the need to utilize available information. This Act specified that the newly created Department was "to acquire and to diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of that word. . . ."[24] Not only was agriculture the exception to the overall inadequate diffusion pattern for scientific and technological information, even its agricultural extension service which has been most successful in practically all its programs, required 14 years to achieve adoption of hybrid corn by Iowa farmers.[25]

Agricultural problems in a particular region could often be solved through the diffusion of techniques or processes having wide and generalized application. The introduction of commercial fertilizers or the planting of hybrid corn did not demand the tailor-made intensive information service essential for such things as the problem of the machine-tool manufacturer who encounters difficulties in joining two dissimilar alloys. Another factor is that there are approxi-

mately 312,000 manufacturing companies in the United States and that they have a wide variety of information needs.[26]

An indication of the time lag in industrial applications is the fact that forty years elapsed between the first successful use of the tunnel oven and its general acceptance in the pottery industry.[27] A study of twelve important innovations in the bituminous coal industry, iron and steel industry, brewing industry, and railroad industry indicates that, measured from the date of the first commercial application, it took twenty years or more for all the major firms to adopt a number of vital innovations. In three only instances was the time period ten years or less.[28] Obviously, inefficient dissemination of information has been very costly to the national economy.

Expansion of information services to the industrial community at large has been limited by opposition from major segments of industry as well as from industrial associations, including the National Association of Manufacturers and the U. S. Chamber of Commerce. The argument against an industrial information service similar in intent and function to that of the agricultural extension service was based on the fear that the provision of such a service would tend to upset the competitive balance. Established firms saw the threat of competition from weaker competitors who might adopt innovations and processes to invade their markets.[29]

Studies carried out by Arthur D. Little Inc. for the National Science Foundation and the Department of Commerce indicate that there is some basis for these fears.[30] Industries, such as textile, building, and machine tools and the newer industries such as chemicals and electronics were analyzed to determine the source, over the last fifty years, of their technically and economically significant innovations as well as the factors leading to the development and adoption of these innovations. The conclusion reached is that industries of high sophistication have led in both investment for research and in application of research results. Furthermore, the major innovations adopted by research-oriented industry, such as plastics, transistors and turbojets, have been developed and, whenever feasible, economically marketed from within the innovating industry.

Information as an Economic Resource

During the thirty year period covered by the study, the traditional industries, while improving products and processes and attaining substantial increases in productivity, developed little new technology of major economic significance. The few major technical and economically important innovations adopted by traditional industry came primarily from outside the industry, from foreign technology, from independent inventors or from new small firms.[31] In considering the "innovation by invasion" process, the investigators noted that in principle, "an industry about to be invaded could simultaneously be an invader itself." This has not been the case. Companies in textiles, building, or machine tools have not invaded other industrial areas with new ideas; instead the new, fast-growing, technically advanced industries have invaded stable or declining industries. For textiles, building, and machine tools, the invaders have been the chemical industry and the aerospace industry. The building industry has been invaded by all industries having advanced manufacturing techniques.[32]

It is understandable that organized Federal diffusion of new technology would tend to generate resistance, yet from the point of view of national economic well-being, not only the creation, but the most widespread utilization of the latest technology is highly desirable.

Summary

The rate of economic growth has been of considerable concern to industrialized as well as to underdeveloped nations. Recent studies dealing with economic effects of investment in human capital (i.e., training, education, basic research, applied research and development, which is generally grouped under the term technical progress) when compared with investment in machinery and labor, made it abundantly clear that technical progress was responsible for the major part of increases in national productivity and in rates of economic growth.

Research and development investment, a major component of technical progress, has been found to be a causative factor in increased productivity and profitability within certain industries. More-

over nations as well as the segments of industry which invested heavily in research and development were found to be in the forefront of economic expansion.

While allocations for research and development have increased tremendously within the last few decades, it is now being recognized that not merely investment in R & D, but utilization of the results of R. & D is of crucial importance to national economies or private enterprises. Effective information transfer is one of the prime components leading toward widespread adoption and utilization of research findings. Industry attitudes tend to inhibit maximum information diffusion. However, national welfare requires full exploitation of all information derived from the expenditure of public funds.

---

1. Gavin, James M. "Military Power: The Limits of Persuasion." Saturday Review, v. 49, no. 31, July 30, 1966. pp. 18-30, 64.

2. First National City Bank of New York. Monthly Economic Letter, Aug. 1965, p. 93.

3. Denison, Edward F. The Sources of Economic Growth in the United States and the Alternatives Before Us. (Supplementary Paper No. 13). New York, Committee for Economic Development, 1962.

4. Schultz, Theodore W. The Economic Value of Education. New York, Columbia University Press, 1963.

5. Organization for Economic Cooperation and Development. Science, Economic Growth and Government Policy. Paris, 1963, p. 17.

6. Ewell, Raymond H. "Role of Research in Economic Growth." Chemical and Engineering News, v. 33, no. 29, July 18, 1955, pp. 2980-2985.

7. Hoffmann, Walther G. The Growth of Industrial Economies. Tr. from German by W. O. Henderson and W. H. Chaloner [Manchester, Eng.] Manchester University Press [c1958].

8. Maizels, Alfred. Industrial Growth and World Trade; an Empirical Study of Trends in Production, Consumption and Trade in Manufactures from 1899-1959, with a Discussion of Probable Future Trends. (National Institute of Economic and Social Research. Economic and Social Studies, 21), Cambridge [Eng.] University Press, 1963.

9. U. S. Dept. of State. Scientific and Technical Developments Report: United Kingdom, 1962-63. (A-2668) [London, Eng.] April 17, 1964, p. 11.

10. Minasian, Jora R. "The Economics of Research and Development." In National Bureau of Economic Research. The Rate and Direction of Inventive Activity: Economic and Social Factors. Conference of the Universities-National Bureau Committee for Economic Research and the Committee on Economic Growth of the Social Science Research Council. Princeton, N. J., Princeton University Press, 1962, p. 95.

11. Mansfield, Edwin. "The Process of Technical Change." Paper presented at Symposium on the Diffusion of Technological Change, Nov. 1, 1962, p. 1. (Summary published in Special Libraries, v. 54, no. 6, July-Aug. 1963, pp. 353-355).

12. "Yardstick for Management." Chemical and Engineering News, v. 33, no. 35, August 29, 1955, p. 3606.

13. Ewell, Raymond H. "Role of Research in Economic Growth." Chemical and Engineering News, v. 33, no. 29, July 18, 1955, p. 2985.

14. U. S. National Science Foundation. Publication of Basic Research Findings in Industry, 1957-59. (NSF 61-62). Washington, D. C., U. S. Govt. Print. Off., 1961, p. 43.

15. "Technical Notes." Reviews of Data on Science Resources. (NSF 65-11). v. 1, no. 4, May 1965, p. 10.

16. Korol, Alexander G. Soviet Research and Development; Its Organization, Personnel, and Funds. Cambridge, Mass., M. I. T. Press, 1965. p. 226.

17. U. S. Congress. Senate. Committee on Labor and Public Welfare. Subcommittee on Employment and Manpower. Impact of Federal Research and Development Policies on Scientific and Technical Manpower. Hearings. 89th Cong., 1st Sess., June 2, 3, 4, 7, 8, 9, 10, and July 22, 1965. Washington, D. C., U. S. Govt. Print. Off., 1965, p. 234.

18. Machlup, Fritz. The Production and Distribution of Knowledge in the United States. Princeton, N. J., Princeton University Press, 1962, p. 156.

19. U. S. Congress. House. Select Committee on Government Research. Federal Research and Development Programs. Hearings. 88th Cong. 1st Sess., Nov. 18-22, 1963. pt. 1. Washington, D. C., U. S. Govt. Print. Off., 1964, p. 258.

20. Danilov, Victor J., ed. "23 Billion for Research Funds; R & D Spending to Increase 8%." Industrial Research, Jan. 1966, p. 35.

21. Williams, B. R. "Research and Economic Growth - What Should We Expect?" Minerva, v. 3, no. 1, Autumn, 1964, pp. 56-71.

22. Hollomon, J. Herbert. "Science, Technology, and Economic Growth." Physics Today, v. 16, no. 3, March 1963, pp. 38-42.

23. Conference on the Communications of Scientific and Technical Knowledge to Industry, Stockholm, October 7-9, 1963.

Proceedings. Paris, Organization for Economic Cooperation and Development, 1965, p. 10.

24. "An Act to Establish a Department of Agriculture." U. S. Statutes at Large, v. 12, 1859-1865, p. 387.

25. Ryan, Bryce and Gross, Neal C. "The Diffusion of Hybrid Seed Corn in Two Iowa Communities." Rural Sociology, v. 8, no. 1, March 1943, pp. 15-24.

26. U. S. Bureau of the Census. Statistical Abstract of United States: 1966. Washington, D. C., U. S. Govt. Print. Off., 1966, p. 765.

27. Carter, C. F. and Williams, B. R. Industry and Technical Progress: Factors Governing Speed of Application of Science. London, Oxford University Press, 1957.

28. Mansfield, Edwin. "Diffusion of Technological Change." Reviews of Data on Research and Development, no. 31, Oct. 1961, p. 2 (NSF-61-52).

29. Carter, Luther J. "Technical Services Act; Industry to Benefit from New Programs Paralleling Farm Extension Service." Science, v. 149, no. 3691, Sept. 24, 1965, p. 1485.

30. Little (Arthur D.) Inc. Patterns and Problems of Technical Innovation in American Industry. (C-65344; PB-181573). Report to the National Science Foundation, Sept. 1963.

31. Schon, Donald A. "Innovation by Invasion." International Science and Technology, no. 27, March 1964, p. 54.

32. Ibid., p. 56.

Chapter 3

Abstracting and Indexing Services as Diffusion Media

In considering diffusion of scientific and technical information one must take full cognizance of the role played by abstracting and indexing services in the diffusion process.

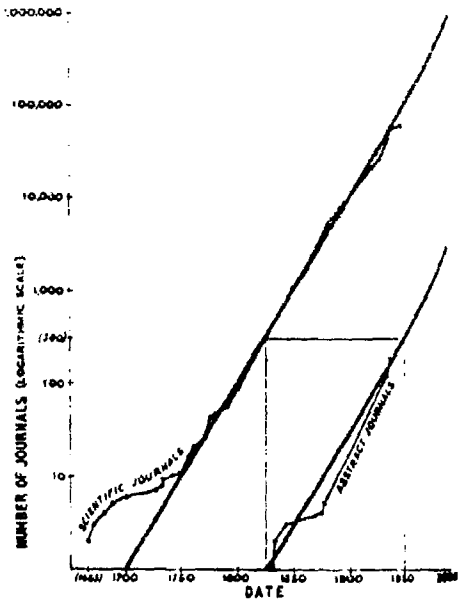
The first science abstracting journal, Le Journal des Scavans, had its 300th anniversary in 1965.[1] Various forms of abstracting and indexing services have been issued and they have grown rapidly in number. For the year 1959, the Soviet national documentation center, VINITI, reported 1,494 such services, including 360 devoted entirely to abstracting and indexing.[2] The figures were partially detailed as follows:

Country	Total Services	Purely Abstracting and Indexing Services
United States	300	60
USSR	260	20
Japan	200	10
Great Britain	191	40
France	162	22
West Germany	134	36

A more recent U.S. compilation lists 1,855 such titles, issued in 40 countries, of which 365 are reported to be published in the United States. Bourne[4] arrived at a comprehensive estimate of 3,500 abstracting and indexing services, including 450 published in the United States. Figure 7 indicates that abstracting journals have kept pace with the overall rise in the publication of scientific and technical journal literature. The increase in the total number of abstracts published in Chemical Abstracts[5] and in some other representative services during 1955 and 1965 (Table 2), is a further indication of the effort to cope with the world-wide increase in scientific and technological publishing.

Figure 7

Number of Scientific Journals and Abstract Journals



Source: Price, Derek J. "The Exponential Curve of Science." Discovery, v. 17, no. 6, June 1956. p. 242.

In recent years there has been a proliferation of KWIC-type services and of title announcement media for reference use and for current awareness service. Indications are, however, that information retrieved on the basis of titles only is not as relevant as that obtained with the aid of abstracts.[6] There is also evidence to indicate that selection of publications through perusal of titles is far less accurate than selection by reading abstracts.[7]

There have been a number of studies on the usefulness and effectiveness of abstracting and indexing services.[8, 9, 10, 11]

While there has been sporadic and intense criticism of

Table 2

Abstract and Citation Coverage Provided by Selective Abstracting and Indexing Services for the Years 1955 and 1965

Abstracting and Indexing Service	Year	Year	Percent increase
	1955	1965	
ASM Review of Metal Literature	7,463	13,214	77.06
Analytical Abstracts	3,280	6,865	100.15
Applied Mechanics Review	3,961	7,847	98.10
Biological Abstracts	30,058	110,119	266.35
Chemical Abstracts	84,590	194,995	130.52
Electrical Engineering Abstracts	5,403	19,500	260.91
Engineering Index	25,600	49,000	91.40
International Aerospace Abstracts (Successor to Aerospace Engineering Index)	3,900[a]	26,851	588.48
Nuclear Science Abstracts	8,020	48,118	499.75
Physics Abstracts	10,160	34,000	234.64
Psychological Abstracts	9,103	16,619	82.56
Referativnyĭ Zhurnal	209,967	700,000[a]	233.38
Technical Abstract Bulletin	26,720	59,238	121.69
Scientific and Technical Aerospace Reports (Successor to Index of NASA Technical Publications)	3,500[a]	26,851	667.17

(a) Estimate

abstracting and indexing services,[12] for the most part the criticism has centered on inadequate abstracting, lack of indexing, undue delay in publishing, lack of comprehensiveness, lack of selectivity, etc., rather than on any inherent inadequacy of the abstracting and indexing service as a mechanism for the diffusion of research results. The mass of scientific and technical information now being published in a variety of languages, the inordinate cost of making a systematic review of a literature th t is not organized, the limited

access to source materials and the limited time available to perform a search have all contributed to making the abstracting and indexing service one of the prime clearinghouses for current additions to knowledge. Abstracts provide the capability to concentrate within a single publication knowledge that is recorded in a multitude of research papers and technical reports. Adequate and efficient indexing can achieve a synthesis of the fractionalized, dispersed portions of new knowledge. Information thus assembled and indexed can be of significance to the researcher in providing the background needed for further synthesis of information. Such a synthesis represents a link in the communications chain between the scientist and engineer and provides another argument in favor of abstracting and indexing services. In reviewing and summarizing extensive hearings on U. S. scientific information dissemination, a Congressional Committee staff report noted:[13]

> It is belived by many that the most effective and economical way of bringing world scientific information to the attention of American scientists and stirring their interest in it is an effective system of distribution of abstracts. Carefully prepared abstracts are economical to distribute widely and permit the individual scientist to keep himself abreast of worldwide scientific developments in his field with little expenditure of time. Carefully prepared abstracts encourage scientists to seek copies of articles of interest, either through lending libraries, purchase, or photographic reproduction.

Primary distribution of AEC, NASA, and DOD technical reports is often made directly by contractor organizations as well as by the national documentation centers of these agencies. This is a costly process and it is limited to a relatively small group of recipients. In almost all instances, prior approval is necessary in order to be placed on such distribution lists, yet the history of science and technology is replete with examples illustrating the impossibility of predicting with any certainty the application that can be made of data or information resulting from any scientific investigation.[14] Moreover, for economic reasons this limited primary dissemination of full size copies of technical reports has recently been reduced drastically in favor of the microfiche form. For this reason

the abstract has to be relied upon as one of the few media currently available for general communication of information about R & D activity of these agencies.

Soviet Bloc Exploitation of Abstracting and Indexing Services

Nowhere has the abstract been more fully adopted and more doggedly exploited in the diffusion of scientific and technical information than in communist countries. Whether indicative or informative,[15] in card format or published in primary journals or in abstracting and indexing services, the abstract has been frequently used as the official medium for current awareness and information retrieval.

While methods employed in disseminating information within particular countries depend in large measure upon their internal socio-political systems, problems and solutions relating to information diffusion for the more industrialized nations of the world, whether communist or not, generally have been found to have a common base. This is true particularly when the publication media are under the control of government agencies and when the information to be disseminated, which is derived through the employment of public funds, is not subject to copyright.

Poland

Some 84 centers in Poland receive and abstract literature in specifically designated subject disciplines. The abstracts, in manuscript form, are forwarded to the Central Institute for Scientific, Technical, and Economic Information (Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, CIINTE)[16] where they are edited, printed on cards (Figure 8) and sold or distributed to "manufacturing plants, laboratories, planning and administrative offices of various industries, institutes, universities and other institutions of higher learning, engineering and improvement clubs, and individuals." The subscriber may select one or more of 850 subject fields assigned and arranged in accordance with the Universal Decimal Classification system. Some of the cards provide on the verso the full text in microprint. Since its founding through 1962, CIINTE has printed and disseminated a total of 55 million cards, averaging approximately 4-1/2 million cards annually.[17] Some 700,000 titles

Figure 8

Sample Abstract Card Issued by CIINTE, Poland

664.951.51:576.8 Zimne marynaty a bakterie MIR +
616.77 Antyseptyki, środki konser- TR 151
wujące nm 3/4

Untersuchungen über biologisch bedingten Verderb von Fischwaren und seine Verhinderung. Badania psucia się produktów rybnych pod względem biologicznym i zapobieganie temu. Allg. Fischwirtschaftsztg. Bremerhaven, 1958, t. 10, nr 41, A 4, s. 15, poz. bibl. 3. -

Zachowanie się hexametylentetraminy, która w kwaśnym środowisku wydziela formaldehyd. Zastrzeżenia co do używania tego środka konserwującego. Badania działania hexametylentetraminy, stosowanej do zimnych marynat, na bakterie mlekowe. Stwierdzono że wzrost temp. wpływa na rozpad hexam., wobec czego należy składować marynaty rybne w niskich temperaturach. Najmniejsza ilość hexametylentetraminy w mięsie ryb, działająca bakteriostatycznie, wynosi 6 mg %. -

Tarchalska

600409/58/60/k

UDC Classification

Citation

Abstract

Abstracter

were abstracted in 1950-1959. An equivalent number of photocopies (including 420,000 supplied by CIINTE) and 7,500,000 microfilms (5,700,000 supplied by CIINTE) were supplied to subscribers during that period.[18] In 1959, the Institute is reported to have sold approximately 7-1/2 million cards. Of these, 55 percent went to industrial recipients, 23 percent to technical schools and colleges, 20 percent to governmental bodies, and 5 percent to miscellaneous subscribers.[19] In 1965 the Institute distributed about 10 million cards, covering approximately 100,000 titles.[20]

About 15 percent of the titles distributed in the form of abstract cards are also published in a number of primary scientific and technical journals, industry information bulletins and abstracting

and indexing services. The quarterly CIINTE abstracting journal, Obzor Polskoĭ Tekhnicheskoĭ Literatury - Polish Technical Abstracts, published in English and Russian, contains on the average 167 pages of abstracts of selected scientific and technical papers written by Polish scientists and engineers. Such publications as Przegląd Dokumentacyjny Elektrotechniki (Documentation Review for Electrotechnology) issued by the Institute for Electrotechnology, Biuletyn Dokumentacji Naukowo-Technicznej (Science-Techology Documentation Bulletin) issued by the Institute for Automotive Transportation, Biuletyn Dokumentacyjny Metali Nieżelaźnych (Documentation Bulletin for Nonferrous Metals) issued by the Science-Technology Documentation Section of the Institute for Nonferrous Metals, Przegląd Dokumentacyjny Hydrologii i Meteorologii (Documentation Review for Hydrology and Meteorology) issued by the State Hydro-Meteorological Institute, unlike abstracts in card form, illustrate the decentralized publication and dissemination of abstract-type journals within the Polish documentation network. A total of 110 documentation reviews, 94 express-information type publications and 304 information bulletins were issued during 1964.[21]

Czechoslovakia

The abstract has been a basic medium for technical and scientific communication in Czechoslovakia. For the period 1957-1959, centralized abstracting evaluated about 2,500 journal titles annually in addition to other documents.[22] The abstracted information was disseminated both in card form and in abstract journals. The "Kartoteka technicke a ekonomicke literatury," (Card-File of Technical and Economic Literature) was distributed weekly in DIN A6 (Deutsche Industrie-Norm, 148x150 mm) format. It went to more than 1,000 subscribers. Approximately 100,000 abstracts (10 million cards) were sold during 1959.[23] With the transfer in 1959 of the Bibliographic Department of the State Technical Library (Formerly the Library of the Technical University of Prague), the Center for Scientific, Technical and Economic Information (Ústřední vědeckých, technických a ekonomických informací)[24] has, among other responsibilities, been assigned the function of evaluating, indexing and abstracting the

scientific and technical literature through the support and coordination of the decentrialized information centers.[25] The industrial centers share in collecting and processing of information and making it available to the Center as well as to their own industries, scientists, and engineers. In 1959 about 165 such centers prepared a total of 28,000 abstracts, selected from 32,000 serial issues.[26] Abstracts, both those prepared by the Center's own staff and those received from industrial information centers, are disseminated by the Center in card form and in journals.[27] The comprehensive centrally issued abstract journal, Prehled technicke a hospodarske literatury (Survey of Technical and Economic Literature) represents the result of interaction between the Center and local industrial documentation units. During the year 1959 the Center had approximately 4,550 subscribers for various sections of Prehled (see Table 7A, Appendix A). Only about half of the abstracts received by the Center were published in the Prehled. Librarians as well as scientists and engineers are urged to make full use of internally produced as well as foreign abstracting and indexing services.[28]

Hungary

Until 1962 Hungarian information services were carried out mostly by technical libraries attached to scientific institutes and industrial enterprises. The National Committee for Technological Development (Orszagos Müszaki Fejlesztesi Bizttsag) was established in 1962 and was given full responsibility for the bibliographic control and dissemination of scientific and technological information.[29] Its Central Technical Library and Technical Documentation Center (OMKDK - Orszagös Müszaki Könyvtar es Dokumentacios Központ) was charged with supplying abstracting and indexing services covering both domestic and foreign literature. The Central Technical Library, while providing for the most part traditional library services, forms the basis for the work of the Technical Documentation Center, which provides abstracts, searches, reviews and translations of scientific and technical literature. Nearly 85,000 abstracts are currently prepared and published in 13 series of reviews covering such fields as physics, chemistry, mining, metallurgy, energy, engineering,

electro-technics, textiles, food industry, etc. The abstracts are also available in the form of cards classified according to UDC.[30]

East Germany

The indicative abstract in card form has been the principal means for disseminating scientific and technical information in East Germany. The decision to exploit the abstract in this form was made in September 1952 during the first workshop of East German documentalists. DIN A6 (Deutsche Industrie-Norm, 148x150 mm) card size was eventually agreed upon and the make up for the abstract, form of citation and classification system were made standard for all documentation centers.[31] As of January 1961, a total of 227 documentation centers (Dokumentations-stellen) abstracted more than 5,000 serials and other forms of publication. During the first six months of 1961, 163,861 titles were abstracted.[32] Approximately 18 million cards, 610,000 photocopies and 250,000 microfilms were made available in 1961 to some 14,952 subscribers serviced by the Institute for Documentation of the German Academy of Sciences (Institut für Dokumentation der Deutschen Akademie der Wissenschaften), the principal abstracting and indexing organization for East Germany.

The East German information network consists of central documentation institutes, industrial agencies having information centers, and information sections within industrial enterprises. The Central Institute of Information and Documentation (Zentralinstitut für Information und Dokumentation), created in accordance with a decree issued by the Council of Ministers on August 8, 1963, is responsibile for administering the information network in the fields of science, technology, and economics. One of the prime functions of the decentralized industrial information sections is to evaluate and abstract newly acquired literature.[33] Highly qualified personnel are used for abstracting. The completed abstracts are forwarded to the industrial agency information centers for industry-wide and national dissemination in abstract services. More than 130 of such services were issued in 1961 among which are found the major abstracting and indexing journals published by the Institut für Dokumentation: Chemisches Zentralblatt, Technisches Zentralblatt (issued in sections: 1. En-

eigiewesen; 2. Chemische Technik; 3. Textiltechnik; 4. Maschinewesen; 5. Elektrotechnik; 6. Bauwesen; 7. Berg- und Hüttenwesen), and Zentralblatt für Kernforschung und Kerntechnik. The abstracting journal Landwirtschaftliches Zentralblatt (published in sections: 1. Landtechnik; 2. Pflanzliche Produktion; 3. Tierzucht, Tiernährung, Fischerei; 4. Veterinärmedizin) formerly issued by the Institute, is now published by the newly organized Institute of Agricultural Information and Documentation, which is responsible to the Academy of Agricultural Sciences (Deutsche Akademie der Landwirtschaftswissenschaften).

Soviet Union

Few are the Soviet documentalists who, in discussing dissemination of scientific and technological literature, would fail to invoke the writings of Lenin. A recent textbook prepared by high-ranking staff members of the All-Union Institute of Scientific and Technical Information, cites Lenin as follows:

> V. I. Lenin pointed out that success in fulfilling the projected Program of the Party for the development of science, the economy and education would depend in large measure on the creative study and utilization of everything of value to be found in scientific and technical achievements and industrial experience of advanced capitalist countries. He taught that the results of theoretical and experimental research of Soviet scientific establishments and institutions should be evaluated in relation to the level of worldwide achievements in science and technology. V. I. Lenin emphasized that to accomplish these goals, we must 'take over everything of real value which European and American science has to offer; - this is our first and most important mission.' From the sum total of measures directed toward assuring the fulfillment of planned tasks for the development of Soviet science and the creation on its foundation of a socialist economy, V. I. Lenin specifically singled out the task of studying thoroughly all aspects of world literature with the aim of disseminating information on the newest achievements of science and technology and introducing this knowledge into socialist production.[34]

The services of the All-Union Institute of Scientific and Technical Information (Vsesoyuznyy Institut Nauchnoy i Tekhnicheskoy

Information. VINITI plays a fundamental role in diffusing newly acquired scientific and technical information. Founded in accordance with a resolution of July 19, 1952 issued by the USSR Council of Ministers (Sovet Ministrov),[35] the Institute was asked to undertake

> systematic and exhaustive abstracting of all world literature in the fields of natural sciences and technology (astronomy, geodetics, mathematics, mechanics, cybernetics, physics, chemistry, bio-chemistry, biology, geophysics, geography, geology, mining engineering, machine-building, transportation, automation, radio-electronics, electrical engineering, power engineering and industrial economics), on the basis of the above to prepare and publish abstract journals (Referativnyĭ Zhurnal), to issue review-bibliographies, reference literature and spot reports on the most timely topics, and also to organize and develop scientific research directed toward the improvement of the methods and techniques currently used in scientific information service.[36]

From a total of four series (Astronomy, Chemistry, Mathematics, Mechanics), containing 14,466 abstracts published during the initial year of publication of 1953, the major Soviet abstracting and indexing service, Referativnyĭ Zhurnal, rapidly increased in scope (see Table 3 and Figure 9). Approximately 17,000, or more than one third of the world's total output of 45,000 scientific and technical journals, as well as a great quantity of other scientific literature, is processed by the Institute. Materials are received and analyzed from more than a hundred countries covering 64 languages of which 22 are from within the Soviet Union. The Institute has a permanent staff of about 2,500, many of whom are highly qualified scientists and engineers. Advisors from Soviet research organizations and industrial enterprises aid in the fulfillment of VINITI tasks. Approximately 22,000 specialists can be called upon to prepare abstracts.[37]

During 1967, Referativnyĭ Zhurnal expects to publish 25 series and 800,000 abstracts. The centrally processed and published abstracts are often repackaged and distributed in the form of subsections of the main subject series. A total of 134 sub-sections will be issued in 1967. (See Table 8A, Appendix A). In addition, 35

Table 3

"Referativnyĭ Zhurnal," Abstracts and Citation Coverage, 1953-1959

	1953	1954	1955	1956	1957	1958	1959
Astronomiia: Goedeziia Astronomy: Geodesy	1,468	4,432	5,125	7,110	10,000	7,902	9,700
Biologiia Biology	-	15,937	62,958	107,610	103,445	113,375	104,500
Biokhimiia Biochemistry	-	-	18,004	23,973	27,023	33,207	32,600 [a]
Khimiia Chemistry	10,042	51,047	57,470	82,316	79,039	84,041	89,013
Elektrotekhnika Electrical Engineering	-	-	-	23,099	40,083	47,507	51,294
Geografiia Geography	-	-	-	26,848	27,601	30,197	33,715
Geologiia Geology	-	7,567	20,493	13,763	16,394	22,203	27,000
Geofizika Geophysics	-	-	-	-	10,750	9,650	12,650
Matematika Mathematics	1,516	4,403	6,307	9,228	9,035	10,925	11,725
Mashinostroenie Machine Construction	-	-	-	35,600	53,450	84,005	103,000
Mekhanika Mechanics	1,440	4,450	6,481	8,775	13,649	15,105	14,748
Metallurgiia Metallurgy	-	-	-	15,354	25,562	25,579	28,176
Fizika Physics	-	14,200	26,550	36,500	31,850	28,970	28,751
Totals	14,466	102,036	203,388	390,176	449,881	512,766	550,077

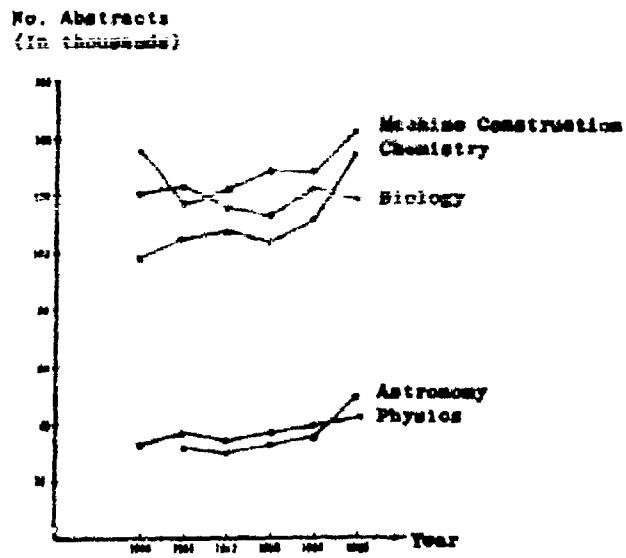
(a) Estimate arrived at by extrapolation of available issues.
Source: See top of p. 62.

[illegible] Pattern

Source: Part of data for 1956-1959 derived from: Teplov, D. I. [illegible] Informatsionno-tekhnicheskaia bibliografiia v SSSR. Moskva, Izd-vo Akademii nauk SSSR, 1963, p. 55.

Figure 6

Growth of Selected Series of "Referativnyi Zhurnal," 1960-1965



Series	Abstracts Published					
	1960	1961	1962	1963	1964	1965
Mashinostroenie Machine Construction	137500	116377	120379	127800	126992	140500
Biologiia Biology	120000	122979	116280	114313	120676	118600
Khimiia Chemistry	94400	104555	107415	102975	112828	127500
Astronomiia* Astronomy		36603	36407	36638	37291	46400
Fizika Physics	34500	38871	36723	38269	39142	40800

*Prior to 1960 issued as part of ASTRONOMIIA: GEODEZIIA

Source: Mikhailov, A. I. and others. Osnovy nauchnoi informatsii. Moskva, Izd-vo nauka, 1965, p. 703.

separate subject volumes will be compiled and disseminated (See Table 8B, Appendix A). High selectivity is employed for journal titles abstracted in the VINITI services. Of a total of 2,967 new serial titles received and reviewed during 1963, only 787 were abstracted.

The abstracting and indexing services have, since 1958, been supplemented by Ekspress Informatsiia (Express Information), and Itogi Nauki (Review of Science), which began in 1962, as well as by other publications in the field of bibliography, library science and documentation. Ekspress Informatsiia, a selective current awareness bulletin, provides extensive and often illustrated abstracts of items considered to be of particular significance to Soviet science and industry. A total of 30 such series were issued in 1957. The Institute expects to publish 68 series during 1967.

The Institute has apparently kept pace with the general increase in the quantity and diversity of the world's scientific and technological literature, and substantial effort and resources have been devoted to this task. How widely have the resulting abstracting and indexing services been distributed within the Soviet Union? Which segments of the communist and non-communist scientific communities have made use of these services?

The impression has been created in the non-Soviet literature,[38,39,40] which may have been occasioned by rare criticism in the Soviet press,[41,42] that an inadequate number of copies is printed of Referativnyĭ Zhurnal, that the cost of the service is prohibitive to Soviet users, and that a substantial portion of the copies printed are sold to Western subscribers to the detriment of Soviet scientific and technical personnel. The factual basis for these statements has not been fully established in the past.

Direct and indirect evidence indicates that the Soviet scientific community relies heavily on Referativnyĭ Zhurnal as a basic medium for the communication of scientific and technical information. At the Sixth Scientific Conference of the Library of the USSR Academy of Sciences held in Leningrad in 1960, it was noted:

Many scientific institutions and industrial establishments

make ever greater use of the VINITI materials to speed up their scientific and planning work and to learn about new technological processes and progressive work methods.

For example, the factory, "Rostsel'mash," has been trying for a long time without success to obtain higher strength cast iron well suited to heat processing. This problem was solved only after information contained in an abstract from Metallurgy was utilized. The same factory examined material from Chemistry and was able to set up production of fast drying bonds in a period of two weeks.

A number of enterprises adopted new technological processes, equipment, and devices after studying materials of the All-Union Institute of Scientific and Technical Information and achieved considerable savings as a result. For example, the Kuibyshev Plant, "KATEK," introduced a new method of sealing automobile spark plugs using volatile inhibitors developed as a result of VINITI materials. Savings amounted to 15,000 rubles per year.

Savings by many establishments that have used information from Abstract Journals come to hundreds of thousands of rubles.

The scientific information of VINITI helped the scientists of the Kuibyshev Industrial Institute to solve an important, practical problem about the origin of static electricity in large oil reservoirs and ways of removing it. Introduction of pressing of refractories in a closed drum permitted considerable improvement of quality in this material and resulted in savings of more than 300,000 rubles.

The growth in the number of readers of the Abstract Journals can be judged by the fact that in the past year, the VINITI photographic laboratory filled orders for 660,000 photostats and 648,000 microfilm reproductions of original articles included in the Abstract Journal. The translation office completed orders for translations of 4,700 authors' sheets of text and, taking into account repeat orders, sent out 18,000 authors' sheets[43] of translations.[44]

Individual comments, while in some instances critical of the time lag between the publication of research papers and their appearance in Referativnyĭ Zhurnal, were for the most part laudatory.

Thus, for example, Referativnyĭ Zhurnal was said to be heavily used by scientists and students in the Gorki Library of Odessa.[45] A representative of the Saltykov-Shchedrin State Public Library, one of the largest public libraries in the Soviet Union, referred to the "tremendous popularity" of Referativnyĭ Zhurnal.[46] The distribution policy for Referativnyĭ Zhurnal and other VINITI services may be inferred from the following statement in a brochure describing the photoreproduction service for items listed in Referativnyĭ Zhurnal:

> The publications of VINITI are the most important and accessible sources of information for a wide circle of the scientific-technical intelligentsia. They are distributed to the scientific and technico-engineering workers of the scientific research institutes and organizational projects or construction bureaus, to the leading workers in the Sovnarkhozy (Soviet People's Enterprises), industrial combines, factory laboratories and experimental stations, as well as to the professional and technical staff, the aspirants and the students of the higher educational institutions.[47]

The statement quoted above indicates that the allegation that distribution is based solely on paid subscriptions is erroneous.[48]

Album and Hoshovsky say in reference to Referativnyĭ Zhurnal:

> What about the distribution of the Soviet Abstracts Journal? Would they really use 3,000 full-time workers and 20,000 part-time abstractors to publish their best abstracting journal and then fail to distribute it properly? Would they print only a few copies and then ship a large percentage of these out of the country thus leaving the desks of their engineers and scientists bare? We think not.[49]

The authors cite information indicating that the actual number of recipients of Referativnyĭ Zhurnal - Khimiia is roughly three times the figures published in the open press.[50]

Misinformation about Soviet distribution figures for Referativnyĭ Zhurnal may be intentional. When responding to inquiries by members of a U.S. delegation visiting VINITI in October 1959, Soviet officials indicated that about 2,000 copies of Referativnyĭ Zhurnal - Mashinostroenie (Machine Construction) were printed,[50] but attendees of a Soviet Seminar for Workers for Scientific and Technical

Information, held in Moscow in May 1960, were told that the Mashinostroenie series of Referativnyĭ Zhurnal had 1,459 subscribers in 1959, and that after subdividing this series and issuing it also in 16 subsections in 1960, the number of subscribers was increased to 19,000.[51] During this seminar the following overall foreign subscriber statistics for Referativnyĭ Zhurnal for the year 1960 were released:[52]

"Referativnyĭ Zhurnal" Foreign Subscribers, 1960

Country	Ref. Zh. Subscribers	Percent
National Democracies (Soviet bloc, Europe)*	8,959	36.0
Yugoslavia	452	1.8
China (Mainland)	10,655	42.8
Korea (North)	2,250	9.0
Vietnam/Mongolia	370	1.5
United States	847	3.4
Great Britain	383	1.5
France	395	1.6
West Germany	232	0.9
Japan	354	1.4
	24,897	99.9

*Information in parentheses added by author.

In an effort to gain some first hand information regarding VINITI distribution policy and extent of distribution of VINITI services, the author communicated with VINITI officials. While few data not already published in the Soviet and foreign press were thus obtained, Y. N. Sorokin, Deputy Director of VINITI, stated that for the approximately 160 sub-sections published, each containing from eight to ten author sheets, the "average circulation equals approximately 2.5-3 thousand copies."[53] The total number of domestic and foreign subscribers to Referativnyĭ Zhurnal has been stated to be 400 thousand.[54]

If one subtracts from the above figure the approximately 25,000 foreign subscribers, accepting the subscriber figures cited, that leaves a total of 375,000 or 93.8 percent of domestic Soviet Union subscribers to Referativnyĭ Zhurnal.

As indicated by the table of foreign subscriptions, Referativnyĭ Zhurnal is distributed to all foreign communist institutions and individuals that can derive even the slightest benefit from this service. Even a relatively small and unindustrialized country such as North Korea received almost three times as many subscriptions as were mailed to the United States. The subscriptions mailed to European Soviet bloc countries totalled more than four times the number received by all the Western powers combined. The number of subscriptions mailed to China in 1960 was almost 13 times the number sent to the United States.

Self-criticism, formal evaluations, as well as official decrees stemming from the Council of Ministers provide the drive toward maximum exploitation of available information. While the results of evaluation of Referativnyĭ Zhurnal are not generally made available, it is known that such evaluations are made regularly. The quality and usefulness of the service is assessed through the following methods:

a. Questionnaires are sent to the Institutes of the Academy of Sciences.

b. Each autumn, 40-50 VINITI staff visit the economic councils (Sovnarkhozy), the large industrial enterprises and technological research institutes to secure subscriptions and to receive comments and criticism.

c. Periodical readers' conferences are organized on a regional basis in the main subject fields. For example, on 11th June 1963, a chemical conference was held in Moscow by VINITI in conjunction with the Lenin Library, with 16 speakers and an attendance of 200; Professor Mikhaĭlov spoke on the work of the chemistry department of VINITI, and the role of Ekspress Informatsiia ('Express Information') in putting out organic chemical abstracts quickly was discussed; the indexing of formulae and the lateness of abstracts generally were also considered.[55]

The Council of Ministers resolution of May 11, 1962 relating to measures for improving the organization of scientific and technical information within the Soviet Union required a review of

activities of VINITI and of those of a number of central branch institutes and scientific and technical libraries, ministries, and state committees providing information services. A conference of 18 high ranking officials responsible for the fulfillment of the resolution was held in Moscow on April 10, 1964, and a report was made on the degree to which the Council resolution had been implemented.[56]

While VINITI was singled out and praised for its "efficiently organized preparation and publication of information materials,"[57] considerable criticism was heaped upon it and other Soviet institutions for the undue time lag between receipt of scientific and technical information and its appearance in the abstracting and indexing services:

> In the V. S. Malov report, a large number of facts are given of impermissible delays in preparation and publication of information. Subjected to sharp criticism is the work of VINITI, TsINTIPishcheprom [Central Institute of Scientific and Technical Information of the Food Industry], TsINTILegprom [Central Institute of Scientific and Technical Information for the Light Industry], TsINTIAM [Central Institute of Scientific and Technical Information on Automation and Mechanical Engineering], institutes of scientific and technical information of the RSFSR and Ukrainian SSR, TsBTI [Central Bureau of Technical Information] of Middle Ural Sovnarkhoz and others. It would be possible to give a great number of examples when 10-12 months or more are required for processing and publication of information. Delays such as these discredit the idea of organization of a system of scientific and technical information.[58]

By decree No. 775 dated September 10, 1964, the Council of Ministers set time limits for publishing Referativnyi Zhurnal at 3 to 4 months and Ekspress Informatsiia at one month from the time the original source material is received. An earlier decree of the Council of Ministers (no. 418) directed that abstracts be delivered to VINITI within 10 days of acceptance of materials for printing. With such action it was hoped in some cases to publish and disseminate abstracts prior to original publication of documents or journal articles.[59]

Not content with the dissemination of abstracts in journal form, Soviet documentation centers have begun reissuing abstracts

in card format. Standardized formats (75 x 125 mm) were adopted for abstract cards by all documentation centers. With the publishing of Referativnyĭ Zhurnal in 1953, such previously existing card services as Tekhkart (Technical Card), issued by the State Scientific Library, were discontinued. Arguments for disseminating abstracts in card vs. journal format, or both, have been revived and are being pursued vigorously.[60]

Regardless of the format, there is no question that intense effort is being exerted to provide prompt abstracting, indexing and dissemination of pertinent information to the Soviet scientific community. A delegation of British librarians and information specialists, having visited Soviet information centers, including VINITI, reported:

> The main impression we derived from our visit was the sense of urgency and importance which is accorded in the Soviet Union to all aspects of the preparation, publication and dissemination of the results of scientific research and development and the flow of technical information to industry.... The organized supply of scientific and technical information is an essential part of the centralized control of research and development in support of national plans for industrial production.[61]

Diffusion of information as an integral part of research has been accepted and practiced in the Soviet Union for many years. The theoretical bases for this practice are deeply rooted in fundamental communist dogma.

Summary

Abstracting and indexing services have traditionally played a vital role in the information diffusion process. The increased growth in scientific and technological reporting, the physical impossibility and inordinate cost of reviewing unorganized literature, the pressures of time on the modern researcher, have all contributed to making the abstracting and indexing service a basic medium for current awareness and an essential key to retrospective scientific and technical information.

Primary distribution of full size copies of the technical report literature, carried out for the AEC, NASA, and DOD by their

respective agency contractors and national documentation centers, has been quite limited in the past and, within recent months, has been further curtailed in favor of microfiche. At best, such distribution is confined to institutions and organizations with a demonstrated need, or having an official connection with Federal government agency activities. Frequently, however, it is difficult, if not impossible, to predict the usefulness or the application that can be made of research results. For wider dissemination of R & D results, particularly to the non-defense-oriented research community, Federal agency documentation centers are increasingly relying upon the abstract as a basic communication medium.

National documentation centers established in Poland, Czechoslovakia, Hungary, East Germany and the Soviet Union have made extensive use of the abstract in both card and journal format as their official medium for scientific and technological communication. The Soviet abstracting and indexing service, Referativnyĭ Zhurnal, during the year 1967, is expected to publish 800,000 abstracts to be distributed in 25 series, 134 sub-sections and 35 separate independent volumes. Of the approximately overall total of 400,000 recipients of Referativnyĭ Zhurnal, about 375,000 are within the Soviet Union. Distribution is directed to scientists, engineers, and technical personnel at many professional, scientific and industrial levels, including personnel employed in industrial combines, factory laboratories, experiment stations, as well as to students and candidates for higher degrees in Soviet educational institutions. Heavy reliance is placed upon the abstracting and indexing services. Available evidence on foreign dissemination indicates that distribution of Referativnyĭ Zhurnal is purposefully channeled to Communist nations.

---

1. Polzovich, I. "K 300-letiiu referativnogo zhurnala po estestvennym naukam." Nauchno-tekhnicheskaia informatsiia, no. 10, 1965, p. 8-11.

2. Fomin, A. A. "Vsesoiuznyĭ Institut Nauchnoĭ i Tekhnicheskoĭ Informatsiĭ; evo struktura i soderzhanie raboty." In Voprosy organizatsiĭ i metodiki nauchno-tekhnicheskoĭ informatsiĭ i propagandy. Po materialam seminara rabotnikov nauchno-tekhnicheskoĭ informatsiĭ i

propagandy, Moskva, 16 Maia - 11 Iiunia 1960 g. Moskva, TSINTI, 1960. p. 19.

3. National Federation of Science Abstracting and Indexing Services. A Guide to the World's Abstracting and Indexing Services in Science and Technology. (Report No. 102). Washington, D.C. 1963.

4. Bourne, Charles P. "The World's Technical Journal Literature: An Estimate of Volume, Origin, Language, Field, Indexing, and Abstracting." American Documentation, v. 13, no. 2, April 1962, p. 162.

5. Baker, Dale B. "Growth of Chemical Literature; Past, Present, and Future." Chemical and Engineering News, v. 39, no. 29, July 17, 1961, p. 81.

6. Bernard, Jesse and Shilling, Charles. Accuracy of Titles in Describing Content of Biological Science Articles. Washington, D. C., American Institute of Biological Sciences, 1953.

7. Bernier, Charles L. "Accelerating Information Transfer in Science and Technology." Paper presented at the Congress of International Federation for Documentation, Washington, D.C., Oct. 10-15, 1965.

8. Cf. "The Function and Effectiveness of Abstracting and Indexing Services: Area II papers presented at the International Conference on Scientific Information, Washington, D.C., Nov. 16-22, 1958. Washington, D.C., National Academy of Sciences, National Research Council, 1958, vol. 1, pp. 315-535.

9. Martyn, John and Slater, Margaret. "Tests on Abstracts Journals." Journal of Documentation. v. 20, no. 4, Dec. 1964, pp. 212-35.

10. See also footnotes 11 through 29, at the end of Chapter 1.

11. Cf. Urquhart, D. J. "Physics Abstracting - Use and Users." Journal of Documentation, v. 21, no. 2, June 1965, p. 113. The study sought to establish the source of reference for publications requested from the National Lending Library for Science and Technology (Great Britain). Results of the study revealed that 49 percent of the chemists and 38 percent of the physicists obtained the reference for the publication requested from an abstract journal. Out of an overall total of 1,144 items requested by all types of users, a total of 469 citations (41 percent) were said to have been obtained from abstracting-type services.

12. Dutta, S. and Das Gupta, A. K. "National/Regional Abstracting Services as Feeders for Tertiary Services." Annals of Library Science and Documentation, v. 13, no. 1, March 1966, pp. 25-33.

13. U. S. Congress. House. Committee of Science and Astronautics. Dissemination of Scientific Information; Report. 86th Cong., 1st Sess. (House Report No. 1179). Washington, D. C., U. S. Govt. Print. Off., 1959, p. 8.

14. Cf. U. S. Naval Research Advisory Committee. Basic Research in the Navy; a Report to the Secretary of the Navy. Vol. 1-2 (PB-151925). Prepared by Arthur D. Little, Inc. under Contract Nonr-2516 (00) Washington, D. C., June 1959.

15. For definitions see Appendix B.

16. CIINTE was organized in accordance with a decree of February 17, 1960 and succeeds the Central Institute for Scientific and Technical Documentation (Centralny Instytut Dokumentacji Naukowo-Technicznej, CIDNT) founded in September 24, 1953, which in turn succeeded the Main Institute for Scientific and Technical Documentation (Główny Instytut Dokumentacji Naukowo-Technicznej, GIDNT), initially founded in 1950.

17. "Działalność CIINTE w roku 1962." Aktualne Problemy Informacji i Dokumentacji, v. 8, no. 1, 1963, p. 32-34.

18. Pas, Ryszard, comp. Informator Służby Informacji Naukowo-Technicznej i Ekonomicznej. Warszawa, Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, 1960, p. 7.

19. Baker, D. B., and others. Some Counterparts in Perspective: A Report on Research Data Processing and Information Retrieval in Other Countries, Including Poland and the Soviet Union. Prepared by Task Force of Visiting Scientists. Washington, D. C., National Federation of Science Abstracting and Indexing Services, 1960, pp. 42-43.

20. Pirog, Wojciech. "Nowe 5-lecie 1966-1970 w działalności informacyjnej w Polsce." Aktualne Problemy Informacji i Dokumentacji, v. 11, no. 10, May/June, 1966, p. 1.

21. Pirog, Wojciech. "Aktualne problemy informacji naukowo-technicznej i ekonomicznej w Polsce" Aktualne Problemy Informacji i Dokumentacji, v. 10, no. 3, May/June, 1965, p. 6-7.

22. Spirit, Jiri. "Ceskoslovenske 'Prehledy technicke a hospodarske literatury' ve srovnani a celosvetovu orovni referatovych casopisu." Technicka knihovne, v. 9, 1959, pp. 157-161.

23. Slamecka, Vladimir. "The Semi-Centralized Systems of Technical Documentation and Information of the Czechoslovak Republic and East Germany." Unpublished Doctoral dissertation, Columbia University, School of Library Service, 1962, p. 111.

24. The Center, formerly known as Institute of Technical and Economic Information (Institut technicke a ekonomicke informace) was reorganized i 1966 and fused with the other departments of the State Technical Library.

25. Iankovskiĭ, IA. "O deiatelnosti chekhoslovatskogo Instituta Tekhnicheskoĭ i Ekonomicheskoĭ Informatsii." Nauchno-tekhnicheskaia informatsiia, no. 8, 1965, pp. 45-46.

26. Pittermann, R. "Technicke knihovny a vedeckotechnicke informace v 15. roce sveho rozvoje." Knihovnik, no. 5-6, 1960, pp. 172-77.

27. "Statut ustavu pro technicke a ekonomicke informace." Metodika a technika informaci, v. 2, no. 1, 1960, pp. 35-40.

28. Mikesova, Ludmila. "Referatova periodika dulezity zdroj informaci." Metodika a technika informaci, no. 3-4, 1962, pp. 36-64.

29. Janszky, L. "Informacja naukowo-techniczna w Węgierskiej

Republice Ludowej." Aktualne Problemy Informacji i Dokumentacji, v. 10, no. 4, Aug./Sept. 1965, p. 5.

30. Lazar, P. "Organization of Documentation in Hungary." Annals of Library Science and Documentation, v. 11, no. 1-3, March-Sept. 1964, p. 6.

31. Slamecka, Vladimir. "The Semi-Centralized System of Technical Documentation and Information of the Czechoslovak Republic and East Germany." Unpublished Doctoral dissertation, Columbia University, School of Library Service, 1962, pp. 52-56.

32. Leibnitz, Eberhard and Koblitz, Josef. "Zehn Jahr Dokumentations - und Informationsnetz in der DDR." Dokumentation, v. 9, no. 1, Feb. 1962, pp. 1-3.

33. Organization of Scientific and Technical Information in the Communist World. (ATD Report 66-11; AD 627 802). Washington, D. C., Aerospace Technology Division, Library of Congress, Jan. 24, 1966, p. 77.

34. Mikhaĭlov, A. I. and others. Osnovy nauchnoĭ informatsii. Moskva, Izd-vo nauka, 1965, p. 494.

35. The Institute initially consisted of a Scientific Information Section having responsibility for the preparation of abstracts, an Editorial Board preparing materials for publication, a Production and Publishing Branch, and a Technical Section. The Institute was placed under administrative control of the Publishing House, Academy of Sciences of the SSSR. Toward the end of 1955 it was reorganized into the All-Union Institute for Scientific and Technical Information under the dual administrative jurisdiction of the Academy of Sciences and the State Scientific and Technical Committee (GNTK) of the Council of Ministers, U. S. S. R. Further reorganization in April 1961 placed the Institute under control of the State Committee for the Coordination of Scientific Research, which had been given overall responsibility for information processing. In September-October 1965, changes promulgated by the Central Committee of the Communist Party created a new State Committee for Science and Technology which now has jurisdiction over the Institute.

36. Organization of Scientific and Technical Information in the Communist World. (ATD Report 66-11; AD 627 802). Washington, D. C., Aerospace Technology Division, Library of Congress, Jan. 24, 1966, p. v.

37. Michajlow, A. I. "Organizacja działalności naukowo-informacyjnej w Związku Radzieckim." Aktualne Problemy Informacji i Dokumentacji, v. 9 no. 5, Sept./Oct. 1964, p. 3.

38. Green, John C. "Comparison of Methods of Technical Communication in the U. S. and Russia." IRE Transactions. Engineering Writing and Speech, v. 5, no. 2, 1962, pp. 94-98.

39. Sullivan, Walter. "World's Scientists Press Drive to Translate Data." New York Times, Dec. 26, 1961, p. 22, col. 4.

40. Gorokhoff, B. I. Publishing in the U. S. S. R. [Washington, D. C., Council on Library Resources, 1959], pp. 145-47.

41. Chernova, T. V. "O referativnom zhurnale 'Khimiia.'"

Akademii nauk SSSR. Vestnik, no. 1, Jan. 1955, pp. 127-32.

42. Cf., Reply by A. I. Mikhaĭlov, "Otvet nedrugu," published in Ekonomicheskaia Gazeta, June 20, 1961, p. 4, to an earlier article published in Neue (Austria) denigrating VINITI and its services.

43. Note: An author sheet contains 40,000 ems.

44. Fomin, A. A. "Referativnye zhurnaly Vsesoiuznovo instituta nauchnoĭ i tekhnicheskoĭ informatsii ("Abstract Journals for the All-Union Institute of Scientific and Technical Information"). In Voprosy otraslevoĭ bibliografii po estestvennym naukam (Bibliographic Problems in the Natural Sciences; Reports Delivered at the VI Scientific Conference of the Library of the Academy of Sciences USSR, Leningrad, March 2-4, 1960). (Tr. by Adam Kahane). Cambridge, Mass., Massachusetts Institute of Technology, 1962. pp. 32-33.

45. Ibid., p. 89.

46. Ibid., p. 96.

47. Russia. Soviet Ministrov. Gosudarstvennyĭ Nauchno-Tekhnicheski Komitet. Photocopies, Microfilms. Prospectus (Tr. from Russian by Medical Documentation Service, Philadelphia). Moscow, 1959, p. 1.

48. Cf. System Development Corporation. Recommendations for National Document Handling Systems in Science and Technology. (AD624560, PB168267). Appendix A, Background Study, Vol. II, p. 10-10: "Apparently, dissemination is entirely by subscription or direct purchase; i. e., the available published literature of VINITI does not suggest that any special alerting function or active dissemination is carried out."

49. Album, Hyman I and Hoshovsky, Alexander G. Threat of Communist Technology. Proposals for Free World Cooperation in R & D and Information Transfer. (OAR-018; AD 435 598). Washington, D.C., Office of Aerospace Research, U.S. Air Force, Sept. 1963. Annex A, p. 14.

50. Baker, D. B., and others. Some Counterparts in Perspective. A Report on Research Data Processing and Information Retrieval in Other Countries, Including Poland and the Soviet Union. Prepared by Task Force of Visiting Scientists. Washington, D. C., National Federation of Science Abstracting and Indexing Services, 1960, p. 17.

51. Fomin, A. A. "Vsesoiuznyĭ institut Nauchnoĭ i Tekhnicheskoĭ Informatsii; evo struktura i soderzhanie raboty." In Voprosy organizatsii i metodiki nauchno - tekhnicheskoĭ informatsii i propagandy. Po materiĭyam seminara rabotnikov nauchno - tekhnicheskoĭ informatsiĭi propagandy, Moskva, 16 Mata - 11 Iiunia 1960 g. Moskva, TSINTI, 1960. p. 22.

52. Ibid., p. 37.

53. Sorokin, Y. N. Private Communication (No. 64-645/5). Jan. 25, 1967.

54. Ibid.

55. D. S. I. R. - Aslib Delegation to Moscow and Leningrad. Scientific and Technical Information in the Soviet Union. Report. London, Department of Industrial and Scientific Research, 1964, p. 20.

56. Malov, V. S. "Results of a Check of Fulfillment of Resolution of Council of Ministers of USSR 'About Measures for Improvement of Organization of Scientific and Technical Information in this Country.'" Scientific and Technical Information (Selected Articles). No. 6, 1964. (FTD-MT-65-07; AD 619 553). Wright-Patterson Air Force Base, Ohio, Foreign Technology Division, 1965, p. 1-13.

57. Ibid., p. 6.

58. Arutyunov, N. B. "On Measures for Further Improvement of System of Scientific and Technical Information in Our Country." Scientific and Technical Information (Selected Articles). No. 6, 1964. (FTD-MT-65-07; AD 619 553) Wright-Patterson Air Force Base, Ohio, Foreign Technology Division, 1965, p. 16. (A more formal report on this subject "O opatrenich k dalsimu zdokonalovani soustavy vedecko-technickyich informaci v SSSR," was published by N. B. Arutyunov in Metodika a technika informaci. No. 6, 1965, pp. 12-25).

59. Fokin, S. IA. "O dvukh formakh izdanii referativnoi informatsii." Nauchno-Tekhnicheskaia Informatsiia, no. 6, 1966. p. 8-9.

60. Ibid.

61. D. S. I. R. - Aslib Delegation to Moscow and Leningrad. Scientific and Technical Information in the Soviet Union. Report. London, Department of Industrial and Scientific Research, 1964. p. 2.

Chapter 4

Diffusion Pattern for NSA, STAR, TAB, and USGRDR

Both public and private agencies have indicated concern about adequate bibliographic control, abstracting, indexing, and dissemination of the technical report literature stemming from U. S. financed research. Substantial intellectual and material resources have been committed by the Federal government toward the attainment of these objectives. During fiscal year 1967, it is estimated that 273 million dollars will be obligated by the Federal government for scientific and technical information of which approximately 30 percent will be devoted to "publication and distribution" (See Figure 10).

The U. S. Federal Council for Science and Technology took cognizance of the progress made to date and of the vital role played by abstracting and indexing services in the information diffusion process:

> The Federal agencies have made significant strides in the improvement of abstracting-indexing mechanisms for the announcement and availability of Government research reports. The importance of advances in this area of information handling is underlined by the fact that abstracting-indexing is a principal means available for providing scientists with current awareness of their fields of interest as well as guides for retrospective search of the world's literature. In brief, abstracting-indexing of the significant literature is central to effective scientific research services both within and outside Government.[1]

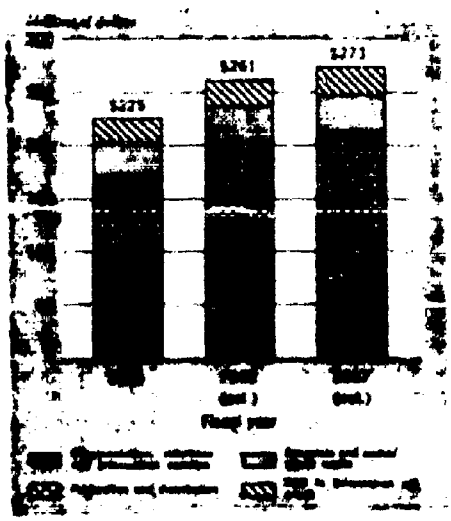
"Prompt and informative abstracting and indexing" as well as "prompt announcement on the broadest scale...both within the Department of Defense and the rest of the U. S. technical community, commensurate with security needs" are basic recommendations of a Department of Defense study on scientific and technical information.[2] The "Weinberg" report opens with the statement: "Transfer of information is an inseparable part of research and development."[3] What, then, is the current distribution pattern for the four major Federal abstracting and indexing services of NSA, STAR, TAB, and USGRDR?

Which industries, subject disciplines or geographic regions are the primary recipients of the services?

One of the first tasks confronting the investigator in seeking answers to the above questions was to obtain mailing lists for the

Figure 10

Federal Obligations for Scientific and Technical Information, by Agency and Performer, 1967 (est.)



Source: U. S. National Science Foundation. Funds for Research, Development and Other Scientific Activities, 1967. (NSF 66-25). Washington, D. C., U. S. Govt. Print Off., 1966, p. 47.

recipients of each of the abstracting and indexing services under study. Understandably, a good deal of caution was exercised by Federal agencies before releasing recipient or subscriber information for government publications. Correspondence, personal visits, sufficient assurance that the mailing lists would be used solely for research purposes eventually yielded the following recipient files:

Recipient Files

1. Official Distribution List, TAB

U. S. Diffusion Pattern

Source: Defense Documentation Center, Cameron Station, Virginia
No. of Addresses: 5,473
Format: Computer printout, arranged by DDC user code number
Date of File: June 13, 1965
Coding: User code; type of institution; facility clearance; number of TAB copies; number of TAB indexes.

2. Official Distribution List, NSA
Source: U. S. Atomic Energy Commission, Division of Technical Information Extension, Oak Ridge, Tennessee
No. of Addresses: 1,420
Format: Computer printout, arranged by AEC computer filing code
Date of File: December 31, 1965
Coding: Type of recipient; computer filing code; number of NSA copies

3. Official Distribution List, STAR
Source: National Aeronautics and Space Administration, Washington, D. C.
No. of Addresses: 4,103
Format: Computer printout (Master Address Authority List), arranged by NASA user code
Date of File: October 11, 1965
Coding: Coding indicating the number of copies mailed to each recipient was withheld by NASA.

4. Subscriber List, NSA
Source: U. S. Government Printing Office via U. S. Atomic Energy Commission, Washington, D. C.
No. of Addresses: 1,673
Format: Elliott addressoplate printout sheets containing 10 addresses each, arranged alphabetically, by state
Date of File: July 13, 1965
Coding: Number of copies, service, subscription expiration date.

5. Subscriber List, USGRDR
Source: U. S. Government Printing Office via Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia
No. of Addresses: 3,071
Format: Elliott addressoplate printout sheets, containing 10 addresses each, arranged alphabetically, by state
Date of File: August 19, 1965
Coding: Number of copies; services, subscription expiration date.

6. GPO Depository Library Recipients, NSA, STAR, USGRDR
Source: U. S. Government Printing Office, Washington, D. C.
No. of Addresses: 502 NSA recipients
398 STAR recipients
459 USGRDR recipients
Format: Elliott addressoplate printout sheets containing 10 addresses

each, arranged alphabetically, by state
Date of File: August 10, 1966
Coding: Number of copies; service.

7. Smithsonian Institution Exchange Recipients, NSA, STAR, USGRDR
Source: International Exchange Service, Smithsonian Institution, Washington, D. C.
No. of Addresses: 59 NSA recipients
59 STAR recipients
59 USGRDR recipients
Format: A listing of institutional recipients of full sets of official United States government publications, as recorded on pp. 148-50 of the Report on the International Exchange Service for the year ending June 30, 1965.
Date of File: Transmitted via Smithsonian International Exchange Letter of October 4, 1966
Coding: Number of copies.

8. Library of Congress Exchange Recipients, NSA, STAR, USGRDR
Source: Exchange and Gift Division, Library of Congress, Washington, D. C.
No. of Addresses: 31 NSA recipients
5 STAR recipients
44 USGRDR recipients
Format: Addressopiate printout mailing labels
Date: October 27, 1966
Coding: None.

9. Subscriber Data: STAR
Source: U. S. Government Printing Office, Washington, D. C.
No. of recipients: 300
Format: Private communication providing data, by state and subject, for the number of STAR subscribers and number of copies received. No addresses were disclosed. A total of 125 U. S. subscribers to STAR represented all U. S. subscribers (Federal and non-Federal) out of an overall total of 300 for all subscribers receiving 345 copies of STAR
Date of File: March 21, 1966
Coding: Broad subject grouping; number of copies; distribution by state.

The total number of recipients (i. e., addresses) obtained for all four services is summarized as follows:

Table 4

Total Recipient File, by Source

Source File	No. of Recipients	Percent
Official Distribution, TAB	3,473	22.18
Official Distribution, NSA	1,420	9.07

U. S. Diffusion Pattern

Source File	No. of Recipients	Percent
Official Distribution, STAR	4,103	26.21
Subscribers, NSA	1,673	10.69
Subscribers, USGRDR	3,071	19.62
GPO Depository Library Distribution	1,359	8.69
Smithsonian Exchange Distribution	177	1.13
LC Exchange Distribution	80	.51
Subscribers, STAR	300	1.92
Total	15,656	100

The comprehensive recipient file was combined and rearranged into the following segments:

Table 5

Total Recipient File, by Segment

Recipient Group	No. of Recipients	Percent
Non-Federal U. S. Recipients	8,074	51.57
Federal Recipients	2,822	18.03
GPO Depository Libraries (Federal and Non-Federal)	1,359	8.68
Foreign Recipients	3,401	21.72
Total	15,656	100

The file for domestic U. S. recipients[4] contained 12,255 recipients of which 11.09 percent were GPO Depository Libraries, 23.03 percent Federal recipients, and 65.88 percent non-Federal U. S. recipients.

While the primary aim of this study has been to analyze the private, non-Federal U. S. recipient population, to acquire adequate statistical background and perspective, it was necessary to examine all of the above groups in some detail.

Non-Federal U. S. Recipients

The Non-Federal U. S. Recipient File of 8,074 addresses included industrial organizations, educational and nonprofit institutions, state and local government agencies, and unaffiliated private subscribers or individuals. The addresses were standardized and arranged alphabetically under corporate name of the recipient, with divisions or sub-units grouped under the corporate entry. Unaffiliated

private recipients were filed under the last name of the recipient. Each corporate or private recipient entry was assigned a unique five digit number (0-99999) identifying the organization, institution, or non-corporate private addressee. An additional two digits (0-99) were used as part of the number to identify subdivisions or affiliates grouped under the corporate entry. The entire file was coded and the data keypunched on standard EAM equipment.

The coding system was designed to enable the investigator to group and permute the characteristics of the recipients. Of considerable importance was the determination and eventual analysis of such latent variables as number of institutions or industries dealt with, as well as number of geographic locations or sites receiving one or more of the abstracting and indexing services under study. It is obvious that more than one recipient may be found within a single industrial organization or educational institution and that more than one site can be utilized by such an organization or institution, its subdivisions and affiliates.

For each address, in addition to corporate accession number and sub-unit identification, codes were assigned for the following:

1. Type of organization or institution
   a. Industrial
   b. Educational/Nonprofit
   c. State and local government
   d. Unaffiliated private recipient
2. Industry classification
   Based on the Standard Industrial Classification Manual (U. S. Office of Statistical Standards, 1957 ed. and supplements) a three digit industry classification number was assigned for each corporate entry.
3. COSATI subject category classification
   A four digit subject classification number was assigned for each recipient. The DOD-extended COSATI Subject Category List (Defense Documentation Center, 1965) was employed for this purpose.
4. Abstracting and indexing service received
   a. NSA
   b. STAR
   c. TAB
   d. USGRDR

U. S. Diffusion Pattern

5. Number of copies received

6. Attention line for service
   a. Library
   b. Information center
   c. Security officer
   d. Individual (other than above)
   e. None

7. Geographic location
   A two digit code was assigned to designate the U. S. state location for each recipient. An additional two digits were used to differentiate between various organization or institution sites within any one state.

8. Source of Receipt
   a. Subscriber
   b. AEC distribution
   c. DDC distribution
   d. NASA distribution
   e. Exchanges
   f. Depository distribution
   g. Other distribution

All keypunched data were converted to magnetic tape and analyzed with the aid of a Control Data Corporation computer, CD1604-A.

Analysis of the non-Federal U. S. Recipient File revealed that two thirds of the total of 7,949 recipients[5] were in industrial organizations, 30.4 percent in educational and nonprofit institutions, 2.3 percent were private subscribers or individuals having no apparent institutional affiliation, and a small fraction (0.7 percent) were state and local government recipients (Table 6). Thus 97 percent of all non-Federal U. S. recipients were within industrial organizations and educational institutions, with the former in the majority.

When the distribution pattern is examined in terms of the individual services, it is apparent that four fifths of the USGRDR recipients, a somewhat lesser portion of TAB and STAR recipients, and less than half of NSA recipients are industrial organizations. Of course, there are many more industrial organizations extant than there are educational institutions[6] and this would tend to account for the preponderance of STAR, TAB, and USGRDR recipients within industrial organizations. The almost equal distribution of NSA among industrial and educational recipients may be attributed in part to the

comparatively heavy use made of NSA by pure scientists, particularly biologists, medical personnel and physicists (Table 11A, Appendix A). This type of user is found in the educational rather than industrial environment (Table 10A, Appendix A).

The 7,949 non-Federal U.S. recipients were associated with 3,004 separate industrial, educational or nonprofit organizational units in 4,179 different sites or geographic locations. The organizational recipient breakdown is as follows:

		Percent
Industrial Corporations	2,154	71.7
Universities	184	6.1
Colleges	169	5.6
Junior Colleges	13	0.4
Independent Libraries	56	1.9
Foundations	20	0.7
Hospitals	42	1.4
Institutes	41	1.4
Museums	4	0.1
Professional Associations	40	1.3
Business Associations	43	1.4
State Government	41	1.4
Local Government	5	0.2
Private or Unaffiliated Recipients	183	6.1
Other Recipients	10	0.3
Total	3,004	100

COSATI Subject Grouping

Disregarding for the present institutional or organizational affiliation and grouping the entire non-Federal U.S. recipient population within broad COSATI subject categories,[7] we find, in rank order, that the largest recipient groups for the combined services are in the field of Electronics and electrical engineering (14.04 percent), followed closely by the fields of Mechanical, industrial, civil and marine engineering (13.45 percent), Materials (10.68 percent), Biological and medical sciences (7.87 percent), Aeronautics (5.10 percent), Chemistry (5.0 percent) (See Table 7). Practically all of the categories listed above are representative of subject fields which are the primary recipients of R & D funds and generally denote those industries which are in the forefront of economic expansion.

From the more detailed breakdowns arranged under four digit

Table 6

Non-Federal U.S. Recipients, by Service and Type of Institution

Type of Institution	Service Received: NSA	STAR	TAB	USGRDR	Total	Percent
Industrial	46.6	62.1	71.9	79.4		
	588	1688	1346	1666	5288	66.5
Educational	48.9	35.7	27.3	15.3		
	617	970	510	322	2419	30.4
Private	1.9	1.9	0.6	4.6		
	24	52	11	96	183	2.3
St-Loc Govt	2.6	0.3	0.2	0.7		
	33	8	4	14	59	0.7
Total	1262	2718	1871	2098	7949	
Percent [a]	15.9	34.2	23.5	26.4		100.0

(a) Percent based on column sum.

Table 7

Non-Federal U. S. Recipients, by COSATI Subject Field

	No. of Recipients[a]	Percent
Aeronautics (01)	398	5.10
Agriculture (02)	62	0.80
Astronomy and Astrophysics (03)	72	0.93
Atmospheric Sciences (04)	46	0.59
Behavioral and Social Sciences (05)	208	2.68
Biological and Medical Sciences (06)	611	7.87
Chemistry (07)	388	5.00
Earth Sciences and Oceanography (08)	120	1.55
Electronics and Electrical Engineering (09)	1,090	14.04
Energy Conversion (Non-propulsive) (10)	67	0.86
Materials (11)	829	10.68
Mathematical Sciences (12)	36	0.46
Mechanical, Industrial, Civil, and Marine Engineering (13)	1,044	13.45
Methods and Equipment (14)	257	3.31
Military Sciences (15)	37	0.48
Missile Technology (16)	121	1.56
Navigation, Communications, Detection, and Countermeasures (17)	392	5.05
Nuclear Science and Technology (18)	268	3.45
Ordnance (19)	76	0.98
Physics (20)	367	4.73
Propulsion and Fuels (21)	206	2.65
Space Technology (22)	277	3.57
Science (25)	132	1.70
Technology (26)	119	1.53
General (27)	545	7.02
Total	7,766	100

[a]Excludes subject analysis for 183 private/official recipients.

COSATI subject groups (Table 9A, Appendix A), we learn of the predominance of particular subject groupings within the broader COSATI subject fields. Thus, for example, within the Materials field, the subject groups Metallurgy and metallography, and Ceramics, refractories, and glasses, constitute the most numerous recipient groups, while such groups as Fibers and textiles or Wood and paper products, found in other studies to represent industries having relatively small portions of R & D expenditures as percentage of sales or

net industrial output (See Table 2A, Appendix A), constitute some of the smallest recipient groups; within the subject field Biological and medical sciences, following the subject group Clinical medicine, Pharmacology is the most numerous recipient group. As in the case of the other major recipient fields of Electronics and electrical engineering, Chemistry, and Aeronautics, the field of Pharmacology is representative of a research-oriented and fast-growing segment of the industrial community.

Expected and rather distinct differences appear in the subject orientation of the industrial and educational portions of the recipient population (Table 10A, Appendix A). While the fields of Electronics and electrical engineering, Materials, Mechanical, industrial, civil, and marine engineering constitute, in rank order, the most populous subject fields for industry with an aggregate of 47.3 percent of industrial recipients, for educational and nonprofit institutions, the primary interest fields, also in rank order, are Biological and medical sciences, Mechanical, industrial, civil and marine engineering, and Physics, accounting for 35.5 percent of the educational and nonprofit institutional recipients. The differences in subject emphasis within each of the 27 COSATI subject fields become apparent as they are reflected in the quantitative differences for the respective recipient populations. Apparent, too, is the more general emphasis on applied sciences in industrial organizations, and pure sciences within educational institutions. Thus, while the field of Materials constitutes 14.6 percent of the industrial recipient population, for educational recipients it constitutes 2.3 percent. On the other hand, for the field of Biological and medical sciences, 15.2 percent of the population is in the educational sector, while 4 percent is in the industrial sector; for Electronics and electrical engineering, 18.8 percent is in the industrial sector, and 3.9 percent in the educational sector, for Physics, 8.1 percent is found to be in the educational sector, and 3.2 percent in the industrial sector.

When the recipient population is examined from the point of view of distribution of the specific abstracting and indexing services among various population segments as grouped under COSATI subject

fields (Table 11A, Appendix A), it is evident that each of the abstracting and indexing services is received within each of the 27 COSATI subject fields. Thus, apparently, recipients in each of the COSATI subject fields hope to obtain pertinent information from each of the abstracting and indexing services of NSA, STAR, TAB, and USGRDR. The mission rather than the subject-orientation of the services is certainly underscored by these data. Conversely, each of the abstracting and indexing services of NSA, STAR, TAB, and USGRDR is received within a broad range of subject disciplines. The subject field rankings of the respective recipient populations for these services bear only a slight relationship to the subject fields generally thought to be directly pertinent to the missions of the Federal agency issuing agencies. The combined fields of Space technology and Aeronautics account for only 10.6 percent of the STAR recipient population. However, these fields also constitute 9.0 percent of TAB recipients, 4.6 percent of NSA recipients, and 4.8 percent of USGRDR recipients. The recipient population data indicate the subject disciplines essential in carrying out the respective Federal documentation center agency missions and, consequently, the major recipient subject fields for STAR are found to be within the fields of Mechanical, industrial, civil, and marine engineering, containing 17.3 percent of the STAR recipient population, Electronics and electrical engineering with 12.7 percent, Aeronautics with 8.6 percent, and Materials with 7.4 percent. For TAB and USGRDR, though place rankings undergo some change, the above fields also constitute major recipient groups. The field of Electronics and electrical engineering comprises 19.9 percent of the TAB recipients, the field of Mechanical, industrial, civil and marine engineering 10.8 percent, the defense-oriented field, Navigation, communication, detection, and countermeasures 8.7 percent, and the Materials field 7.0 percent. When one excludes the "General" category with 14.1 percent of recipients, the greatest number of NSA recipients is concentrated, in rank order, in the fields of Biological and medical sciences with 18.1 percent, Materials with 9.8 percent, Nuclear science and technology with 9.0 percent, Chemistry with 7.8 percent, Mechanical, industrial, civil, and

marine engineering with 6.7 percent, and Physics with 6.5 percent.

Geographic Distribution

The states of California, New York, and Massachusetts, in that order, account for 35.88 percent of all recipients. When one adds to the above the states of Pennsylvania (6.97 percent) and New Jersey (5.47 percent), nearly half of the abstracting and indexing service recipient population have been accounted for. Eighteen states total only 3.41 percent of the recipients. These are: Alaska, Arkansas, Hawaii, Idaho, Maine, Mississippi, Montana, Nebraska, Nevada, New Hampshire, North Dakota, Rhode Island, South Carolina, South Dakota, Utah, Vermont, West Virginia, Wyoming, each with less than one half of one percent of the recipient population. Thirteen additional states each contain less than one percent of the recipient population (Table 12A Appendix A).

While the heavy concentration of recipients in California, New York, Massachusetts, etc., may be explained in part as a result of their relatively large populations, as may be seen from Tables 13A and 14A, Appendix A, these states also rank high in Federal R & D contract allocations and also in terms of number of scientists and engineers employed as a percentage of the total labor force. Significantly, though no cause and effect relationship is implied, states having a high industrial recipient population generally are also found to have a high educational recipient population (Table 15, Appendix A) and within the educational recipient sector, we again note the top ranking industrial recipient states of New York (13.01 percent), California (10.71 percent), Massachusetts (7.9 percent), Illinois (6.16 percent), Pennsylvania (5.87 percent), and Ohio (4.38 percent).

Distribution of the individual services of NSA, STAR, TAB, and USGRDR conforms for the most part to the overall geographic pattern established for all the services. In ranked order, recipients in the top seven states, by service, are located geographically as follows:

NSA	STAR	TAB	USGRDR
New York	Calif.	Calif.	New York
Calif.	New York	New York	Calif.
Penn.	Penn.	Mass.	Penn.

Mass.	Mass.	Penn.	New Jersey
Ohio	Ohio	New Jersey	Illinois
Illinois	Illinois	Ohio	Mass.
New Jersey	New Jersey	Maryland	Ohio

When the geographic distribution by state is examined for each service within the industrial or educational recipient sectors (Tables 17A-18A, Appendix A), with minor exceptions, the same states attain top recipient ranking for each of the abstracting and indexing services. These rankings hold equally well when looked at from the point of view of industrial or educational segments of the recipient population:

Comparison Ranking
Industrial Recipients

NSA	STAR	TAB	USGRDR
Calif.	Calif.	Calif.	New York
New York	New York	New York	Calif.
Penn.	Penn.	Mass.	Penn.
New Jersey	Mass.	New Jersey	New Jersey
Ohio	New Jersey	Penn.	Illinois
Mass.	Ohio	Ohio	Mass.
Illinois	Maryland	Maryland	Ohio

Comparison Ranking
Educational Recipients

NSA	STAR	TAB	USGRDR
New York	New York	New York	Calif.
Calif.	Calif.	Calif.	New York
Penn.	Illinois	Mass.	Mass.
Mass.	Mass.	Penn.	Penn.
Ohio	Penn.	Illinois	Indiana
Illinois	Michigan	Maryland	Illinois
Michigan	Ohio	Ohio	Ohio

A regional grouping of recipients (Table 19A, Appendix A) reveals that the East South Central, Mountain, West North Central and West South Central regions, in that order, rank lowest in number of recipients, while the Middle Atlantic, Pacific, and East North Central regions have top ranking. When the regional percentage distribution of recipients is compared with the distribution of such economy input variables as total R & D funds, industrial R & D funds, percent of doctorates employed, percent of scientists in Federal government

work, a definite relationship is found to exist between the regional geographic distribution of the abstracting and indexing services under study and the other factors listed (See Table 8).

Table 8

Regional Percentage Distribution of Non-Federal U. S. Recipients Compared to Percentage Distribution of Other Variables

	Percent Recipients	Percent Total R & D Funds 1963	Percent Manufactures 1963 (Prel)[8]	Percent Industrial R & D Funds 1964[9]	Percent of Scientists in Fed. Govt. Work 1962[10]	Percent Doctorates Employed 1962[11]
Middle Atlantic	25	23	26	23	23	24
Pacific	18	15	14	29	15	15
East North Central	17	16	20	17	16	18
South Atlantic	13	15	11	7	15	15
New England	11	4	8	8	7	8
West South Central	5	7	7	6	6	6
West North Central	4	6	7	4	6	6
Mountain	4	6	3	3	6	5
East South Central	3	3	5	2	3	3

Copy Distribution

Data on the number of copies disseminated were available only for NSA, TAB and USGRDR. For the 5,231 non-Federal U. S. recipients of the above services, a total of 11,243 copies were distributed, or an average of 2.15 copies per recipient.[12] A detailed analysis of the ratio of recipients to number of copies received reveals that 80.7 percent of the members comprising the recipient population received one copy each, 8.7 percent 2 copies, 4.8 percent 3 copies, 3.1 percent 4-9 copies, and 2.5 percent 10 or more copies (Table 20A, Appendix A). For USGRDR which is available almost exclusively through paid subscription, the percentage of single copy recipients totaled 96.8 percent, for NSA 87.4 percent, and for TAB 58.5 percent. Obviously, the bulk of multiple copy receipts is confined to those services

available gratis through official distribution channels. While it is understandable that paid subscribers would order a minimal number of copies of the abstracting and indexing services, it is also certain that unless the recipient organization established a formal mechanism for wider dissemination of the service received, the receipt of a single copy only within the recipient organization would preclude its extensive use for current awareness purposes. Certainly this generalization may well be applicable to USGRDR recipients.

From a comparison of the geographic distribution of recipients, by state (Table 12A, Appendix A) and a similar distribution of copies for NSA, TAB, and USGRDR (Table 21 A, Appendix A) it can be concluded that the geographic distribution pattern for non-Federal U. S. recipients and number of copies is quite similar. Although some of the rankings undergo change, the highest ranked seven states appear in both listings:

States by No. of Recipients	States by No. of Copies
Calif.	Calif.
New York	New York
Mass.	Illinois
Penn.	Mass.
Ohio	Penn.
New Jersey	Ohio
Illinois	New Jersey

When the comparison is made between recipient distribution by type of institution (Table 15A, Appendix A) and copy distribution (Table 22A), Appendix A, the basic distribution pattern remains constant:

Type of Recipient	Percent Copy Distribution NSA, TAB, USGRDR	Percent Recipient Distribution NSA, STAR, TAB, USGRDR
Industrial Organizations	70.9	66.5
Educational/Nonprofit Institutions	27.5	30.4
Private/Unaffiliated	1.2	2.3
State and Local Govt.	0.5	0.7

Some significant differences do appear when the recipient-copy comparison is made by individual service and subject field (Table 11A and Table 23A, Appendix A). While the relative rankings of the top

subject fields for TAB and USGRDR remain for the most part unchanged, for NSA the changes are pronounced. Thus, for example, the field of Nuclear Science and Technology ranks fourth in the recipient listing (111 recipients representing 8.0 percent of the NSA recipient population), but ranks first in the copy distribution listing (1,526 copies representing 48.6 percent of the total NSA copy distribution). Apparently, unlike copy distribution for TAB and USGRDR, distribution of NSA copies to non-Federal U.S. recipients is concentrated within a small group of organizations. Understandably, several large laboratories operated under contract for the Atomic Energy Commission, such as Argonne National Laboratory, Oak Ridge National Laboratory, Brookhaven National Laboratory, Battelle Northwest Laboratory, receive the bulk of NSA copy distribution. This phenomenon is supported by data in Table 20A, Appendix A indicating five NSA recipients, each receiving more than 100 copies of the relatively small NSA distribution. The differing approaches toward meeting current awareness needs as exemplified by many a large educational institution or industrial corporation receiving a single copy only of any one service, and laboratories operated by industry for the Federal government receiving as many as 300 copies of the pertinent abstracting and indexing service, though not subject to appraisal in this study, are certainly worth further investigation.

Industry Classification

What are the characteristics of the recipient industrial population, not in terms of the particular subject disciplines or geographic locations of recipients, but in terms of the specific industrial enterprises with which two thirds of the recipient population is affiliated? As is evident from data in Table 9, a total of 2,154 industrial establishments were represented in the file. Coded in terms of Standard Industrial Classification (SIC), nonmanufacturing industries comprised the largest industrial groups with 27.21 percent of all industrial establishments. A breakdown of these establishments by more detailed SIC headings (Table 24A, Appendix A) revealed that 483 of the 586 industries classed within the nonmanufacturing industries groups were in subgroups 739 and 891. These subgroups represent

codings for independent laboratories and engineering and consulting services whose primary activity is research and development work rather than manufacturing.

The economically expanding manufacturing group of Electrical equipment and communications was in forefront with 18.20 percent of all industrial enterprises represented in the recipient file, followed by Chemical and allied products (9.10 percent), Machinery (9.05 percent), Professional and scientific instruments (7.61 percent), Aircraft and missiles (6.13 percent). It is precisely these industries that received the greatest share of research and development funds during 1964 (See Table 25A, Appendix A). On the other hand, such industries as Lumber, wood products, and furniture, Textiles and apparel, Paper and allied products, ranked lowest with a recipient file representation ranging from 0.23 to 1.1 percent. The industries, previously established as lagging in the economic race, received the smallest portion of research and development funds.

Table 9

Industrial Recipient Establishments, by Major S.I.C. Groups

	Industries	Percent
Food and kindred products (20)	29	1.35
Textiles and apparel (22 and 23)	15	0.70
Lumber, wood products, and furniture (24 and 25)	5	0.23
Paper and allied products (26)	23	1.07
Chemicals and allied products (28)	196	9.10
Industrial Chemicals (281-82)	86	4.10
Drugs and medicines (233)	33	1.53
Other chemicals (284-89)	76	3.53
Petroleum refining and extraction (29 and 13)*	45	2.10
Rubber products (30)	33	1.53
Stone, clay, and glass products (32)	36	1.67
Primary metals (33)	87	4.04
Primary ferrous products (331-32)	41	1.90
Nonferrous and other metal products (333-39)	46	2.14
Fabricated metal products (34)	81	3.76
Machinery (35)	195	9.05
Electrical equipment and communications (36 and 48)*	392	18.20
Communication equipment and electronic components (366-67 and 48)	261	12.12

U. S. Diffusion Pattern

	Industries	Percent
Other electrical equipment (361-65 and 369)	129	5.99
Motor vehicles and other transportation equipment (371 and 373-79)	38	1.76
Aircraft and missiles (372 and 19)**	132	6.13
Professional and scientific instruments (38)	164	7.61
Scientific and mechanical measuring instruments (381-82)	104	4.83
Optical, surgical, photographic, and other instruments (383-87)	59	2.74
Other manufacturing industries--tobacco manufactures (21), printing and publishing (27), leather products (31), and miscellaneous manufacturing industries (39)	97	4.50
Manufacturing industries--Mining (10-12 and 14), contract construction (15-17), transportation and other public utilities (40-47 and 49), wholesale and retail trade (50-59), finance, insurance, and real estate (60-67), and selected service industries (70-79 and 89)	586	27.21
Total	2154	100.00

* For the purposes of this study, crude petroleum and extraction (13) is grouped with petroleum refining (29), and communication (48) is grouped with electrical equipment (36) in the manufacturing group of industries.

** Companies primarily engaged in the manufacture of ordnance and accessories, including complete guided missiles, are grouped with companies primarily engaged in the manufacture of aircraft and parts because of close similarity of R & D activities carried out by major companies in the two industries.

Distribution Pattern by Site

NASA and AEC technical reports are announced in USGRDR without abstracts. Format changes for USGRDR instituted in 1967 provide references to STAR and NSA with the hope that needed abstracts may thus be located. To what extent do the USGRDR recipient sites also receive NSA, STAR, or both? To what extent is it necessary for STAR to duplicate in its abstracting and indexing service announcements of reports listed also in TAB? Conversely, what percentage of the TAB recipient sites also acquire STAR, NSA or USGRDR? What are the most prevalent combinations for these

services at the various sites?

For the purposes of this study, a site has been defined and coded for computer input as a specific geographic location which may house one or more buildings (usually having a common address) all reachable within easy walking distance one from the other. Thus, for example, the Columbia University campus at Morningside Heights, New York, would be considered a single site, its Nevis Cyclotron Laboratories at Irvington, New York, another.

A printout of the coded data revealed that the 7,949 non-Federal recipients were located at 4,179 discrete sites. The combination of services, arranged in rank order, is indicated in Table 10. USGRDR is received exclusively at 1,067, or 25.5 percent of all recipient sites, followed by the exclusive receipt of STAR at 853 or 20.4 percent sites. A total of 239 sites, or 5.7 percent are recipients of all four services. Of all four services, the least exclusive distribution is that for NSA which is received uniquely at 334 or 7.99 percent of the 4,179 recipient sites.

Table 10

Sites and Combinations of Services Received

	No. of Sites	Percent
USGRDR	1,067	25.53
STAR	853	20.41
TAB	529	12.66
TAB, STAR	362	8.66
NSA	334	7.99
NSA, STAR, TAB, USGRDR	239	5.72
STAR, TAB, USGRDR	160	3.83
NSA, USGRDR	125	2.99
STAR, USGRDR	114	2.73
NSA, STAR, TAB	113	2.70
NSA, STAR, USGRDR	85	2.03
TAB, USGRDR	77	1.84
NSA, STAR	66	1.57
TAB, NSA	29	.69
TAB, NSA, USGRDR	26	.62
Total	4,179	100

Extrapolating from the above data and disregarding exclusive combinations of services, NSA, STAR, TAB and USGRDR are dis-

tributed among the 4,179 sites as indicated in Table 11. Thus, close to half of all recipient sites (1,992 or 47.67 percent, and 1,893 or 45.30 percent respectively) receive STAR and USGRDR. TAB is received by 1,535 sites, or 36.73 percent, and NSA by 1,017 or 24.34 percent of all recipient sites. From the point of view of site dissemination, STAR is the most widely disseminated service, followed closely by USGRDR. The most widely disseminated combination of services is STAR and TAB which is received by 20.91 percent of all recipient sites.

Table 11

Distribution of Services, by Site

Service	No. of Sites	Percent of Total Sites (a)
NSA	1,017	24.34
STAR	1,992	47.67
TAB	1,535	36.73
USGRDR	1,893	45.30
NSA, STAR	503	12.04
NSA, TAB	407	9.74
NSA, USGRDR	475	11.37
STAR, TAB	874	20.91
STAR, USGRDR	598	14.31
TAB, USGRDR	502	12.01
NSA, STAR, TAB	352	8.42
NSA, TAB, USGRDR	265	6.34
NSA, STAR, USGRDR	324	7.75
STAR, TAB, USGRDR	399	9.55
NSA, STAR, TAB, USGRDR	239	5.72

(a) Percent based on total of 4,179 sites.

Attention Line Distribution

Excluding the approximately 180 private and unaffiliated recipient addresses known, of course, to be addressed to specific individuals, the question posed by the investigator was: who are the initial recipients of the abstracting and indexing services within the industrial organizations and institutions to which they are mailed?

An analysis of organizational and institutional recipients (Table 12) reveals that 43.3 percent of the recipient addresses were designated for the attention of the library, 39.3 percent for the attention

of specific individuals, 14.8 percent had no attention line, 1.3 percent were for the attention of information centers and 1.4 percent for the attention of the security officer. It is, of course, quite

Table 12

Attention Line, by Service

	Service Received					
	NSA	STAR	TAB	USGRDR	Total	Percent
Library	59.4 734	38.0 1012	34.9 649	48.3 967	3362	43.3
Individual	22.9 283	55.2 1470	39.4 733	28.1 563	3049	39.3
No one spec	15.9 196	4.6 123	20.5 381	22.4 448	1148	14.8
Info center	1.4 17	1.1 29	1.6 29	1.2 24	99	1.3
Security off	0.5 6	1.2 31	3.7 68	0.0 1	106	1.4
Total	1236	2665	1860	2003	7764	
Percent[a]	15.9	34.3	24.0	25.8		100.0

[a] Percent based on column sum.
Excludes 183 private/official recipients.

possible that services addressed to the security officer or specific individuals may have been forwarded directly to the library. Thus it can be assumed that libraries are the initial recipients of at least half of the abstracting and indexing services mailed to industrial or institutional recipients.

U. S. Diffusion Pattern

Of the four services, NSA with 59.4 percent has the highest library attention line designation, followed by USGRDR with 48.3 percent, STAR with 38.0 percent and TAB with 34.9 percent. More than half of the STAR and less than one quarter of the NASA distribution is addressed to individuals outside libraries or information centers.

No distinctive trend emerges when the attention line designations are recorded in terms of COSATI subject fields (Table 26A, Appendix A). Understandably, categories embracing more than one discipline, such as Technology (26), General (27), contain the greatest percentages of recipients with the library attention designation. The greatest number of information center designations are for the fields of Space technology; Materials; Navigation, communications, detection, and countermeasures; Electronics and electrical engineering; Missile technology; and Nuclear science and technology. Within the fields of Mechanical, civil, industrial and marine engineering; Electronics and electrical engineering; Materials, Biological and medical sciences; Aeronautics, are found, in the order stated, the greatest numbers of recipients obtaining directly individually addressed copies of NSA, STAR, TAB, or USGRDR.

STAR Domestic Subscribers

Data for STAR domestic subscribers were not released by NASA. For this reason, the partial data that were made available by the U. S. Government Printing Office had to be treated separately. The overall total of 125 domestic subscribers, representing the entire U. S. STAR subscriber population, was subtracted from the total of 8,074 non-Federal U. S. recipients and is presented in Table 27A, Appendix A.

A comparison of data from Table 27A, Appendix A with analogous compilations for the other services (Tables 12 and 15, Appendix A) reveals that the geographic and institutional distribution patterns for STAR subscribers conform closely to the pattern established for the other services. New York, California, New Jersey, Massachusetts, Pennsylvania, Ohio, in the order stated, rank (as they did for all other services) as major recipients for the relatively small number of STAR subscribers. The exclusion of less than one percent of the

Non-Federal U. S. Recipient population and 5.7 percent of the STAR recipient population is believed to be statistically insignificant.

Federal Recipients

U. S. Federal Government recipients have been treated in two segments comprising Federal agency recipients other than military, and military recipients. Table 28A, Appendix A provides data on the number of recipients by service, and specific agency. Although STAR is the most widely distributed abstracting and indexing service, more than half of its recipients are within the National Aeronautics and Space Administration. Table 29A, Appendix A provides copy distribution data for NSA, TAB, and USGRDR. It should be noted that about 100 copies of NSA, and a somewhat smaller number of TAB and USGRDR are distributed internally to the respective staffs of the Atomic Energy Commission, Department of Defense, and Department of Commerce. This informal distribution is not reflected in the statistics represented in Table 29A.

Compiled in Tables 30A-31A, Appendix A is the military recipient distribution in terms of service received, number of copies distributed, subdivided by state. As might have been expected, TAB is by far the most heavily distributed abstracting and indexing service. It is received by 70.36 percent of the military population, followed by STAR, received by 15.28 percent, NSA by 8.19 percent and USGRDR by 6.16 percent. The concentration of recipients in the District of Columbia, Ohio (site for Wright Air Development Center), Virginia, and Maryland is indicative of military R & D activity within these states. The sizable recipient figures for California and New York should be discounted to some degree since they reflect distribution destined for U.S. overseas military installations.

GPO Depository Library Recipients

As a group, GPO depository libraries represent both Federal and non-Federal organizations which have a number of common characteristics. Invariably, such libraries are housed within educational and nonprofit institutions. By statute the resources of these libraries are made accessible to the general public. The libraries have the right to select and acquire without cost from the Superintendent of Documents items designated for depositories which may be

of interest to their respective clienteles. While the three abstracting and indexing services of NSA, STAR, and USGRDR are listed as depository items and available for distribution, 28 percent of the 854 GPO depositories chose to select none of the abstracting and indexing services (see Table 32A, Appendix A). One possible reason for non-selection may be due to the fact that a number of state and municipal law libraries, and small college and public libraries have been designated as GPO depositories. Frequently there is little demand for science and technology-oriented abstracting and indexing services within their particular institutional environments.

Of the 616 GPO depositories that did elect to receive one or more of the services, 81.5 percent selected NSA, 74.5 percent USGRDR, and 64.6 percent selected STAR. A breakdown of specific services received, arranged by state, is provided in Table 33A, Appendix A.

Foreign Recipients

Out of the entire universe of 15,656 recipients for all four abstracting and indexing services, the foreign population comprises 3,401 addresses, or 21.7 percent. The percentage of foreign recipients would have been 27.9 percent were it calculated on the basis on those services which are not subject to export restrictions. Department of Defense regulations place TAB under special export controls. While transmittal of TAB to certain foreign nations has been made under existing information exchange agreements, the number of recipients under such agreements has been quite small.

In considering foreign as well as domestic distribution of abstracting and indexing services, one must not lose sight of the fact that well-organized national or regional documentation center networks, even when receiving a single copy of any one service, through reproduction and allied selective dissemination systems, can attain wide diffusion of information.

Unlike the foreign distribution pattern for Referativnyĭ Zhurnal, the major recipients of NSA, STAR, and USGRDR are the research-oriented, heavily industrialized nations. The United Kingdom has 17.5 percent of the foreign recipient population, Japan 10.3

percent, France 9.7 percent, Germany (East and West) 9.4 percent and Canada 7.0 percent (see Table 34A, Appendix A). A clear inference that can be drawn from these data is that the foreign country distribution pattern for NSA, STAR and USGRDR bears a positive relationship to the per capita and gross national product devoted by the respective countries to research and development.

When the distribution pattern is examined in terms of the individual services, we find that 46.73 percent of the foreign recipient group receives NSA, 27.40 percent STAR, and 26.23 percent USGRDR. The popularity of NSA is also evident when one notes the distribution pattern based on paid subscriptions. About half or 51.71 percent of all foreign subscribers obtain NSA, 8.77 percent obtain STAR, and 39.52 percent acquire USGRDR. The U. S. Atomic Energy Commission established a total of 78 depository libraries in foreign countries. These libraries have been placed on standard distribution to receive most of the technical report literature abstracted and indexed in NSA. The knowledge that the technical report literature is accessible may have been a contributing factor to the relatively high demand for Nuclear Science Abstracts.

Summary

The Federal government recognized the need for abstracting, indexing and disseminating the technical report literature stemming from publicly-financed research. An average of 250 million dollars has been allocated annually by Federal government agencies for scientific and technical information needs. Of this total, approximately 30 percent was earmarked for publication and distribution tasks. On the basis of data collected in the course of this study, an effort was made to determine the extent of distribution and pattern of diffusion for the federally-produced abstracting and indexing services of NSA, STAR, TAB, and USGRDR. Information derived from nine official mailing lists and subscriber and exchange mailing lists for each of the services was coded and permuted with the aid of data processing equipment. While of immediate concern was the analysis of data relating to the non-Federal U. S. recipient sector, all recipient information, including that for Federal recipients, GPO Depository Library

recipients as well as foreign recipients was quantified and tabulated. Some of the more significant findings are the following:

Total Recipients

Total recipients for all four services comprised 15,656 addresses of which eighty percent represented domestic recipients and twenty percent foreign recipients.

Domestic Recipients

Of 12,225 domestic recipients, twenty-three percent were in the Federal government (including the Military), 12 percent were GPO Depository Library recipients, and 66 percent were non-Federal U. S. recipients.

Non-Federal U. S. Recipients

Analysis of 7,949 non-Federal U. S. recipient file addresses revealed that the addresses represented recipients affiliated with 3,004 discrete organizations or institutions occupying a total of 4,179 sites or geographic locations.

Two-thirds of all non-Federal U. S. recipients were affiliated with industrial organizations, and thirty percent with educational and nonprofit institutions.

Seventy-two percent of all non-Federal U. S. recipient establishments were from the industrial sector, and twenty-three percent from the educational and nonprofit sector.

Each of the services of NSA, STAR, TAB, and USGRDR was received to a varying degree, by recipients in each of the twenty-seven COSATI subject fields, thus indicating an overall recipient population covering the entire spectrum of science and technology.

Without implying a cause and effect relationship, a definite correlation was found to exist between subject field areas in the forefront of R & D investment and top ranking COSATI subject field recipients.

Within the industrial sector, the COSATI subject field, Electronics and electrical engineering contained the largest number of recipients (18.8 percent).

Within the educational and nonprofit sector, the COSATI subject field Biological and medical sciences contained the largest

number of recipients (15.2 percent).

Without implying a cause and effect relationship, a definite correlation was found to exist between industry segments in the forefront of R & D investment and economic expansion and top ranking Standard Industrial Classification (S.I.C.) recipient categories.

Classed in accordance with S.I.C. categories, the 2,154 industrial recipient establishments had the largest recipient group of twenty-seven percent, representing for the most part industrial organization whose primary activity was research and development rather than manufacturing.

Top ranking for manufacturing establishments, in the order stated, are establishments classed in the S.I.C. categories of Electrical equipment and communication, Chemical and allied products, Machinery, Professional and scientific instruments, and Aircraft and missiles.

Without implying a cause and effect relationship, a definite correlation has been found to exist between regional and state distribution of such economy input variables as total R & D funds, industrial R & D funds, scientists and engineers employed, number of manufacturing establishments, doctorates employed, and the regional or state distribution of recipients of the abstracting and indexing services.

Five U.S. states accounted for nearly half of all non-Federal U. S. recipients; seventeen states each contained less than one-half of one percent of the recipient population; thirteen additional states each contained less than one percent of the recipient population.

Regions and states having a high industrial recipient population also had a high educational recipient population.

The Middle Atlantic, Pacific and East North Central regions, in the order stated, are the top-ranking recipient regions for the abstracting and indexing services.

Geographic distribution of recipients for the specific services of NSA, STAR, TAB, and USGRDR generally conformed to the pattern established for all four services.

An average of 2.15 copies of one or more abstracting and

indexing services was sent to each recipient address.

Geographic distribution of copies generally conformed to the pattern established for geographic distribution of recipients.

The bulk of multi[illegible] recipients was confined to those services available grati[illegible] recipients having an official connection with Federal government a[illegible]es.

Ninety-seven percent of USGRDR recipients subscribed to a single copy only of that service. The inference can thus be made that unless formal provision is made for wider internal dissemination, receipt of a single copy of any one abstracting and indexing service would preclude its extensive use as a current awareness medium.

Of 4,179 sites or geographic locations receiving the abstracting and indexing services, forty-eight percent received STAR, forty-five percent received USGRDR, thirty-seven percent receive[illegible], and twenty-four percent received NSA.

The most widely disseminated combination of services was for TAB and STAR, received by twenty-one percent of the recipient sites.

A total of 239 sites, or six percent of the 4,179 sites, received all four services; 437 sites, or ten percent, received the combination of NSA, STAR, and USGRDR or TAB.

Close to half of the abstracting and indexing services were specifically addressed to the attention of the library or information center.

GPO Depository Library Recipients

Twenty-eight percent of 854 GPO Depositories received none of the abstracting and indexing services.

Of 616 recipient GPO Depository Libraries, eighty-one percent received NSA, seventy-five percent USGRDR, and sixty-five percent received STAR.

Federal Recipients (Military)

Of the total 1,852 Federal military abstracting and indexing service recipients, seventy percent received TAB, fifty percent received STAR, eight percent received NSA, and six percent received

USGRDR.

Foreign Recipients

Without implying a cause and effect relationship, a definite correlation has been found to exist between R & D investment and degree of industrialization in foreign countries and the concentration of recipients of the abstracting and indexing services within these countries.

In sharp contrast to the dissemination pattern for Referativnyĭ Zhurnal whose foreign recipients were to be found overwhelmingly in Communist countries, i. e., without regard to degree of national industrialization, foreign recipients of the federally-produced abstracting and indexing services were sent to the research-oriented, industrialized nations.

---

1. U. S. Federal Council for Science and Technology. Committee on Scientific Information. Status Report on Scientific and Technical Information in the Federal Government. (AD 411 939). Washington, D.C., June 18, 1963, p. 5.

2. U. S. Office of the Director of Defense Research and Engineering. Defense Science Board Subcommittee. Final Report on Scientific and Technical Information. (AD 416 655). Washington, D. C., July 16, 1963, p. 5.

3. U. S. President's Science Advisory Committee. Science, Government and Information. Report. Washington, D. C., U. S. Govt. Print. Off., 1963, p. 1.

4. For the purposes of this study, a recipient is defined as an addressee that may be an individual, departmental unit, institution or industrial organization on the mailing list to receive one or more copies of any one of the abstracting and indexing services of NSA, STAR, TAB, or USGRDR.

5. Complete data were not released by NASA and the Government Printing Office for STAR official recipients and subscribers. All U. S. STAR subscribers totaling 125 in number have been excluded from these calculations and were treated separately in pp. 98-99.

6. See the organizational recipient breakdown, p. 83.

7. COSATI subject categories, including scope notes for their fields and group extensions, will be found in COSATI Subject Category List (DOD-Extended) (AD 624 000). Alexandria, Va., Defense Documentation Center, Dec. 1965. To facilitate coding of institutions having a very broad scientific or technical orientation, or having no specific subject area interest, the fields Science (25), Technology (26), and General (27) have been added by the author to the COSATI

ities.

8. Source: U. S. Bureau of the Census. Statistical Abstract of the United States: 1966. 87th ed. Washington, D. C., U. S. Govt. Print. Off., 1966, pp. 774-75.

9. Source: U. S. National Science Foundation. Basic Research, Applied Research, and Development in Industry, 1964. (NSF 66-28). Washington, D.C., U. S. Govt. Print. Off., 1966, p. 35.

10. Source: U. S. Congress. Senate. Committee on Labor and Public Welfare. Subcommittee on Employment and Manpower. Impact of Federal Research and Development Policies on Scientific and Technical Manpower. Hearings. 89th Cong., 1st Sess., June 2, 3, 4, 7, 8, 9, 10, and July 22, 1965. Washington, D. C., U. S. Govt. Print. Off., 1965, p. 608.

11. Source: U. S. Congress. House. Select Committee on Government Research. Statistical Review of Research and Development. Report, 88th Cong., 2nd Sess. (Study No. IX; House Report No. 1940). Washington, D.C., U. S. Govt. Print. Off., 1964, p. 201.

12. Approximately 9,000 copies of STAR have been printed in 1965-66 for both foreign and domestic use. (Source: Sauter, Hubert E. Private Communication, July 26, 1965). Of this total, only about 130 copies were sold by the Government Printing Office to U. S. subscribers. The number of non-Federal U. S. official STAR recipients was 2,718 (See Table 6). Excluding the Federal, GPO Depository Library and foreign recipient distribution, it is estimated that an average of about two copies of STAR are sent on NASA official distribution to NASA recipients.

Chapter 5

Recipient Population Characteristics and Use Made of NSA, STAR, TAB, and USGRDR

While quantitative data for recipients of the abstracting and indexing services of NSA, STAR, TAB, and USGRDR were readily available from the analyses of the recipient file addresses, qualitative data relating to recipient creativity or educational background, company or institutional research environment, degree and type of use made of the abstracting and indexing services, were totally lacking. No data at all were available on research-oriented firms and institutions that were nonrecipients of any of the services. The questionnaire method, supplemented by selective interviews and detailed analyses of a number of industrial and institutional directories, provided information to assess, in some depth, recipient and nonrecipient characteristics as well as the actual use made of the abstracting and indexing services. A "Recipient Questionnaire" (Appendix C) and a "Nonrecipient Questionnaire" (Appendix D) were designed and pretested on more than 50 scientists, engineers, and librarians. After incorporating comments and suggestions, including those from members of the Columbia University faculty and an industry survey consultant, the questionnaires were mailed to selected samples of recipients and nonrecipients of the four abstracting and indexing services under study.

The Recipient Questionnaire was sent to a stratified random sample of 1,153. The sample represents 15 percent of the entire population in the Non-Federal U. S. Recipient File. The Recipient Questionnaire was also mailed to a 15 percent random sample (91 recipients) selected from the 616 GPO Depository Library File. The Nonrecipient Questionnaire, a shorter and revised version of the Recipient Questionnaire, was sent to a random sample of supposed research-oriented nonrecipients of any of the services. Analysis of the nonrecipient population, including results of the Nonrecipient Questionnaire, is provided in Chapter 6.

Recipient Population Sampling Technique

Since major characteristics of the recipient population had been coded and were available on tape, a sample was sought which would take into account such factors as institutional or organizational types, concentration of recipients within certain geographic regions, and each of the abstracting and indexing services under study.

A permutation of the major recipient types (Industrial Organizations; Educational and Nonprofit Institutions; Private and Unaffiliated Recipients; State and Local Government Agencies), geographic locations (50 U. S. states and the District of Columbia), and the four abstracting and indexing services yields a theoretical possibility of 816 combinations, assuming that each combination or permutation is represented in the recipient file. As determined after a computer run of the 7,949 non-Federal U. S. recipients, a total of 449 combinations was actually present.

The 449 combinations or permutations were grouped by the computer, and the accession numbers of the recipient members counted and stored in its memory. From each permutation of recipients, a 15 percent sample was sought. In some instances the number of recipients selected from a given permutation resulted in a number containing a fraction. When that was the case, the change of the fraction to an integer was determined through the use of the following procedure: a random number between 0 and 1 was supplied by a computer subroutine. The random number was compared to the fractional part of the selected number. If the random number was larger than the fractional part of the number, the nearest smaller integer was used. If it was smaller, the nearest larger integer was used.

The selection of recipients from a given permutation was performed as follows: a random number between 0 and 1 was multiplied by the total number of recipients grouped within a permutation. The nearest permutation group member whose number was greater than the random number was selected as part of the sample. The selected member or recipient was then removed from the permuted group of recipients, and another random number was used to select the next recipient. If needed, this process was repeated until the predetermined

number of recipients, approaching 15 percent of the permuted population, had been selected.

A printout of the selected recipient accession numbers was obtained in numerical sequence. A set of punched cards containing all data previously coded for these recipients was also obtained. Since the questionnaires were assigned the accession numbers of the selected recipients, these cards served as a control file for completed questionnaires and were eventually used for a comparative analysis of the portion of the questionnaire sample returned, and the entire Non-Federal U. S. Recipient File population from which the sample was drawn.

Recipient Questionnaire Mailings

In August 1966, the Recipient Questionnaire and cover letter (Appendix C) was mailed to each of the 1,153 individuals, institutions, and industrial firms comprising the sample derived from the Non-Federal U. S. Recipient File. Mailed also were the 91 Recipient Questionnaires representing a 15 percent random sample selected from the GPO Depository Library File. A single follow-up letter (Appendix C, no. 3) was sent to nonrespondents one month from the date of the initial mailing of the questionnaire.

While addressed exactly as indicated on the mailing label found in the Non-Federal U. S. Recipient File, instructions for the Recipient Questionnaire called for completion by the "primary user" of only those services circled in red on the first page of the questionnaire. When addressed to and used by a library or information center, the librarian or information specialist "most knowledgable about the use made of the services," was requested to complete the questionnaire.

Recipient Questionnaire Responses

Since the Recipient Questionnaire was rather formidable--12 pages and 50 questions--a minimal response was anticipated. The response, however, was adequate to assure valid results. For the 1,139 questionnaires mailed (14 questionnaires were undeliverable), a total of 823 or 72.3 percent responses were received. Many included extensive comments. Of the total non-Federal U. S. respondents,

Recipient Population

776 or 68.1 percent returned usable questionnaires. For the GPO Depository Library recipient mailing, 67 responses were received (73.6 percent) including 60 usable questionnaire returns comprising 65.9 percent of the questionnaire sample mailing.

Representativeness of Recipient Questionnaire Returns

How representative were the returns in relation to the population bases from which the questionnaire samples were drawn? Table 13 provides a breakdown for the 776 non-Federal U.S. respondents by abstracting and indexing service as well as recipient type. A comparison of data in Table 13 with analogous data for the entire Non-Federal U. S. Recipient File (Table 6) discloses that the four abstracting and indexing services as well as the four types of institutions receiving them are fully represented in the returns. Whereas industrial recipients represent 66.5 percent, educational and nonprofit recipients 30.4 percent, private or unaffiliated recipients 2.3 percent, and state and local government agencies 0.7 percent of all non-Federal U. S. recipients, for the 776 Recipient Questionnaire returns industrial recipients represent 65.9 percent of responses, educational and nonprofit recipients 32.0 percent, private or unaffiliated recipients 1.8 percent, and state and local government recipients 0.4 percent. In terms of specific services, the Non-Federal U. S. Recipient File comprises 15.9 percent of NSA recipients, 34.2 percent of STAR recipients, 23.5 percent of TAB recipients, and 26.4 percent of USGRDR recipients. The questionnaire responses represent replies for 16.5 percent NSA, 36.9 percent STAR, 25.3 percent TAB, and 21.4 percent USGRDR recipients.

Table 36A, Appendix A provides a geographic breakdown by 50 U. S. states and the District of Columbia for the 776 non-Federal U. S. respondents. When data in Table 36A, Appendix A, are compared with similar data in Table 12A, Appendix A, indicating the geographic distribution pattern for all non-Federal U. S. recipients, the representativeness of the questionnaire returns with respect to the 51 geographic distribution variables is also amply demonstrated.

GPO Depository Libraries are a relatively homogeneous group and have been established historically on the basis of geographic

Table 13

Recipient Questionnaire Respondents,
by Service and Type of Institution

Type of Institution	Service Received: NSA	STAR	TAB	USGRDR	Total	Percent
Industrial	53.1 68	59.4 170	70.4 138	81.3 135	511	65.9
Educational	44.5 57	38.5 110	28.1 55	15.7 26	248	32.0
Private	1.6 2	2.1 6	1.0 2	2.4 4	14	1.8
St-Loc Govt	0.8 1		0.5 1	0.6 1	3	0.4
Total (a)	128	286	196	166	776	
Percent	16.5	36.9	25.3	21.4		100.0

(a) Percent based on column sum.

representation rather than specific need. As may be surmised from Table 32A, Appendix A, many of these libraries receive all three of the distributable services of NSA, STAR, and USGRDR. A return of 65.9 percent of the random sample, accounting for 9.7 percent of the entire GPO Depository Library population, can therefore be considered sufficient to represent this segment of recipients.

Recipient Questionnaire Analysis

Individual Recipient Characteristics

Of all non-Federal U. S. respondents returning completed questionnaires, nearly half were completed by librarians or analogous information services personnel. A total of 36.9 percent of the librarian respondents were from industrial establishments, while 13.0 percent were from educational and nonprofit institutions. Not unexpectedly, the questionnaires returned by GPO Depository Libraries were nearly all completed by librarians (Table 14).

Table 14

Recipient Questionnaire Respondents, by Broad Institutional Groupings

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Library Respondents	Percent
Librarians (Industry)	286	36.9	-	-
Individuals (Industry)	240	30.9	-	-
Librarians (Educational/Nonprofit Institutions)	101	13.0	56	93.3
Individuals (Educational/Nonprofit Institutions)	149	19.2	4	6.6
Totals	776	100	60	99.9

Primary Activities of Respondents

What were the primary activities of the majority of industrial and institutional respondents whose official titles did not indicate library or information service affiliation? About one-fifth of all non-Federal U. S. respondents indicated Management and Administration as their primary activity. A total of 8.9 percent was engaged in

teaching at the college or university level. Excepting librarianship, the largest group (21.5 percent) was engaged primarily in research and development activity (Table 15). Of course, it must be realized that the checking of a primary activity[1] other than research and development does not necessarily imply that the respondent was not participating to a more limited extent in research and development work. When all respondents were asked to reply whether they were personally engaged in carrying out current research and development, a total of 48.3 percent answered positively to this question (Table 16). When the percentages of respondents carrying out research and development activity was calculated on the basis of non-librarian responses, a total of 69.2 percent of individuals in industry and 85.2 percent of individuals in educational and nonprofit institutions indicated that they personally carried out research and development work. Thus, an average of 77.0 percent of non- librarian respondents was engaged to some extent in research and development. Many librarians, particularly those employed in special libraries, while answering in the negative, commented that although not "personally" engaged in research, a great deal of their time was devoted in direct support of R & D projects. Of the close to 360 respondents who did engage in research and development, over half spent 50 or more percent of their total staff time in this activity (Table 17).

To what extent was research and development carried out for Federal government agencies? A comparison of data in Table 18 and those presented in Table 16 reveals that while 360 respondents stated that they performed research and development, a total of 263 or about 73 percent of that total also stated that they performed R & D for Federal government agencies. It thus seems obvious that of those who engaged in R & D work, approximately three quarters were to some extent performing R & D for Federal government agencies. The Department of Defense, the National Aeronautics and Space Administration, and the Atomic Energy Commission, in the order given, were the most frequently cited Federal government contracting agencies (Table 18). A majority of 88.6 percent of GPO Depository Library respondents, compared to 46.7 percent of non-Federal U. S. respondents,

Table 15

Recipient Questionnaire Respondents, by Primary Activity

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Lib. Respondents	Percent
Research and Development	167	21.5	1	1.8
Teaching - College or University	69	8.9	1	1.8
Graduate or Undergraduate Study	4	0.5	1	1.8
Library or Information Service	363	46.8	53	94.6
Technical Sales and Service	8	1.0	-	-
Production and Operation	4	0.5	-	-
Management and Administration	151	19.5	-	-
1. Company or institution official (President, Vice President, General Manager, Assistant General Manager)	48	6.2	-	-
2. Operations Manager (Works Manager) Superintendent, Assistant Works Manager, Assistant Superintendent)	5	0.6	-	-
3. Research Director (Chief Engineer, Chief Chemist, Chief Metallurgist, Chief Physicist)	47	6.1	-	-
4. Project Scientist or Engineer	18	2.3	-	-
5. Foreman, Supervisor, Department Head	17	2.2	-	-
6. Other Management	16	2.1	-	-
Other	10	1.3	-	-
Total	778	100	56	100

Table 16

Recipient Questionnaire Respondents, R & D Performance

	Non. Fed. U. S. Respondents	Percent	GPO Dep. Lib. Respondents	Percent
Yes	360	48.3	6	11.5
No	386	51.7	46	88.5
Total	746	100	52	100

Table 17

Recipient Questionnaire Respondents, Percent of Time Devoted to R & D Performance

Staff Time	Non. Fed. U. S. Respondents	Percent	GPO Dep. Lib. Respondents	Percent
1%-19%	49	13.6	-	-
20%-49%	111	31.0	2	50.00
50%-74%	99	27.6	1	0.25
Over 75%	100	27.9	1	0.25
Total	359	100	4	100

Table 18

Recipient Questionnaire Respondents, R & D Performance for Federal Agencies

Federal Agency	Non-Fed. U. S. Responses	Percent[a]	GPO Dep. Lib. Responses	Percent[a]
AEC	48	9.7	1	2.9
DOD	185	37.5	2	5.7
NASA	95	19.3	-	-
Other	42	8.5	1	2.9
None	230	46.7	31	88.6
Total	493[a]		35[a]	

(a) Percent and totals based on number of respondents.

did not engage in R & D work for Federal agencies. This, of course, is a reflection of the relatively smaller percentage of educational and nonprofit personnel engaged in R & D, as compared to industrial personnel.

Subject Specialization of Respondents

Recipient Population

Librarianship as a subject specialty rather than prime activity was common to 30.2 percent of non-Federal U. S. respondents and to 80 percent of GPO Depository Library respondents. Apparently many individuals in the non-Federal U. S. recipient sector, while concerned primarily with the operation of libraries, have had other than library school training. Additional high ranking subject field specialties, in the order stated, were Electronics and electrical engineering (10.8 percent of respondents), Chemistry and chemical engineering (10.5 percent), Mechanical, industrial, civil and marine engineering (8.6 percent), Materials and metallurgy (7.2 percent), Aeronautics (6.3 percent), and Physics (5.3 percent). Behavioral and social sciences (including Humanities) constituted the major specialty for only 1.8 percent of non-Federal U. S. respondents and 9.1 percent for GPO Depository Library respondents (Table 19). Excluding librarianship, the subject specialties of the Recipient Questionnaire respondents, though not factorized into the sampling procedure, paralleled closely the subject fields determined to represent the entire non-Federal U. S. recipient population of the abstracting and indexing services (See Table 7).

Scope of Respondent Information Needs

In practicing their particular specialties, did the respondents have a need within the last twelve months to undertake a line of research that was definitely outside their field of specialization? Of the 605 non-Federal U. S. respondents to this question, a total of 42.1 percent indicated that they did have such a need (Table 20). An even greater percentage (61.0 percent) indicated a need within the last twelve months for "data, techniques, processes, equipment," from outside the field of their specialization (Table 21). The broad spectrum of information needs may have contributed in part to the reluctance of respondents to maintain a personal file of citations pertinent to their subject specialty. Less than half of the non-Federal U. S. respondents maintained such a file (Table 22).

Educational Background

As a group, the respondents were highly educated. Nearly all had undergraduate or higher degrees, while approximately one fourth

Table 19

Recipient Questionnaire Respondents, By Subject Specialization

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Aeronautics	46	6.3	-	-
Agriculture	3	0.4	1	1.8
Astronomy and Astrophysics	5	0.7		-
Atmospheric Sciences	3	0.4	[illegible]	[illegible]
Behavioral and Social Sciences (Including Humanities)	13	1.8	5	[illegible]
Biological and Medical Sciences	27	[illegible]	-	-
Chemistry and Chemical Engineering	77	10.5	-	-
Earth Sciences and Oceanography	9	1.2	-	-
Electronics and Electrical Engineering	79	10.8	1	1.8
Energy Conversion (non-propulsive)	7	1.0	-	-
Engineering (Mechanical, Industrial, Civil, and Marine)	63	8.6	-	-
Library or Information Sciences	221	30.2	44	80.0
Materials and Metallurgy	53	7.2	-	-
Mathematical Sciences	9	1.2	-	-
Methods and Equipment	3	0.4	-	-
Military Sciences	2	0.3	-	-
Missile Technology	2	0.3	-	-
Navigation, Countermeasures, Defection, Communication	12	1.6	-	-
Nuclear Science and Technology	16	2.9	-	-
Ordnance	6	0.8	-	-
Physics	39	5.3	2	3.6
Propulsion and Fuels	7	1.0	-	-
Space Technology	14	1.9	-	-
Other	16	2.2	1	1.8
Total	732	100	55	99.9

Recipient Population

Table 20

Recipient Questionnaire Respondents, R & D Performance Outside Respondent's Field of Specialization

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Yes	255	42.1	13	54.2
No	350	57.9	11	45.8
Total	605	100	24	100

Table 21

Recipient Questionnaire Respondents, Need for Information Outside Respondent's Field of Specialization

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Yes	364	61.0	13	62.0
No	233	39.0	8	38.1
Total	597	100	21	100.1

Table 22

Recipient Questionnaire Respondents, Maintenance of Personal Citation File

	Non-Fed. U. S. Respondents	Percent
Yes	228	41.4
No	323	58.6
Total	551	100

held doctoral degrees (Table 23). The greatest number of respondents (39.6 percent) received degrees during the period of 1950-1959 and a total of 24.2 percent graduated in 1960 or later (Table 24). Thus it can be concluded that a preponderance of respondents falls within the 30-40 year age group.

Individual Publishing and Innovation Record

To what extent were the recipients and supposed prime users

Table 23

Recipient Questionnaire Respondents, by Highest Degree Earned

Highest Degree	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
B. A. /B. S.	244	35.0	5	10.8
M. A. /M. S.	257	36.8	35	76.1
Ph. D/D. Sc.	181	26.0	6	13.1
Other	16	2.2	-	-
Total	698	100	46	100

Table 24

Recipient Questionnaire Respondents, by Year in which Highest Degree was Earned

Year	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Before 1930	23	3.7	1	2.7
1930-1939	70	11.2	5	13.6
1940-1949	133	21.3	6	16.2
1950-1959	247	39.6	10	27.0
1960 and later	151	24.2	15	40.5
Total	624	100	37	100

of the abstracting and indexing services contributors to the professional literature? A total of 40.1 percent of non-Federal U. S. respondents, compared to 3.8 percent of GPO Depository Library respondents, had been authors, coauthors, or editors of technical reports within a specified twelve month period (Table 25). More than a fourth of the non-Federal U. S. respondents (26.2 percent) and 7.8 percent of GPO Depository Library respondents had been authors, coauthors, or editors of professional papers published in the journal literature within that same period (Table 26). A total of 10.6 percent of all non-Federal U. S. respondents compared to zero percent for GPO Depository Library respondents had submitted patent applications within the last twelve months (Table 27).

While writing or editing technical reports and papers and submission of patent applications may not necessarily be wholly reliable

indicators of individual or corporate creativity or innovation, their overall statistical evaluation can, in conjunction with other factors, be helpful in characterizing a respondent group or organization.

Fifty percent of the non-Federal U. S. respondent group were librarians whose tasks generally do not entail direct research or publication of research results. The percentage of respondents writing and editing technical reports and professional papers, and the percentages of those with patent applications would probably have been considerably higher if they were calculated solely on the basis of non-librarian responses. The data from the GPO Depository Library respondents support this conclusion. Cross-tabulation of the variable "writing and editing technical reports" revealed that of 459 negative responses, 72 percent were from librarians.

Table 25

Recipient Questionnaire Respondents, Technical Report Authorship, Coauthorship, or Editorship within 12 Month Period

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Yes	307	40.1	2	3.8
No	459	59.9	51	96.2
Total	766	100	53	100

Table 26

Recipient Questionnaire Respondents, Professional Paper Authorship, Coauthorship, or Editorship Within 12 Month Period

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Yes	201	26.2	4	7.8
No	566	73.8	47	92.2
Total	767	100	51	100

Recipient Organization Environment

Most of the respondents were employed in companies and institutions with staffs of many hundreds of scientists and engineers.

More than a third of the organizations with which the respondents were associated employed 500 or more scientists and engineers exclusive of managerial and supporting personnel. Two thirds of all companies and institutions employed 100 or more scientists and engineers. It is evident that the larger companies were predominant in the Recipient Questionnaire responses (Table 28). On the other hand, data derived from the Nonrecipient Questionnaire (See Table 66) indicated that the smaller companies were predominant. At what point in the industrial growth cycle did the large companies begin to acquire the abstracting and indexing services? Is there a clear cause and effect correlation between size of company and receipt of these services? One can only speculate as to the probable answers. The only conclusion that can be safely drawn is that a relationship exists between the size of the scientific and technical staff of an organization and the receipt or nonreceipt of the abstracting and indexing services within that organization.

Table 27

Recipient Questionnaire Respondents, Patent Application Submission Within 12 Month Period

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Yes	81	10.6	-	-
No	684	89.4	53	100
Total	765	100	53	100

Table 28

Recipient Organizations, by Number of Scientists and Engineers Employed

No. of Scientists and Engineers	Non-Fed. U. S. Recipients	Percent	GPO Dep. Libr. Recipients	Percent
1-9	59	12.0	5	20.8
10-19	21	4.3	2	8.3
20-49	56	11.3	6	25.0
50-99	37	7.5	4	16.7
100-199	52	10.5	1	4.2
200-299	39	7.9	1	4.2
300-499	50	10.1	1	4.2
Over 500	180	36.4	4	16.7
Total	494	100	24	100.1

Recipient Population

Recipient Organization R & D Performance

While only about half of all non-Federal U. S. respondents and 77.0 percent non-librarian respondents indicated that they were personally engaged in research and development activity (Table 18), a total of 87.7 percent stated that their companies and institutions conducted in-house or internally sponsored research (Table 29). About half of the employers were conducting research and development for other private organizations and institutions (Table 30).

Table 29

Recipient Organizations, Internally-Sponsored R&D

	Non-Fed. U. S. Recipients	Percent	GPO Dep. Libr. Recipients	Percent
Yes	668	87.7	26	53.1
No	94	12.3	23	46.9
Total	762	100	49	100

Table 30

Recipient Organizations, R & D Performance for Private Companies and Institutions

	Non-Fed. U. S. Recipients	Percent	GPO Dep. Libr. Recipients	Percent
Yes	374	50.4	20	40.8
No	368	49.6	29	59.2
Total	742	100	49	100

With regard to R & D work for the Federal government, a vast majority of respondents (82.0 percent) stated that their employers held current R & D contracts with Federal government agencies. The contracting agencies mentioned, in rank order were: the Department of Defense, cited by 71.7 percent of all non-Federal U. S. respondents, the National Aeronautics and Space Administration, cited by 53.6 percent and the Atomic Energy Commission, cited by 31.1 percent of respondents (Table 31).

Recipient Organization Publishing and Innovation Record

Federal agency contractors constituted the vast majority of

Table 31

Recipient Organizations, R & D Performance for Federal Government Agencies

	Non-Fed. U. S. Responses	Percent[a]	GPO Dep. Libr. Responses	Percent[a]
Atomic Energy Commission	222	31.1	9	17.0
Department of Defense	511	71.7	12	22.6
National Aeronautics and Space Administration	382	53.6	11	20.8
Other Federal Agency	197	27.6	9	17.0
None	128	18.0	29	54.7
Total	713[a]		53[a]	

[a] Percent and totals based on number of respondents.

recipient organizations. They were also contributors to the technical report literature. When asked the more restrictive question as to whether company or institution scientists and engineers, other than the respondent, published professional papers in the journal literature within the most recent twelve month period, 89.2 percent of respondents answered affirmatively (Table 32). 81 percent of the respondents stated that other scientists and engineers employed with the host organizations had submitted patent applications within the last twelve months (Table 33).

Table 32

Recipient Organizations, Professional Paper Publishing

	Non-Fed. U. S. Recipients	Percent	GPO Dep. Libr. Recipients	Percent
Yes	630	89.2	31	72.1
No	76	10.8	12	27.9
Total	706	100	43	100

Table 33

Recipient Organizations, Submission of Patent Applications

	Non-Fed. U. S. Recipients	Percent	GPO Dep. Libr. Recipients	Percent
Yes	462	80.6	3	13.0
No	111	19.4	20	87.0
Total	573	100	23	100

Use of Abstracting and Indexing Services

When asked whether the respondent had, within the last six months, made any use of these abstracting and indexing services, 91 percent of non-Federal U. S. respondents answered affirmatively. Of the small group of 69 non-Federal U. S. recipient nonusers of the services within the preceeding six month period, 33 were individuals from industry, 14 were librarians in industrial establishments, 17 were individuals in educational and nonprofit institutions, and 5 were librarians in educational and nonprofit institutions. Of the 55 GPO

Depository Library respondents, only about half personally used the services (Table 34). Some negative responses mostly from GPO Depository and university librarians were qualified with statements indicating that although not personally used by the librarian, the services were used by the public, but to an unknown degree. A typical qualifying statement is the following made by a university librarian:

> We receive the publications listed. They are added to our general catalogued collection and are available to any student or faculty member as any other item on our library shelves. We have no means of obtaining user information.

Table 34

Recipient Questionnaire Respondents, Use of Abstracting and Indexing Services Within Last Six Months

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Yes	697	91.0	30	54.5
No	69	9.0	25	45.5
Total	766	100	55	100

Of 625 non-Federal U. S. respondents who had personally devoted a certain amount of time to the scanning of issues of the abstracting and indexing services as soon as they were received, 31 percent spent 5-14 minutes, while 14.0 percent spent less than five minutes in scanning the issues (Table 35). Thus, for any one of the semi-monthly, federally produced abstracting and indexing services, approximately three quarters of the non-Federal U. S. recipients devoted less than one half hour each to scanning the newly received service. Apparently, the current awareness function which has proven to be the primary function of the abstracting and indexing services, can be fulfilled by the services without excessive demands on the recipient's time.

Factors such as growing output and the dispersal of relevant abstracts among several disciplines have been cited in the past as reasons for not scanning such services as Chemical Abstracts.[2] The provision of detailed indexes, including subject, personal author,

Table 35

Recipient Questionnaire Respondents, Amount of Time Devoted to Scanning a Single Issue of Service

	Service									
	NSA		STAR		TAB		USGRDR			
	Non-Fed. U. S. Respondents	Percent	Non-Fed. U. S. Respondents	Percent	Non-Fed. U. S. Respondents	Percent	Non-Fed. U. S. Respondents	Percent	Total	Percent
Less than 5 minutes	20	20.8	32	13.8	21	12.0	14	11.4	87	14.0
5-14 minutes	31	32.3	73	31.6	55	31.4	37	30.1	196	31.4
15-29 minutes	29	30.2	73	31.6	42	24.0	38	30.9	182	29.1
30-49 minutes	8	8.3	33	14.3	29	16.6	20	16.3	90	14.4
50-59 minutes	3	3.1	7	3.0	9	5.1	8	6.5	27	4.3
60-120 minutes	5	5.2	8	3.5	14	8.0	5	4.1	32	5.1
More than 2 hours	-	-	5	2.2	5	2.9	1	0.8	11	1.8
Total	96	99.9	231	100	175	100	123	100.1	625	100.1

Percent based on column sum.

corporate author, and report number indexes which have been made available with each issue of NSA, STAR, TAB and, more recently, for USGRDR, and the grouping of abstracts within a number of clearly defined subject fields, have substantially overcome the objections to scanning.

With what frequency have the specific abstracting and indexing services of NSA, STAR, TAB, and USGRDR been used for retrospective information searches? How does this frequency of use compare with the use made of other privately published abstracting and indexing services? Bearing in mind that responses were elicited from known recipients of the federally-produced abstracting and indexing services, those receiving the greatest daily use for retrospective searching were, in the order stated, Technical Abstract Bulletin, Scientific and Technical Aerospace Reports, Chemical Abstracts, Engineering Index, Nuclear Science Abstracts, and U. S. Government Research & Development Reports (Table 36).

Rather sharp differences in the daily use made of USGRDR as compared to the other services are apparent and can in all probability be explained by the unavailability of USGRDR cumulative indexes. The announcement by the Clearinghouse for Federal Scientific and Technical Information that beginning July 1966, the Government-Wide Index to Federal Research & Development Reports (GWI) would be published on a semi-monthly basis and should thus better serve as an index to USGRDR may alleviate, but certainly will not solve the indexing problem for that service. A university librarian comments:

> My principal objection to USGRDR-GWI now is the lack of cumulated indexes. I believe the only cumulation done since 1963 is the one covering January-March 1965. I now hear that no full-size copy cumulated indexes for USGRDR or GWI are to be published in the future. . . If this information is correct, the value of this abstracting service must decrease over the years because searches will prove too time-consuming for most reference purposes. (For those of us who have access to TAB, we can use it for locating information about DOD reports. Its cumulated indexes have been coming out quite promptly. However, TAB is restricted. We are

Table 36

Recipient Questionnaire Respondents, Frequency of Use of NSA, STAR, TAB, and USGRDR

	Frequency of Use									
	Daily[a]		Weekly[a]		Monthly[a]		Occasionally[a]			
	Non-Fed. U. S. Respondents	Per-cent[a]	Non-Fed. U. S. Respondents	Per-cent[a]	Non-Fed. U. S. Respondents	Per-cent[a]	Non-Fed U. S. Respondents	Per cent[a]	Total	[illegible]
Nuclear Science Abstracts	45	16.2	89	32.1	78	28.2	65	23.5	277	[illegible]
Scientific & Technical Aerospace Reports	81	18.7	155	35.7	132	30.4	66	15.2	434	[illegible]
Technical Abstract Bulletin	91	22.8	140	35.1	124	31.1	44	11.0	399	[illegible]
U. S. Government Research & Development Reports	27	7.4	115	31.3	122	33.2	103	28.1	367	[illegible]
Applied Mechanics Reviews	12	6.2	34	17.6	62	32.1	85	44.0	193	[illegible]
Biological Abstracts	16	12.9	22	17.7	29	23.4	57	46.0	124	[illegible]
Chemical Abstracts	72	25.3	80	28.1	61	21.4	72	25.3	285	[illegible]
Electrical Engineering Abstracts	19	11.0	53	30.7	45	26.0	56	32.4	173	

Engineering Index	66	23.4	84	29.8	45	16.0	87	30.9	282	[illegible]
Index Medicus	20	20.6	8	8.2	15	15.5	54	55.7	97	[illegible]
Physics Abstracts	25	11.0	65	28.6	68	30.0	69	30.4	227	[illegible]
Other Services	27	24.3	48	43.2	29	26.1	7	6.3	111	[illegible]
Total									2,969[c]	[illegible]

[a] Percent based on row sum.

[b] Percent based on column sum.

[c] Total represents multiple service receipts for 470 respondents.

[illegible] to restrict it [illegible] we limit the use to the library staff and to certain members of the academic staff working on DOD contracts. We cannot allow most library users to see it. I suppose most libraries of a public nature have the same problem!

Reasons for Using Abstracting and Indexing Services

What are some of the most frequent reasons given by non-Federal U. S. respondents for using the abstracting and indexing services? In rank order these are: scanning for specific information directly pertinent to current work (27.9 percent of respondents), keeping abreast of current literature in primary field of interest (24.3 percent), quick retrospective reference or information retrieval (17.3 percent) (Table 37).

When asked to rank reasons for use in descending order of importance, the current awareness function rather than retrospective retrieval was predominant for almost all place rankings. The highest percentage of respondents (57.1 percent) ranked first the use made in acquiring "specific information directly pertinent to... current project or research" (Table 38), (42.2 percent) selected "keeping abreast of current literature in primary field of interest," while (45.3 percent) chose "keeping abreast of current literature in secondary fields of interest."

Table 39 represents responses for the most recent use made of the abstracting and indexing services by non-Federal and GPO Depository Library recipients. The use by almost half of the non-Federal U. S. respondents (46.0 percent) for the purpose of "keeping abreast of newly published literature" lends further support for the "current awareness" function as being the primary function of the abstracting and indexing services.

Types of Information Sought

What types of information or data were most frequently sought by recipients of the abstracting and indexing services? When using these services, was the information generally looked for within the specific section covering the respondents own, subject field, or was it also sought in other sections covering related fields?

Table 37

Recipient Questionnaire Respondents, Frequency of Reasons Given for Using NSA, STAR, TAB, and USGRDR

	Frequency of Use							
	Frequently		Occasionally		Rarely or Never			
	Non-Fed. U. S. Respondents	Percent	Non-Fed. U. S. Respondents	Percent	Non-Fed. U. S. Respondents	Percent	Total	Percent
To scan for specific information directly pertinent to current project or research	396	27.9	109	12.3	16	4.6	521	19.[illegible]
To keep abreast of current literature in primary field of interest	344	24.3	104	11.7	29	8.3	477	18.[illegible]
To keep abreast of current literature in secondary field(s) of interest	172	12.2	157	17.7	49	14.0	378	14.[illegible]
For quick retrospective reference or information retrieval	245	17.3	162	18.3	54	15.5	461	17.4
For exhaustive literature searches	140	9.9	177	20.0	94	26.9	411	15.[illegible]
For "browsing" in fields related or unrelated to specialty	78	5.5	165	18.6	103	29.5	346	13.[illegible]
Other	40	2.8	13	1.5	4	1.1	57	2.[illegible]
Total	1,415	99.9	887	100.1	349	99.9	2,651	100.[illegible]

Table 38

Recipient Questionnaire Respondents, Ranking of Reasons for Using NSA, STAR, TAB and USGRDR

	Non-Fed. U. S. Respondent Rankings													
	1		2		3		4		5		6		7	
	No. of Rankings	Percent	No. of Rankings	Percent	No. of Rankings	Percent	No. of Rankings	Percent	No. of Rankings	Percent	No. of Rankings	Percent	No. of Rankings	Percent
To scan for specific information directly pertinent to current project or research	228	57.1	151	32.5	6	1.7	115	26.5	51	13.5	11	3.7	41	75.9
To keep abreast of current literature in primary field of interest	147	29.1	196	42.2	39	10.9	102	23.3	73	19.3	23	7.7	8	14.8
To keep abreast of current literature in secondary field(s) of interest	45	8.9	67	14.4	162	45.3	78	17.8	76	20.1	40	13.4	-	-
For quick retrospective reference or information retrieval	16	3.2	41	8.8	84	23.5	71	16.2	58	15.3	62	20.8	1	1.9
For exhaustive literature searches	7	1.4	5	1.1	56	15.6	56	12.8	67	17.7	68	22.8	1	1.9
For "browsing" in fields related or unrelated to specialty	2	0.4	4	0.9	11	3.1	15	3.4	53	14.0	94	31.5	3	5.6
Totals	505	100.1	464	99.9	358	100.1	438	100.0	378	99.9	298	99.9	54	100.1

Percent based on column sum.

Table 39

Recipient Questionnaire Respondents, by Most Recent Use of Abstracting and Indexing Service

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Keeping abreast of newly published literature	283	46.0	5	16.7
Information needed for the preparation of a report	45	7.3	3	10.0
Information needed for the preparation of a lecture	2	0.3	2	6.7
Information needed for the preparation of a proposal	41	6.7	2	6.7
Information needed for project experiment	70	11.4	1	3.3
Retrospective Literature research	97	15.8	9	30.0
General "browsing"	29	4.7	1	3.3
Other	48	7.8	7	23.3
Totals	615	100	30	100

Recipient Population

Close to half of the non Federal U. S. respondents did not confine their search for information to their own primary field. The proportion holds constant for almost all types of information listed, with the exception of Reviews, State-of-the-Art Surveys which were sought more extensively in more than one field (Table 40). It is, of course, expected that a greater percentage of respondents would be searching outside their own field for this type of information.

Table 41 discloses that abstracting and indexing services were utilized most frequently by non-Federal U. S. respondents in locating specific data or findings. The category, "Reviews, State-of-the-Art Surveys," ranked second.

User's Approach to Abstracting and Indexing Services

Some users refer only to the Table of Contents when using some of the abstracting and indexing services, others make direct use of the indexes or examine specific sections, while others still may browse through the issue or use a combination of approaches.

Tables 42 and 43 depict the various approaches that are employed by the user when seeking information in abstracting and indexing services. Of 656 non-Federal U. S. respondents, 57.5 percent make direct use of the indexes. As might have been expected, 85.7 percent of GPO Depository Library respondents made direct use of the indexes (Table 42). Since more than one approach could be utilized, the respondent was asked to check all approaches listed.

The unique or combination of approaches is disclosed in Table 43. Unique use of indexes has been found to represent 20.1 percent of respondent approaches, while the unique use of the Table of Contents for checking both the primary and secondary fields of interest, represents 16.0 percent of respondent approaches. The most frequently used combination (10.[illegible] percent of respondents) was use of indexes and the use of the Table of Contents, with the latter used for checking the primary and secondary fields of interest.

Index Usefulness and Frequency of Use

While data from Table 42 and Table 43 disclose the relative percentage of users making direct use of indexes when using abstracting and indexing services, there is no indication of the value attached

Table 40

Recipient Questionnaire Respondents, Types of Information or Data Sought, by Field Scanned

	Field Scanned							
	Own Field	Per cent[a]	Related Field	Per cent[a]	Both Fields	Per cent[a]	Total	Per cent[b]
Specific data or findings	180	51.6	30	8.6	139	39.8	349	29.1
Information relating to laboratory methods, techniques, procedures, apparatus, etc.	142	53.2	23	8.6	102	38.2	267	22.2
Theoretical or conceptual statements or ideas	132	49.6	24	9.0	110	41.4	266	22.2
Reviews, state-of-the-art surveys	119	39.3	36	11.4	148	48.8	303	25.2
Other	7	46.7	2	13.3	6	40.0	15	1.3
Total							1,200	100

[a] Percent based on row sum.

[b] Percent based on column sum.

Table 41

Recipient Questionnaire Respondents, Types of Information or Data Sought, by Frequency of Need

	Frequency of Need							
	Frequently		Occasionally		Rarely or Never			
	Non-Fed. U.S. Respondents	Per-cent[a]	Non-Fed. U.S. Respondents	Per-cent[a]	Non-Fed. U.S. Respondents	Per-cent[a]	Total	Per-cent[b]
Specific data or findings	398	72.6	133	24.2	17	3.1	548	[illegible]
Information relating to laboratory methods, techniques, procedures, apparatus, etc.	199	49.1	162	40.1	44	10.8	405	[illegible]
Theoretical or conceptual statements or ideas	204	51.3	154	38.7	40	10.0	398	[illegible]
Reviews, state-of-the-art surveys	275	48.7	261	46.2	29	5.1	565	[illegible]
Other	37	86.0	5	11.7	1	2.3	43	2.2
Total							1,959	100

[a] Percent based on row sum.

[b] Percent based on column sum.

Table 42

Recipient Questionnaire Respondents, Approach to Abstracting and Indexing Services

Approach No.	Non-Fed U. S. Responses	Per-cent[a]	GPO Dep. Libr. Responses	Per-cent[a]
1. Checks Table of Contents and scans exclusively section relating to primary field of interest	208	31.7	5	17.[illegible]
2. Checks Table of Contents and scans sections relating to primary and secondary field(s) of interest	316	48.2	7	25.[illegible]
3. Scans exclusively secondary field(s) of interest	8	1.2	-	-
4. Scans or "browses" through whole issue	168	25.6	5	17.[illegible]
5. Uses indexes to look up specific items of interest	377	57.5	24	85.[illegible]
6. Other	11	1.7	2	7.[illegible]
Total	656[a]		28[a]	

[a] Percent and totals based on number of respondents.

Table 43

Recipient Questionnaire Respondents, Combinatory Approaches to Using Abstracting and Indexing Services

Approach No. (See Table 42)	Non-Fed. U. S. Respondents	Percent
5	132	20.1
2	105	16.0
2 and 5	71	10.8
1	58	8.8
1 and 5	38	5.8
4 and 5	38	5.8
1, 2 and 5	36	5.5
4	34	5.2
1 and 2	31	4.7
2, 4 and 5	31	4.7
2 and 4	23	3.5
1, 2, 4, and 5	15	2.3
1, 4, and 5	15	2.3
1 and 4	8	1.2
Other	21	3.2
Total	656	99.9

by the user to the various types of indexes. Table 44 represents an evaluation of usefulness of the personal author, corporate, subject, report number, and contract number indexes. Table 44 indicates that though all of the indexes have been found to be useful to some extent by at least 50 percent of respondents, the subject index far outranks all other indexes. Second ranking in the "very useful" category has been accorded to the report number index, while the least useful index was the contract number index. The latter is rarely used by 48.0 percent of the 592 respondents.

Table 45 provides a tabulation of the use or non-use made of indexes to NSA, STAR, TAB, and USGRDR. It indicates that high utility and value are attributed to the subject index. Not only is the subject index used by most respondents as a direct approach to the contents of the services, but also it ranks above all other indexes in frequency of use for "Daily," "Weekly," as well as "Monthly" use.

Subject Scope Preferences for Abstracting and Indexing Services

In recent years there has been considerable discussion and

Table 44

Recipient Questionnaire Respondents, Usefulness of Abstracting and Indexing Service Indexes

	Very useful		Rather useful		Occasionally useful		Of little or no use			
	Non-Fed. U. S. Respondents	Per-cent[a]	Non-Fed. U. S. Respondents	Per-cent[a]	Non-Fed. U. S. Respondents	Per-cent[a]	Non-Fed. U. S. Respondents	Per-cent[a]	Totals	Per-cent[b]
Personal Author Index	217	34.2	118	18.6	192	30.3	107	16.9	634	20.2
Corporate Author Index	201	32.2	106	17.0	156	25.0	162	25.9	625	19.9
Subject Index	543	81.7	86	12.9	29	4.3	7	1.1	665	21.2
Report Number Index	229	37.1	85	13.8	126	20.4	178	28.8	618	19.7
Contract Number Index	121	20.4	53	9.0	134	22.6	284	48.0	592	18.9
Total									3,134	99.9

[a] Percent based on row sum.

[b] Percent based on column sum.

Table 45

Recipient Questionnaire Respondents, Frequency of Use of Indexes to Abstracting and Indexing Services

	Frequency of Use											
	Daily		Weekly		Monthly		Rarely		Never			
	Non-Fed. U. S. Respondents	Per-cent[a]	Non-Fed. U. S. Respondents	Per-cent[a]	Non-Fed. U. S. Respondents	Per-cent[a]	Non-Fed. U. S. Respondents	Per-cent[a]	Non-Fed. U. S. Respondents	Per-cent[a]	Total	Per-cent[b]
Personal Author Index	68	11.4	116	19.5	139	23.4	180	30.3	91	15.3	594	20.2
Corporate Author Index	59	10.3	114	19.9	164	19.2	164	28.6	127	22.1	574	19.6
Subject Index	93	14.5	259	40.5	232	36.3	46	7.2	10	1.6	640	21.8
Report Number Index	65	11.3	129	22.5	89	15.5	141	24.6	149	26.0	573	19.5
Contract Number Index	31	5.6	75	13.6	65	11.8	147	26.6	235	42.5	553	18.9
Total											2,934	100

[a] Percent based on row sum.

[b] Percent based on column sum.

speculation regarding the desirability of segmenting comprehensive abstracting and indexing services into narrow specialties. Such segmentation or fractionalization has, of course, been applied to Referativnyĭ Zhurnal although the complete volumes are still available to those who wish to subscribe to them. A similar trend has also been apparent in Chemical Abstracts and a number of other abstracting and indexing journals.

When the users of the broadly based mission rather than subject-oriented servic of NSA, STAR, TAB, and USGRDR were asked whether, in lieu of present scope, they preferred several other suggested approaches, 63.9 percent preferred the present format (Table 46). Only 4.0 percent preferred to receive abstracts exclusively within their own primary field. A total of 23.1 percent preferred abstracts covering the broad primary field encompassing the respondent's subject specialty.

Comprehensiveness is considered to be an advantage to the librarian conducting a literature search. When abstracting and indexing service preference responses were tabulated on the basis of non-librarian replies, though undergoing some changes, the percentages for the respective responses remained fairly constant. Forty-seven percent of non-library respondents preferred the present format without any change, 6.3 percent were interested in abstracts devoted exclusively to their own subject specialty, and 32.8 percent desired broad primary and secondary subject field coverage.

Recipient Organization Library and Information Services

The vast majority of recipient companies and institutions (96.4 percent) maintained libraries or information centers (Table 47) which were readily accessible to the respondents (Table 48). Asked whether the library or information center was staffed by a professional librarian or information specialist, 70.3 percent answered affirmatively (Table 49). In a number of instances, the responses were qualified with explanatory notes to the effect that the individual responsible for the library, although a professionally trained person, was not necessarily trained as a librarian.

Table 46

Recipient Questionnaire Respondents, Preferences for Subject Scope Coverage for Abstracting and Indexing Services

	Non-Fed. U. S. Responses	Percent[a]	GPO Dep. Libr. Responses	Percent[a]
Exclusively within own primary field	25	4.0	-	-
Within broad primary field encompassing subject specialty	144	23.1	1	4.2
Covering exclusively secondary fields [i.e. excluding subject specialty]	4	0.6	-	-
Covering selected developments, ideas, techniques, etc. from all other fields applicable to subject specialty	81	13.0	1	4.2
Prefer present format as is	398	63.9	20	83.3
Other	6	1.0	2	8.3
Total	623[a]		24[a]	

[a]Percent and totals based on number of respondents.

Table 47

Recipient Questionnaire Respondents, Availability of Libraries or Information Centers

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Yes	733	96.4	57	100
No	20	2.6	-	-
Other	7	0.9	-	-
Total	760	100	57	100

Table 48

Recipient Questionnaire Respondents, Accessibility of Libraries or Information Centers

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Yes	706	96.3	60	100
No	17	2.3	-	-
Other	10	1.4	-	-
Total	733	100	60	100

Table 49

Recipient Questionnaire Respondents, Professional Staffing of Libraries or Information Centers

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Yes	553	70.3	53	98.1
No	216	28.5	1	1.9
Other	9	1.2	-	-
Total	758	100	54	100

A large majority of respondents (82.3 percent) found it "rather easy" to acquire publications cited in the abstracting and indexing services (Table 50). However, a considerable number of comments were made regarding difficulties inherent in obtaining technical reports having a "limited" distribution designation. Problems relating to the maintenance of an active field-of-interest register with the respective agency documentation centers have also been singled out as deterrents to the acquisition of needed reports.

Recipient Population

Table 50

Recipient Questionnaire Respondents, Degree of Difficulty in Acquiring Original or Photocopy of Items Cited in Abstracting and Indexing Services

	Non-Fed. U. S. Respondents	Percent	GPO Dep. Libr. Respondents	Percent
Very Difficult	11	1.8	2	8.0
Rather Difficult	97	15.9	8	32.0
Rather Easy	505	82.3	15	60.0
Total	613	100	25	100

More than half of the non-Federal U. S. respondents retained copies of the respective abstracting and indexing services for a period of three or more years (Table 51). This is an indirect measure of the value attached to these services. The proportion of library recipients retaining copies of the services would, of course, be considerably greater.

As recipients of at least one of the services, the respondents were asked whether they would be interested in obtaining information about any of the other services which they did not currently receive. A total of 259 non-Federal U. S. respondents, or 33.4 percent, and 27 GPO Depository Library respondents, or 45.1 percent, indicated such an interest (Table 52).

Library Facilities, Policies and Procedures

Recipient population library and information center personnel were asked to complete a portion of the questionnaire relating to internal library procedures, practices, and resources which could have an effect on the use made of the abstracting and indexing services and on use of the technical report literature in general.

What direct functions did the library carry out to enhance the value of the abstracting and indexing services? Did the availability of these services relieve the library of the task of cataloging technical reports? What secondary measures were undertaken by the library or information center staffs to bring to the attention of their clienteles items announced in the services?

Table 51

Recipient Questionnaire Respondents, Disposition of Abstracting and Indexing Services

	Service									
	NSA		STAR		TAB		USGRDR			
	Non-Fed. U. S. Respondents	Percent	Non-Fed. U. S. Respondents	Percent	Non-Fed. U. S. Respondents	Percent	Non-Fed. U. S. Respondents	Percent	Total	Percent
File and keep last 5 years or longer	72	66.1	118	47.0	77	43.5	69	53.1	336	50.4
File and keep 3-4 years	3	2.8	20	8.0	20	11.3	7	5.4	50	7.5
File and keep 1-2 years	6	5.5	28	11.2	24	13.6	17	13.1	75	11.2
Keep current issues only	3	2.8	6	2.4	2	1.1	1	0.8	12	1.8
Discard immediately after scanning	-	-	3	1.2	4	2.3	2	1.5	9	1.3
Clip or note issue and discard	-	-	5	2.0	2	1.1	3	2.3	10	1.5
Route issue directly to library	13	11.9	26	10.4	18	10.2	9	6.9	66	9.9
Route to other individuals on routing slip	9	8.3	40	16.0	26	14.7	21	16.2	96	14.4
Other	3	2.8	5	2.0	4	2.3	1	0.8	13	1.9
Total	109	100	251	100.2	177	100.1	130	100	667	99.9

Percent based on column sum.

Table 52

Recipient Questionnaire Respondents, Interest in Obtaining Information About Abstracting and Indexing Services

Service	Non-Fed. U. S. Responses	Per-cent[a]	GPO Dep. Libr. Responses	Per-cent[a]
NSA	69	26.6	10	37.0
STAR	82	31.7	7	25.9
TAB	119	45.9	9	33.3
USGRDR	155	59.8	1	3.7
Total	259[a]		27[a]	

[a] Percent and totals based on number of respondents.

From data disclosed in Table 53, it becomes evident that 80.2 percent of non-Federal U. S. recipient libraries and information centers, compared to 53.1 percent of GPO Depository Libraries, do catalog technical reports; 73.7 percent of non-Federal libraries, compared to 40.6 percent GPO Depository Libraries issue an acquisition or announcement bulletin; close to two-thirds of non-Federal U. S. respondent libraries and information centers compared to one-eighth of GPO Depository Libraries selectively disseminate newly acquired technical reports. The lower percentage figures for the GPO Depository Libraries are indicative of the lower level of specialized service for the technical report literature prevalent within libraries housed in educational and nonprofit institutions. When the non-Federal U. S. recipient population is broken down into its industrial and educational sectors, cataloging of technical reports is performed by 80.2 percent of industrial libraries compared to 19.8 percent of libraries in the educational sector, selective dissemination of incoming technical reports is carried out by 85.2 percent of the industrial sector compared to 14.8 percent of the educational sector, abstracts are selectively disseminated by 88.5 percent of the industrial sector and 11.5 percent of the educational sector, the issuance of an acquisitions or announcement bulletin is undertaken by 83.5 percent of libraries in the industrial sector compared to 16.5 percent of libraries in the educational sector.

Table 53

Recipient Organization Libraries and Information Centers, by Function Performed

	No. of Responses Non-Fed. U. S. Recipients	Percent[a]	No. of Responses GPO Dep. Libr. Recipients	Percent[a]
Catalog technical reports	308	80.2	17	53.1
Selectively disseminate incoming technical reports	253	65.9	4	12.5
Prepare abstracts of newly acquired technical reports	38	9.9	-	-
Selectively disseminate abstracts	85	22.1	2	6.3
Issue acquisition or announcement bulletin	283	73.7	13	40.6
Other technical report service	11	2.9	4	12.5
Total	384[a]		32[a]	

[a] Percent and totals based on number of respondents.

Recipient Population

Why do 50.2 percent of non-Federal U. S. libraries and information centers find it necessary to catalog technical reports? A large segment of respondents (42.5 percent) indicated a need for more detailed subject analysis than that provided in the services (Table 54). Informal comments were made indicating that a number of respondents thought the card catalog should provide a primary approach to the library's collections and that, consequently, it was essential for the card catalog to reflect the library's holdings. Many libraries cataloged technical reports, but did so selectively in order to bring out subject matter of particular interest to the recipient organization. Maintenance of standardized filing procedures, a capability to ascertain quickly holdings within series, a record of documents to be retained for the permanent collections, use of cataloging data for internal announcement bulletins or computer based systems, are some of the additional reasons given for cataloging technical reports.

Internal Announcement and Distribution

From data in Table 53, it is evident that 73.7 percent of non-Federal U. S. recipient libraries and 40.6 percent of GPO Depository Library recipients issue an internally-produced library acquisitions or announcement bulletin. The bulletin is generally distributed on a monthly basis by approximately half of the reporting libraries (Table 55). What are the library and information center policies relating to routing and dissemination of the abstracting and indexing services of NSA, STAR, TAB, and USGRDR? Data in Table 56 indicate that approximately a third (34.0 percent) of non-Federal U. S. recipient libraries and three quarters (74.1 percent) of GPO Depository Library recipients do not permit routing or circulation of the abstracting and indexing service issues. When the issues were sent to individual departments or sections for retention, an average of 6 individuals made use or had access to the service; when sent via routing, an average of 5.7 names were entered on the routing slip (Table 56).

Table 57 discloses the average number of subject headings, descriptors, uniterms, etc., utilized by libraries in the subject analysis of technical reports. Of 258 out of 384 library respondents, or 67.2 percent library respondents performing subject analysis of

Table 54

Recipient Organization Libraries and Information Centers, Reasons for Internal Cataloging of Technical Reports

	No. of Responses Non-Fed. U. S. Recipients	Percent[a]	No. of Responses GPO Dep. Libr. Recipients	Percent[a]
More detailed subject approach needed than that provided in abstracting and indexing services	117	42.5	1	7.1
Subject approach adequate, but indexes are issued too late	33	12.0	3	21.4
The only reports cataloged are those not listed in services	46	16.7	2	14.2
Descriptive cataloging inadequate	21	7.6	3	21.4
Other	87	31.6	6	42.8
Total	275[a]		14[a]	

[a] Percent and totals based on number of respondents.

Recipient Population

Table 55
Recipient Organization Libraries and Information Centers, Frequency of Acquisitions or Announcement Bulletin

	Non-Fed. U. S. Recipient Libraries	Percent	GPO Dep. Recipient Libraries	Percent
Daily	7	2.3	-	-
Weekly	60	19.7	3	15.8
Biweekly	57	18.7	1	5.3
Monthly	131	43.1	11	57.9
Bimonthly	16	5.3	-	-
Semi-Annual	1	0.3	-	-
Quarterly	7	2.3	2	10.5
Irregular	25	8.2	2	10.5
Total	304	99.9	19	100

technical reports, the greatest number (39.1 percent) assigned 3-4 subject headings, descriptors, etc., per report. However, close to 40 percent of all non-Federal U. S. library respondents assigned five or more terms per report (2.3 percent assigned over 15 terms) reflecting the specialized subject approaches provided for the technical reports literature within the non-Federal U. S. recipient population, as compared to the maximum of four terms assigned by the GPO Depository Library recipient population.

When the non-Federal U. S. recipient libraries were analyzed in terms of the industrial and educational sectors, only eight educational or nonprofit libraries, compared to 92 industrial libraries assigned more than five subject terms per report.

In descriptive cataloging of the technical report literature, the greater amount of processing performed by the non-Federal U. S. recipient libraries found within the industrial sector, as compared to GPO Depository Libraries, is reflected in the statistics in Table 53. Entries were prepared most frequently for report numbers (80.3 percent) followed by corporate authors (70.8 percent), personal authors

Table 56

Recipient Organization Libraries and Information Centers, Routing or Circulation Policy for NSA, STAR, TAB, and USGRDR

	Non-Federal U. S. Recipients				GPO Dep. Libr. Recipients			
	Routing/Circulation				Routing/Circulation			
Service	Permitted	Percent	Not Permitted	Percent	Permitted	Percent	Not Permitted	Percent
NSA	33	50.0	33	50.0	10	31.2	22	68.8
STAR	81	69.2	36	30.8	5	22.7	17	77.3
TAB	70	74.5	24	25.5	-	-	-	-
USGRDR	51	64.6	28	35.4	6	22.2	21	77.8
Total	235	66.0	121	34.0	21	25.9	60	74.1

Percent based on row sum.

Recipient Population

Table 57

Recipient Organization Libraries and Information Centers, Number of Descriptors/Uniterms/Subject Headings Used in Subject Analysis of Technical Reports

No. of Descr./ Subjects	No. of Responses Non-Fed. U. S. Recipients	Per-cent[a]	No. of Responses GPO Dep. Libr Recipients	Per-cent[a]
1-2	57	22.1	3	42.9
3-4	101	39.1	4	57.1
5-6	51	19.8	-	-
7-9	26	10.1	-	-
10-15	17	6.6	-	-
Over 15	6	2.3	-	-
Total	258[a]		7[a]	

[a] Percent and totals based on number of respondents.

(67.0 percent) and contract numbers (23.5 percent). Report number entries also predominated in the GPO Depository Library responses.

Technical Report Holdings

For a considerable portion of library recipients of the abstracting and indexing services under study, the technical report literature constituted a significant part of the respective library scientific and technical resources. Of 273 reporting non-Federal U. S. recipient libraries, a total of 107 libraries, or 40.0 percent held more than 15,000 technical report titles in either full size or microfiche copy. Forty-two libraries, or 15.2 percent, held over 100,000 titles (Table 59).

An analysis of the Federal agency document collections held by non-Federal U. S. recipient libraries revealed that DOD reports constituted less than one-half of the collection in less than fifty percent of the libraries; 56 percent reported that their collections were less than 20 percent NASA reports. Approximately half the reporting libraries had less than 20 percent of the collections as AEC technical reports. Thus, Department of Defense reports, NASA and AEC reports, constituted, in the order stated, the most significant technical

Table 58

Recipient Organization Libraries and Information Centers, Kinds of Entries Prepared in Descriptive Cataloging of Reports

	No. of Responses Non-Fed. U. S. Recipients	Per-cent[a]	No. of Responses GPO Dep. Libr. Recipients	Per-cent[a]
Personal authors	211	67.0	13	65.0
Corporate authors	223	70.8	9	45.0
Issuing agency	166	52.5	4	20.0
Monitoring agency	86	27.2	-	-
AD, PB, TID, accession no.	179	55.6	6	30.0
Report number	253	80.3	14	70.0
Contract number	74	23.5	-	-
Project number	15	4.8	-	-
Other	-	-	1	5.0
Total	316[a]		20[a]	

[a] Percent and totals based on number of respondents.

Recipient Population

Table 59

Recipient Organization Libraries and Information Centers, Holdings of Technical Report Titles

No. of Tech. Rept. Titles	Non-Fed. U. S. Recipients	Percent	GPO Dep. Libr. Recipients	Percent
1-999	32	11.7	4	30.8
1,000-2,999	32	11.7	1	7.7
3,000-6,999	62	22.7	3	23.1
7,000-14,999	40	14.7	1	7.7
15,000-29,999	28	10.3	-	-
30,000-49,999	19	7.0	2	15.4
50,000-79,999	14	5.1	-	-
80,000-99,999	4	1.5	1	7.7
Over 100,000	42	15.4	1	7.7
Total	273	100.1	13	100.1

report holdings retained by the responding libraries (Table 60).

Library and Information Center Staffing

What was the level of professional staffing for the libraries and information centers receiving the abstracting and indexing services? Close to half of the 335 non-Federal U. S. responding libraries employed one or less professional full-time employee; approximately three quarters employed four or less professional employees (Table 61). Yet, from data compiled in Table 62, it is evident that close to two-thirds of the non-Federal U. S. recipient libraries had an actual or potential clientele ranging from 100 to over 10,000 scientists and engineers each, exclusive of professional administrative staff as well as sub-professional and technical supporting personnel. When criticism is leveled at insufficient utilization of abstracting and indexing services within recipient organizations or institutions, or when intensified information services are not generally available to their scientific and technical personnel, one needs to bear in mind the fact that close to half of the non-Federal U. S. recipient libraries employ one or less professional librarian whose responsibility

Table 60
Recipient Organization Libraries and Information Centers, by Percent of Federal Agency Technical Report Holdings

Percent of Tech. Reports	AEC				DOD				NASA			
	Non-Fed. U. S. Recipients	Percent	GPO Dep. Libr. Recipients	Percent	Non-Fed. U. S. Recipients	Percent	GPO Dep. Libr. Recipients	Percent	Non-Fed. U. S. Recipients	Percent	GPO Dep. Libr. Recipients	Percent
0-10	15	13.2	-	-	3	1.4	2	33.3	12	5.5	-	-
10-19	41	36.0	2	16.7	26	12.5	3	50.0	50	22.8	2	15.4
20-29	10	8.8	1	8.3	20	9.6	-	-	61	27.9	3	23.1
30-39	6	5.3	1	8.3	29	13.9	-	-	31	14.2	2	15.4
40-49	4	3.5	1	8.3	16	7.7	-	-	23	10.5	-	-
50-59	9	7.9	2	16.7	27	13.0	1	16.7	17	7.8	3	23.1
60-69	6	5.3	-	-	22	10.6	-	-	5	2.3	-	-
70-79	7	6.1	1	8.3	31	14.9	-	-	9	4.1	1	7.7
80-89	7	6.1	1	8.3	17	8.2	-	-	4	1.8	-	-
90-99	9	7.9	3	25.0	17	8.2	-	-	7	3.2	2	15.4
Total	114	100.1	12	99.9	208	100	6	100	219	100.1	13	100.1

Table 61

Recipient Organization Libraries and Information Centers, Full Time Professional Employees

No. of Libr./Inf. Ctr. Prof. Employees	Non-Fed. U. S. Recipients	Percent	GPO Dep. Libr. Recipients	Percent
1 or less	158	47.2	5	13.5
2-4	90	26.9	5	13.5
5-9	44	13.1	9	24.3
10-14	19	5.7	7	18.9
15-19	11	3.3	3	8.1
20-29	4	1.2	3	8.1
30-49	5	1.5	3	8.1
50-74	4	1.2	1	2.7
75-100	-	-	1	2.7
Total	335	100.1	37	99.9

Table 62

Recipient Organization Libraries and Information Centers, Potential Library/Information Center Clientele - Scientists and Engineers

No. of Scientists/Engineers	Non-Fed. U.S. Recipient Libraries	Percent	GPO Dep. Recipient Libraries	Percent
1-19	18	5.4	2	9.5
20-49	30	9.1	3	14.3
50-99	43	13.0	7	33.3
100-199	50	15.1	2	9.5
200-499	83	25.1	5	23.8
500-999	49	14.8	1	4.8
1,000-1,999	37	11.2	-	-
2,000-3,999	8	2.4	-	-
4,000-6,999	6	1.8	1	4.8
7,000-9,999	3	0.9	-	-
Over 10,000	4	1.2	-	-
Total	331	100	21	100

Recipient Population

encompasses the entire range of library or information center operations.

Summary

In order to acquire qualitative data regarding recipient creativity, educational background, employer research environment and use made of the abstracting and indexing services by recipient personnel, the questionnaire method was employed as a data-gathering device. After pretesting, a Recipient Questionnaire was mailed to a stratified random sample of 1,153 non-Federal U.S. recipients, and to a random sample of 91 GPO Depository Library recipients. Sixty-eight percent of the non-Federal U.S. recipients and sixty-six percent of the GPO Depository Library recipients returned usable questionnaires. The Recipient Questionnaire data were coded and frequency distributions were obtained with the aid of data processing equipment. Some of the findings resulting from the analysis of the Recipient Questionnaire are recorded below:

Individual Recipient Characteristics

Occupation

The non-Federal U.S. recipient of any one of the abstracting and indexing services is likely to be a librarian (forty-seven percent), a research scientist or engineer (twenty-two percent), or a manager and administrator (twenty percent).

R & D Activity

Approximately half the recipients personally carried out research and development work. When confined to non-librarian respondents, the percentage of those engaged in research and development tasks was sixty-nine percent for individuals in industrial establishments and eighty-five percent for individuals in educational and non-profit institutions, or an average of seventy-seven percent.

Subject Specialization

Major areas of respondent subject specialization were, in rank order: Library or information sciences (30.2 percent), Electronics and electrical engineering (10.8 percent), Chemistry and chemical engineering (10.5 percent), Mechanical, civil, and marine engineering (8.6 percent), Materials and metallurgy (7.2 percent), Aeronautics

(6.3 percent), and Physics (5.3 percent).

Education

Nearly every respondent held an undergraduate degree; one-fourth held doctorate degrees. The largest segment of respondents (approximately forty percent) earned their degrees during the period 1950-1959, thus placing them in the 30-40 year age group.

Publishing and Innovation Record

More than forty percent of all non-Federal U.S. respondents had written or edited technical reports within a specified twelve month period; more than a fourth had been authors, coauthors, or editors of one or more professional journal articles; eleven percent had submitted patent applications within a specified twelve month reporting period.

Scope of Individual Tasks and Information Needs

Forty-two percent of all non-Federal U.S. respondents had a need to undertake a line of research that was definitely outside the field of their specialization; sixty-one percent had a need for information outside the field of their specialization.

Recipient Organization Environment

R & D Activity

Eighty-two percent of the respondent host organizations carried out research and development work for Federal government agencies; eighty-eight percent conducted internally-sponsored research; about half conducted R & D for other private industrial organizations and institutions.

Recipient Organization Publishing and Innovation Record

Staffs employed in eighty-nine percent of all companies and institutions had published one or more professional papers within a specified twelve month period; eighty-one percent had submitted patent applications.

Size of Recipient Organizations

Compared to the nonrecipient organizations, the majority of recipient organizations and institutions employed huge staffs of professional scientific and technical personnel. Close to half of the non-Federal U.S. recipient host organizations employed more than 300

Recipient Population

scientists and engineers, exclusive of administrative and supporting personnel.

Use of Abstracting and Indexing Services

Ninety-one percent of all non-Federal U. S. respondents had made some use of the abstracting and indexing services within a specified six month period.

The use of the abstracting and indexing services to meet current awareness needs was predominant over all other uses, including the use of the services for retrospective reference and information retrieval.

Types of Information or Data Sought

"Specific data or findings" was the most frequently sought category of information, followed by Reviews, state-of-the-art, as the second highest ranking category; more than half of the desired data were sought outside the respondent's field of specialization.

User's Approach to Abstracting and Indexing Services

More than half of the respondents made use of the indexes to look up specific items of interest; less than half of the respondents made use of the Table of Contents for scanning purposes.

Value of Indexes

Subject indexes ranked well above the personal author, corporate author, report number, and contract number indexes in frequency of daily, weekly or monthly use.

Subject Scope Preferences for Abstracting and Indexing Services

Four percent of all non-Federal U. S. respondents and six percent of non-librarian respondents preferred to receive abstracts exclusively within their particular subject fields; close to two-thirds of all non-Federal U. S. respondents and close to half of non-librarian respondents approved of the present formats of the respective abstracting and indexing services.

Recipient Organization Library and Information Services

Ninety-six percent of all recipient companies and institutions maintained library or information centers. Seventy percent of the libraries or information centers were staffed by professional librarians or information specialists.

With certain qualifications, the vast majority of respondents found it rather easy to acquire publications cited in the abstracting and indexing services.

Library Facilities, Policies and Procedures

Some cataloging of technical reports was performed by eighty percent of non-Federal U. S. recipient libraries and 53 percent of GPO Depository Libraries.

Industrial[1] recipient libraries provided more intensified technical report literature services than educational and nonprofit institution libraries.

Approximately a third of non-Federal U. S. recipient libraries and three quarters of the GPO Depository Libraries did not permit circulation or routing of the abstracting and indexing services of NSA, STAR, TAB, and USGRDR.

Technical Report Holdings

Forty percent of the non-Federal U. S. recipient libraries held more than 15,000 technical report titles; fifteen percent held over 100,000 titles.

Department of Defense reports, NASA reports, and AEC reports, in the order stated, constituted proportionally the major technical report holdings of the recipient libraries.

Library and Information Center Staffing

Close to half of the non-Federal U. S. recipient libraries employed one or less professional librarian; three quarters employed four or fewer professional librarians.

More than half of the recipient libraries had an actual or potential clientele of over 200 scientists and engineers, exclusive of administrative and supporting personnel.

---

1. "Primary Activity" was defined as the activity to which the respondent devoted most time.

2. Columbia University. Bureau of Applied Social Research. The Flow of Information Among Scientists. New York, May 1958, p. 148.

Chapter 6

The Nonrecipient Population

Since a comprehensive file of recipients of NSA, STAR, TAB, and USGRDR has been available, an effort was undertaken to identify research-oriented, non-Federal U. S. industrial establishments, research laboratories, etc., which did not receive any of the services. Once identified, these organizations could offer a basis for a statistical evaluation of the nonrecipient population and provide a universe from which the Nonrecipient Questionnaire sample could be drawn.

Fortunately, basic tools had become available within the last two years to aid in this task. Revised editions of the Industrial Research Laboratories of the United States, and the compilation, Roster of U. S. Government Research and Development Contracts in Aerospace and Defense, had been issued by Bowker Associates. Also published in 1965 was the second edition of the Gale Research Co., Research Centers Directory, containing a listing of more than 3,000 educational and nonprofit research centers. The List of Small Business Concerns Interested in Performing Research and Development, published in 1963 by the U. S. Small Business Administration, was also most useful. Each of these directories was searched against the Non-Federal U. S. Recipient File.

Directory Analysis

The directory, Industrial Research Laboratories of the United States, lists 3,260 industrial firms which the editors believe to represent "more than 95 percent of the dollar volume of the U. S. industrial R & D effort."[1] The entries in this directory are arranged alphabetically under the name of the parent company, with more than 700 cross references provided from divisions, subsidiaries, or affiliates. The directory listing is alphabetized in accordance with the filing principles utilized in organizing the Non-Federal U. S. Recipient File.

A decision was made to consider a company a "nonrecipient"

if none of the services under study were received by the parent body, its subdivisions or affiliates. The receipt of any one service within any one segment of a company, regardless of site location, excluded that firm from the "nonrecipient" population. A search of the 3,260 firms listed in Industrial Research Laboratories of the United States against the 7,949 addresses found in the Non-Federal U. S. Recipient File revealed that 2,236 firms, or 68.6 percent, did not receive any of these abstracting and indexing services.

Since entries in the Industrial Research Laboratories of the United States include Federal government contractor information, a second search identified Federal agency contractors and compared them with the Non-Federal U. S. Recipient File. The search revealed that of 1,383 contractor firms listed, a total of 704, or 50.9 percent, were found to be nonrecipients of the services. Of 1,877 non-contractor firms listed, 1,557 or 83.0 percent were found to be nonrecipients of any of the services.

Another source for Federal contract information was the Roster of U. S. Government Research and Development Contracts in Aerospace and Defense.[2] This publication lists 7,500 contracts awarded to 1,096 firms and institutions during fiscal year 1964 by over 300 procurement centers of the Army, Navy, Air Force, Federal Aviation Agency, Atomic Energy Commission, and the National Aeronautics and Space Administration. Of the 1,076 Federal government contractors located in the United States, a total of 367, or 34.1 percent were found to be nonrecipients.

Of 1,096 entries listed in Roster of U. S. Government Research Contracts in Aerospace and Defense, 623 or 56.8 percent were found to be listed in Industrial Research Laboratories. Much less overlap of firms was found between these directories and the List of Small Business Concerns Interested in Performing Research and Development.[3] An entry-by-entry comparison revealed that of 2,775 industrial firms found in the latter directory, 1,772 or 63.9 percent were not included in Industrial Research Laboratories of the United States. Of course, the U. S. Small Business Administration directory lists many firms whose primary activity involves as much manufacturing

as research. Of the 2,775 industrial firms included in List of Small Business Concerns Interested in Performing Research and Development, 2,397 or 86.4 percent were found to be nonrecipients.

To gain some insight into the pattern of receipt or nonreceipt for educational and nonprofit research-oriented organizations, the Research Centers Directory was searched against the Non-Federal U.S. Recipient File. Listed in this directory are 3,188 organizations, including "research institutes, centers, foundations, laboratories, bureaus, experiment stations and similar nonprofit research facilities, activities formally identified by specific or distinctive names or titles established on a permanent basis as separate entities for carrying on continuing research programs in all fields of endeavor."[4] Of the 3,188 research centers listed, 3,014 were located in the U.S. Of these, 2,950 or 92.1 percent were nonrecipients of any of the services.

Though characterizing themselves as fully independent, many of the research centers were associated with universities. Quite likely the staffs of these centers have some measure of access to the abstracting and indexing services through university libraries or individuals in university departments receiving the services. Ease of access, however, has been proven to be directly related to degree of use made of bibliographic services. It is therefore unlikely that the percentage of nonrecipient and, in essence, under-utilizing research centers, now calculated to be 92.1 percent, would undergo significant change.

Other nonrecipient organizations could have been located by searching regional, state, city, industrial or institutional directories. One must bear in mind that there are approximately 312,000 manufacturing companies in the United States[5] and about 2,200 institutions of higher learning.[6] In a single academic year, a total of 12,822 Doctoral degrees and 91,418 Masters' degrees have been conferred.[7] Approximately 400,000 scientists and engineers are engaged in research and development; about 280,000 of them are working on Government-sponsored research;[8] yet, the entire Non-Federal U.S. Recipient File comprises 7,949 addresses representing a total of only

3,004 different industrial organizations and educational institutions.

Is it ignorance of the availability of the federally-produced abstracting and indexing services that accounts for the relatively large nonrecipient population? Do the information needs of the nonrecipient population differ markedly from those of the recipient population? It is, after all, the industrial firm that must close the gap in the civilian technology lag and infuse into the private sector of our economy the technology and innovations resulting from government-sponsored research.[9]

A 10 percent random sample of 480 industrial nonrecipient firms was selected from Industrial Research Laboratories of the United States, Roster of U. S. Government Research and Development Contracts in Aerospace and Defense, and List of Small Business Concerns Interested in Performing Research and Development. These directories are believed to include entries for practically all U. S. research-oriented industrial organizations. Ostensibly, these organizations have a need for the abstracting and indexing services under study and, consequently, are potential recipients of these services.

Nonrecipient Questionnaire Mailings

In August 1966, the Nonrecipient Questionnaires and cover letters (Appendix D) were mailed to the supposed 480 industrial nonrecipient firms. The questionnaires were addressed to the Director of Research or to an analogous or higher management official. As in the case of the Recipient Questionnaire, a single follow-up letter (appendix C, no. 3) was sent to the nonrespondents one month after the initial mailing of the questionnaires.

Nonrecipient Questionnaire Returns

A total of 250 or 56.1 percent responded to the Nonrecipient Questionnaire, submitting 235 or 52.7 percent completed questionnaires. For a variety of reasons, including mergers, changes of address, dissolutions, etc., 34 Nonrecipient Questionnaires could not be delivered. A considerable number of the nonrecipient respondents commented freely on many aspects of information acquisition, dissemination, and use.

Since the sample was confined to nonrecipients, the question

Nonrecipient Population

of representativeness for each of the abstracting and indexing services does not apply. The 235 questionnaire responses, account for 52.7 percent of the random sample of nonrecipients are deemed statistically adequate to provide insight into the nature of the nonrecipient population.

Nonrecipient Questionnaire Analysis

Individual Nonrecipient Characteristics

While Recipient Questionnaire respondents were divided almost equally between library and non-library personnel, Nonrecipient Questionnaire respondents were overwhelmingly non-librarians (Table 63). The primary activity of the majority of the respondents was in the field of Management and administration (63.0 percent), with a total of 27.2 percent of respondents indicating Research and development as their prime activity (Table 64). Although the instructions for the Nonrecipient Questionnaire called for completion by the individual concerned with the "acquisition and dissemination of scientific and technical information needed by the organization in support of research and development activity," the fact that the questionnaires were addressed to senior management officials may have produced a preponderance of management responses. It should be noted, however, that as defined in the Nonrecipient Questionnaire, "Management and Administration" embraces such scientific and technical job titles as Chief Chemist, Chief Metallurgist, Project Engineer, etc. Often it is difficult to differentiate between the managerial and research activity of these types of positions.

Table 63

Nonrecipient Questionnaire Respondents, by Broad Institutional Groupings

	No. of Respondents	Percent
Librarians (Industry)	3	1.3
Individuals (Industry)	228	97.0
Librarians (Educational/Nonprofit Institutions)	2	0.9
Individuals (Educational/Nonprofit Institutions)	1	0.4
Other	1	0.4
Total	235	100

Table 64

Nonrecipient Questionnaire Respondents, by Primary Activity

	No. of Respondents	Percent
Research and Development	64	27.2
Library or Information Service	4	1.7
Technical Sales and Service	14	6.0
Production and Operation	2	0.9
Management and Administration	148	63.0
1. Company or Institution Official (President, Vice President, General Manager, Assistant General Manager)	101	43.0
2. Operations Manager (Works Manager, Superintendent, Assistant Works Manager, Assistant Superintendent)	7	3.0
3. Research Director (Chief Engineer, Chief Chemist, Chief Metallurgist, Chief Physicist)	18	7.7
4. Project Scientist or Engineer	19	8.1
5. Foreman, Supervisor, Department Head	1	0.4
6. Other Management	2	0.9
Other	3	1.3
Total	235	100

Nonrecipient Organization Characteristics

Table 65 discloses, in rank order, the primary subject specialization of the industrial establishments within which the Nonrecipient Questionnaire respondents were employed. While the nonrecipient sample companies have been selected at random, it is worth noting that the greatest number of respondent firms are to be found in the fields of Electronics and electrical engineering (24.4 percent), Chemistry and chemical engineering (16.2 percent), Mechanical, industrial, civil and marine engineering (15.8 percent), etc. The rankings of subject fields for the nonrecipient industrial firms do not differ in any

marked degree from the ranking of industries by subject field for all U. S. recipient industrial establishments (See Table 9). Neither are there important differences in the geographic distribution of the randomly selected nonrecipient sample or Nonrecipient Questionnaire returns (See Table 37A, Appendix A) when compared with the geographic distribution of all non-Federal U. S. recipients (Table 12A, Appendix A). With respect to size of the organization, however, as measured in terms of number of scientists and engineers employed, nonrecipient companies were, by far, the smaller organizations. Whereas 81.3 percent of nonrecipient companies and institutions employed fewer than 20 scientists and engineers (Table 66), a total of 16.3 percent of recipient organizations employed that number; whereas 1.7 percent of nonrecipients employed 500 or more scientists and engineers, a total of 36.4 percent of recipients employed that number. Obviously, a definite relationship exists between size of a company and the receipt of the abstracting and indexing services.

Nonrecipient Organization R & D Activity

To what extent were the nonrecipient organizations engaged in research and development? 87 percent of non-Federal U. S. respondents, compared to an equal percent of nonrecipient U. S. respondents, stated that their employers conducted in-house or internally sponsored research (Table 67). Somewhat above half of the nonrecipient organizations (54.6 percent) compared with half (50.4 percent) of non-Federal U. S. recipients performed R & D for other private organizations and institutions (Table 68). However, a rather sharp distinction can be noted with respect to research and development performed for the Federal government by nonrecipient and recipient organizations: while two-thirds (67.1 percent) of the nonrecipient organizations held no Federal agency contracts, only 18.0 percent of the recipient organizations held no such contracts (Table 69). Thus, unlike recipient organizations, nonrecipient organizations held few Federal government contracts.

Estimates of nonrecipient organization staff time devoted to research and development activity are portrayed in Table 70. Since many of the respondents indicated management and administration as

Table 65
Nonrecipient Organizations, by Subject Field Specialization

	No. of Organizations	Percent
Electronics and Electrical Engineering	57	24.4
Chemistry and Chemical Engineering	38	16.2
Mechanical, Industrial, Civil, and Marine Engineering	37	15.8
Biological and Medical Sciences	29	12.4
Materials and Metallurgy	21	9.0
Methods and Equipment	13	5.5
Physics	12	5.1
Aeronautics	5	2.2
Agriculture	5	2.2
Navigation, Communication, Detection, Countermeasures	4	1.7
Propulsion and Fuels	3	1.3
Atmospheric Sciences	2	.8
Behavioral and Social Sciences	2	.8
Earth Sciences and Oceanography	2	.8
Energy Conversion (Non-propulsive)	2	.8
Astronomy and Astrophysics	1	.4
Nuclear Science and Technology	1	.4
Space Technology	1	.4
Total	234	100

Table 66
Nonrecipient Organizations, by Number of Scientists and Engineers Employed

No. of Scientists and Engineers	No. of Organizations	Percent
1-9	145	61.7
10-19	46	19.6
20-49	22	9.4
50-99	15	6.4
100-199	2	0.9
200-299	1	0.4
300-499	-	-
Over 500	4	1.7
Total	235	100.1

Nonrecipient Population

Table 67

Nonrecipient Organizations, Internally-Sponsored R & D

	No. of Organizations	Percent
Yes	201	87.0
No	30	13.0
Total	231	100

Table 68

Nonrecipient Organizations, R & D Performance for Private Industry

	No. of Organizations	Percent
Yes	126	55.3
No	102	44.7
Total	228	100

Table 69

Nonrecipient Organizations, Federal Agency Contractors

	No. of Organizations	Percent [a]
Atomic Energy Commission	9	3.6
Department of Defense	45	18.1
National Aeronautics and Space Administration	13	5.2
Other Federal Agency	15	6.0
None	167	67.1
Total	249 [a]	100

[a] Percent and total based on number of respondents.

their prime activity, it is not surprising to find that more than half of the respondents (55.3 percent) devoted from 1-19 percent of their time to R & D work, while twelve percent of the respondents devoted more than three-fourths of their time to that activity.

Table 70

Nonrecipient Organizations, Percentage Staff Time Devoted to R & D

	No. of Organizations	Percent[a]
1% - 19%	125	55.3
20% - 49%	44	19.5
50% - 74%	29	12.8
Over 75%	28	12.4
Total	226	100

When asked whether the nonrecipient organization had a need within a specified twelve month interval to undertake a line of research outside its field of specialization, 28.6 percent of the nonrecipient respondents answered affirmatively (Table 71). A similar question relating to need for data or information from outside the nonrecipient organization's field of specialization drew a 63.6 percent positive response (Table 72).

Table 71

Nonrecipient Organizations, Research Undertaken Outside Field of Specialization

	No. of Organizations	Percent
Yes	65	28.6
No	162	71.4
Total	277	100

Table 72

Nonrecipient Organizations, Data or Information Needed From Outside Field of Specialization

	No. of Organizations	Percent
Yes	145	63.6
No	83	36.4
Total	228	100

Nonrecipient Population

Information Services

Lacking the federally-produced abstracting and indexing services, how adequate were the internally organized library and information service facilities? When asked whether the nonrecipient organization maintained a library or information center, 74.9 percent of respondents answered affirmatively (Table 73), compared to a 96.4 percent response from non-Federal U.S. recipients. However, only 12.1 percent of the nonrecipient libraries, compared to 70.3 percent of non-Federal U.S. recipient libraries, were professionally staffed (Table 74). It can be inferred that one of the possible reasons for nonreceipt of the services is lack of professional librarian advice.

Table 73

Nonrecipient Organizations, Availability of Library or Information Centers

	No. of Organizations	Percent
Yes	171	75.0
No	50	22.0
Other	7	3.0
Total	228	100

Table 74

Nonrecipient Organizations, Professional Staffing of Library or Information Centers

	No. of Organizations	Percent
Yes	22	12.1
No	155	85.2
Other	5	2.7
Total	182	100

Asked for an opinion as to how well the scientific and technical information needs of the company were met, about half (48.2 percent) of the respondents stated that their needs were met "fairly well," 3.1 percent "excellently," and 13.7 percent, "inadequately" (Table 75).

Table 75

Nonrecipient Questionnaire Respondents, Opinion of Degree with which Scientific and Technical Information Needs are Met in Nonrecipient Companies

	No. of Respondents	Percent
Inadequately	31	13.6
Fairly Well	110	48.2
Well	46	20.2
Very Well	34	14.9
Excellently	7	3.1
Total	228	100

Familiarity with a Use Made of Abstracting and Indexing Services

Although not receiving any of the abstracting and indexing services, were the respondents acquainted with any of them? A total of 86.2 percent indicated that they were not acquainted with NSA, 86.0 percent were not acquainted with TAB, 77.1 percent were not acquainted with STAR, and 70.5 percent were not acquainted with USGRDR (Table 76). Of those who stated that they were acquainted with one or more of the services, 69.1 percent had made no use of them within a specified six month interval (Table 77).

Table 76

Nonrecipient Questionnaire Respondents, Acquaintance with NSA, STAR, TAB, and USGRDR

	No. of Responses			
Service	Yes	Percent	No	Percent
NSA	29	13.8	181	86.2
STAR	29	14.0	178	86.0
TAB	49	22.9	165	77.1
USGRDR	64	29.5	153	70.5

Percent based on row sum.

Did the respondents evince an interest in receiving information about any of the abstracting and indexing services? A total of

Nonrecipient Population

141 of the 235 nonrecipient sample, or [illegible] cent, indicated that they would like to receive such information [illegible] one or more of the services (Table 78).

Table 77

Nonrecipient Questionnaire Respondents, Use Made of NSA, STAR, TAB, and USGRDR

	No. of Respondents	Percent
Yes	38	30.9
No	85	69.1
Total	123	100

Table 78

Nonrecipient Questionnaire Respondents, Interest in Obtaining Information on NSA, STAR, TAB, and USGRDR

Interest in Services	No. of Respondents	Percent
TAB, USGRDR	33	23.4
USGRDR	26	18.4
STAR, TAB, USGRDR	22	15.6
STAR, TAB	12	8.5
NSA, STAR, TAB, USGRDR	10	7.1
STAR	9	6.4
TAB	9	6.4
USGRDR, STAR	8	5.7
NSA, STAR, TAB	4	2.8
NSA	3	2.1
NSA, TAB	2	1.4
NSA, USGRDR	2	1.4
NSA, TAB, USGRDR	1	0.7
Total	141	99.9

Types of Information Needs

What types of information were needed by the nonrecipient population? How frequently were they sought? If an abstracting and

indexing service were made available to the respondent, what would be his preference with regard to subject coverage?

As in the case of the recipient population, the majority of nonrecipient respondents indicated a preference for abstracting and indexing services which would cover the subject specialty within the broader primary field of interest (Table 79).

Table 79

Nonrecipient Questionnaire Respondents, Preference for Subject Scope Coverage for Abstracting and Indexing Services

	No. of Responses	Percent[a]
Exclusively within own specialty	55	25.9
Within broad primary field encompassing subject specialty	115	54.2
Covering exclusively secondary fields [i.e., excluding subject specialty]	4	1.9
Covering selected developments, ideas, techniques, etc., from all other fields applicable to subject specialty	70	33.0
Other	7	3.2
Total	212[a]	

[a]Percent and total based on number of respondents.

Table 80 indicates the frequency with which respondents seek information and the reasons underlying the search. Most frequently sought was 1) information directly pertinent to current project or research and 2) information for the purpose of keeping abreast of current literature in the primary field of interest.

When asked to rank information needs in order of importance to the individual nonrecipient, the two categories referred to above also attained the highest rankings (Table 81).

With respect to types of information sought, specific data or findings were sought by more than half (53.1 percent) of the nonrecipient respondents. The second most frequently sought information type was information relating to laboratory techniques, procedures, apparatus, etc., (30.5 percent) (Table 82). Approximately 60 percent of

Table 80

Nonrecipient Questionnaire Respondents, Frequency of Reasons Given for Using Published Materials

	Frequency of Use							
	Frequently		Occasionally		Rarely or Never		Total	
	No. of Responses	Per-cent	No. of Responses	Per-cent	No. of Responses	Per-cent	No. of Responses	Per-cent
To scan for specific information directly pertinent to current project or research	132	38.9	34	10.6	2	1.6	168	21.4
To keep abreast of current literature in primary field of interest	129	38.1	35	10.9	3	2.4	167	21.3
To keep abreast of current literature in secondary field(s) of interest	24	7.1	82	25.5	22	17.6	128	16.3
For quick retrospective reference or information retrieval	23	6.8	54	16.8	26	20.8	103	13.1
For exhaustive literature searches	7	2.1	34	10.6	50	40.0	91	11.6
For "browsing" in fields related or unrelated to speciality	23	6.8	79	24.6	21	16.8	123	15.7
Other	1	0.3	3	0.9	1	0.8	5	0.6
Total	339	100.1	321	99.9	125	100	785	100.0

Table 81

Type of Use Made of Published Materials - Respondent Ranking

	Rank											
	1		2		3		4		5		6	
	No. of Respondents	Percent	No. of Respondents	Percent	No. of Respondents	Percent	No. of Respondents	Percent	No. of Respondents	Percent	No. of Respondents	Percent
To scan for specific information directly pertinent to current project or research	101	57.4	44	28.0	10	7.7	-	-	1	1.4	-	-
To keep abreast of current literature in primary field of interest	68	38.6	77	49.4	10	7.7	2	2.1	1	1.4	-	-
To keep abreast of current literature in secondary field(s) of interest	-	8.9	12	7.6	55	42.6	25	26.0	15	20.5	4	6.8
For quick retrospective reference or information retrieval	3	1.7	9	5.7	23	17.8	24	25.0	20	27.4	8	13.5
For exhaustive literature searches	1	0.6	2	1.3	9	7.0	11	11.5	17	23.3	33	55.9
For "browsing" in fields related or unrelated to specialty	3	1.7	13	8.3	22	17.0	34	35.4	19	26.0	14	23.7
Total	176	100	157	100	129	100	96	100	73	100	59	100

Nonrecipient Population

Table 82
Type of Information Needed and Frequency of Need - Nonrecipient Companies

	Frequently	Percent	Occasionally	Percent	Total	Percent
Specific data or findings[a]	101	53.1[a]	7	3.7	190	28.2
Information relating to laboratory techniques, procedures, apparatus, etc.	70	42.4	32	19.4	165	24.5
Theoretical or conceptual statements or ideas	33	24.3	32	23.5	136	20.2
Reviews, state-of-the-art surveys (b)	54[b]	30.5	23	13.0	177	26.3
Other	1	16.7	3	50.0	6	0.9
Total					674	

[a] 2 additional respondents checked this item without indicating frequency.
[b] 4 additional respondents checked this item without indicating frequency.

respondents confined their search for information or data to their own field (Table 83).

Receipt of Other Selected Abstracting and Indexing Services

With the exception of Chemical Abstracts, received by 23.3 percent of respondents, fewer than 10 percent of the nonrecipient respondents received any of other well-known abstracting and indexing services (Table 84).

Summary

A search of over three thousand firms listed in Industrial Research Laboratories of the United States revealed that about two-thirds (68.6 percent) were nonrecipients of any of the services.

A search of close to three thousand industrial firms included in List of Small Business Concerns Interested in Performing Research and Development revealed that eighty-six percent were nonrecipients of any of the services.

A search of over three thousand educational and nonprofit research institutes, bureaus, experiment stations, foundations, listed in

Table 83

Field Scanned for Needed Information

	Own Field	Percent	Related Field	Percent	Total	Percent
Specific data or findings	138	69.0	62	31.0	200	29.6
Information relating to laboratory techniques, procedures, apparatus	107	61.1	68	38.9	175	25.9
Theoretical or conceptual statements or ideas	77	63.6	44	36.4	121	17.9
Reviews, state-of-the-art surveys	110	62.1	67	37.9	177	26.2
Other	1	33.3	2	66.6	3	0.04
Total					676	

Nonrecipient Population

Table 64

Receipt of Other Selected Abstracting and Indexing Services

	Yes	Percent	No	Percent
Applied Mechanics Reviews	5	3.0	161	97.0
Biological Abstracts	15	8.6	160	91.4
Chemical Abstracts	43	23.4	141	76.6
Electrical Engineering Abstracts	13	7.7	156	92.3
Engineering Index	15	8.9	154	91.1
Index Medicus	7	4.1	162	95.9
Physics Abstracts	12	6.9	161	93.1
Other	16	16.5	81	83.5

Research Centers Directory revealed that ninety-two percent were nonrecipients of any of the services.

To test, in part, the hypothesis that Federal government contractors were the primary recipients of the abstracting and indexing services, directories identifying Federal government contractor organizations were searched against the Non-Federal U. S. Recipient File.

A search of over a thousand U. S. firms listed in Roster of U. S. Government Research and Development Contracts in Aerospace and Defense revealed that thirty-four percent were nonrecipients of any of the services.

A search of over one thousand firms listed in Industrial Research Laboratories of the United States designated as performing R & D for the Federal government revealed that about half were nonrecipients of any of the services. A similar search of about 2,000 firms, listed in the above directory, which did not carry out Federal government research, revealed that eighty-three percent were nonrecipients of any of the services.

Individual Nonrecipient Characteristics

Management and administration was the primary activity of close to two-thirds of the nonrecipient respondents. (As defined in the Nonrecipient Questionnaire, "Management and administration"

encompassed such positions as Chief Chemist, Chief Physicist, Project Manager, etc.)

Nonrecipient Organization Characteristics

In rank order, nonrecipient organizations specialized in the following fields: Electronics and electrical engineering (24.4 percent), Chemistry and chemical engineering (16.2 percent), Mechanical, industrial, civil and marine engineering (15.8 percent). The rankings of the nonrecipient organization subject field specialties do not differ markedly from those for recipient organizations.

The vast majority of nonrecipient organizations (81.3 percent) employed fewer than twenty scientists and engineers. This finding contrasts sharply with recipient organization staffing, often running into hundreds of professional scientific and technical positions.

R & D Activity

Eighty-seven percent of nonrecipient organizations carried out internally-sponsored research; about half performed R & D for other private organizations and institutions. However, only eighteen percent of nonrecipient organizations, compared to sixty-seven percent of recipient organizations, performed R & D for the Federal government.

Scope of R & D Tasks and Information Needs

Within a specified twelve month period, a total of twenty-nine percent of the nonrecipient organizations had to undertake a line of research outside the field of their specialization; sixty-three percent had a need for data or information outside their field of specialization.

Information Services

While three-quarters of the nonrecipient organizations maintained libraries, only twelve percent of the libraries were staffed by professional librarians; thirteen percent of the respondents stated that their information needs were "inadequately" met, and three percent thought the information services to be "excellent." Specific data or findings directly pertinent to current projects or research was the category of information most frequently sought.

Familiarity with Abstracting and Indexing Services

The vast majority of nonrecipient respondents had no knowledge

Nonrecipient Population

of the abstracting and indexing services: eighty-six percent had no knowledge of NSA or STAR; seventy-seven percent had no knowledge of TAB; seventy-one percent had no knowledge of USGRDR, and sixty percent of the respondents expressed a desire for additional information about one or more of the abstracting and indexing services.

---

1. Industrial Research Laboratories of the United States. 12th ed. Ed. by William W. Buchanan [Washington, D.C.: Bowker Associates, Inc., 1965] p. 8.

2. Frost & Sullivan, Inc. Roster of U.S. Government Research and Development Contracts in Aerospace and Defense. Washington, D.C., Bowker Associates, 1965.

3. U.S. Small Business Administration. A List of Small Business Concerns Interested in Performing Research and Development. 4th ed. Washington, D.C., May 1963.

4. Research Centers Directory. 2nd ed. Ed. by Archie M. Palmer and Anthony T. Kruzas. Detroit, Gale Research Co. [1965] p. 12.

5. U.S. Bureau of the Census. Statistical Abstract of the United States: 1966. 87th ed. Washington, D.C., U.S. Govt. Print. Off., 1966, p. 765.

6. U.S. Office of Education. Education Directory, Pt. 3 Higher Education, 1965-1966. (OE-50000-66). Washington, D.C., U.S. Govt. Print. Off., 1966.

7. U.S. Office of Education. Earned Degrees Conferred 1962-1963, Bachelor's and Higher Degrees. (OE-54013-63; Circular No. 777). Washington, D.C., U.S. Govt. Print. Off. [1965] p. 2.

8. U.S. Congress. House. Select Committee on Small Business. The Role and Effect of Technology in the Nation's Economy. Hearings before a Select Subcommittee, 88th Cong., 1st Sess., May 20, June 5, 6, and 20, and Dec. 17 and 18, 1963. Washington, D.C., U.S. Govt. Print. Off., 1964. Pt. 6, p. 655.

9. Allison, David. "The Civilian Technology Lag." International Science and Technology, No. 24, Dec. 1963, pp. 24-34.

Chapter 7

Summary, Conclusions and Recommendations

Diffusion and utilization of scientific and technical information appear to be prime variables influencing individual corporate as well as national economic growth. The circumscribed yet important role played by abstracting and indexing services in the diffusion process has been noted and the distribution and use patterns of the federally-produced abstracting and indexing services of NSA, STAR, TAB, and USGRDR have been analyzed on the basis of available recipient population data and through use of the questionnaire method. The research-oriented nonrecipient population was identified and some of its characteristics determined and compared with those of the recipient population. The analysis, while confined primarily to the United States, took cognizance of the distribution and use made of abstracting and indexing services within a number of Soviet bloc countries which rely heavily upon such services as basic media for scientific and technological communication.

While it is recognized that national systems for dissemination of information should be evaluated only within their own unique socio-political environments, this does not preclude comparative analysis of components of variant systems which are frequently designed to attain similar objectives and are faced with similar problems.

On the basis of statistical evidence derived from the analysis of the Non-Federal U. S. Recipient File (See Chapter 4) and data available from official Government sources and industrial compilations, the following overall potential U. S. recipient populations and their actual recipient segments are contrasted in relation to the first hypothesis:

Research centers	3,014
Recipient centers	64
Percent of recipients	2.1
Manufacturing establishments	312,000
Recipient establishments	2,154
Percent of recipients	0.7

Summary

Industrial research laboratories	3,260
Recipient laboratories	1,024
Percent of recipients	31.4
Small business concerns interested in performing research and development for the Federal government	2,775
Recipient business concerns	378
Percent of recipients	13.6
R & D scientists and engineers	344,900
Total number of U. S. copies distributed	26,340[1]
Percent recipients	7.6
Scientists and engineers in private industry	871,400
Total number non-Federal and GPO Depository Library copies distributed	20,280[2]
Percent recipients	2.3

Distribution and Use Pattern

Obviously, a distribution of national documentation center abstracting and indexing services which reaches two percent of U. S. educational and nonprofit research centers, thirty-one percent of industrial research laboratories, and less than one percent of U. S. manufacturing establishments, cannot be termed adequate. Neither, on the basis of geographic distribution, can we consider adequate a distribution in which five U. S. states contain nearly fifty percent of the population receiving abstracting and indexing servics and eighteen states each contain less than one half of one percent, or about three percent of the recipient population.

While arguments have been presented before Congressional committees championing the allocation of grants to proven researchers, and opposing distribution of research and development funds on a regional basis,[3,4] these arguments do not apply to the distribution of abstracting and indexing services. The same Congressional hearings also provide ample evidence that research and development talent and capability is not confined to a select number of institutions or to a few states. Even if that were the case, greater diffusion and application of research results in all states might well lead to increases in productivity and a resultant increased rate of national economic growth.

Recipient Types

Without question, Federal government contractors are the primary recipients and users of these abstracting and indexing services. Eighty-two percent of the organizations and institutions within which the recipients were employed were Federal Government contractors. Almost the entire STAR non-Federal U. S. distribution (95. 6 percent) went to NASA contractors or individuals having some official connection with that agency. The distribution of TAB is limited to those who have either current Federal agency contracts or who have established their eligibility with the Defense Documentation Center as potential Department of Defense contractors. A search of over a thousand contractor firms included in Roster of U. S. Government Research and Development Contracts revealed that two-thirds of the contractor firms were recipients of one or more of the abstracting and indexing services. Conversely, of close to nineteen hundred noncontractor firms in Industrial Research Laboratories of the United States, eighty-three percent were nonrecipients of the services. Two-thirds of the companies represented in the Nonrecipient Questionnaire returns did not have current contracts with the Federal Government. An average of eighty percent of Nonrecipient Questionnaire respondents had no knowledge of any of the abstracting and indexing services.

Other compilations of data indicate that not only in terms of total number of recipients, but in terms of total number of copies, and number of copies per recipient, firms and institutions having an official connection with the Federal government ranked well above non-contractor organizations. Thus, approximately forty percent of all non-Federal U. S. TAB recipients received two or more copies of TAB; over one hundred recipients acquired from ten to a hundred or more copies (Table 20A, Appendix A). About two-thirds of the TAB copies were addressed directly to individuals rather than to libraries. The inference can be drawn that the receipt of multiple copies of TAB within the same organization would permit their utilization for both current awareness and information retrieval purposes. It is, of course, possible that with the receipt of a single issue of any one service, a library or information center can attain wide dissemination

of the abstracted information. Internal dissemination of abstracts is being carried out, however, by a small portion of the library recipient population.[5]

Responses to the Recipient Questionnaire also revealed that close to half of the non-Federal U. S. recipient libraries employed one (or less) professional full-time librarian and that about two-thirds of all libraries had an actual or potential clientele ranging from 100 to 10,000 scientists and engineers, exclusive of professional administrative and supporting personnel. It can be inferred that serious understaffing at the local library or information center level tends to inhibit selective dissemination of abstracts, or for that matter, any other intensive information service.

In sharp contrast to the multiple distribution of NSA, STAR, and TAB copies, practically all subscribers to USGRDR (96.8 percent) purchased a single copy of the service. Since about half of the USGRDR subscription copies were addressed to libraries and since a third of non-Federal U. S. recipient libraries and close to four-fifths of the GPO Depository Libraries did not permit circulation or routing of USGRDR, it is not unreasonable to state that the receipt of single copies of USGRDR and the restrictions imposed on circulation and routing would preclude its extensive use as current awareness or announcement medium.

With respect to STAR which is disseminated almost entirely on the basis of official distribution, about sixty percent of its recipients were individuals outside the library or information services field. While an equivalent percentage of NSA recipients were libraries and information centers, through official AEC distribution channels, many of the recipient organizations acquired multiple copies of NSA, with five libraries or information centers acquiring more than one hundred copies each.

Abstracting and Indexing Services in Relationship to Other Variables

The evidence collected indicates a positive correlation of the distribution and use pattern for the abstracting and indexing services investigated and other economy input variables known to influence innovation and national economic growth.

Other investigators have demonstrated the effect of the "technical progress" variable upon economic growth of nations or individual corporate enterprises. Research and development constitutes one of the major components of the "technical progress" variable. Whether on a regional, national, or industry segment level, a definite relationship has been found to exist between the "technical progress" input variable and the resultant rate of economic growth. National expenditures in relation to the per capita Gross National Product (GNP) have been shown to be higher in countries having a high per capita GNP than in countries having a low per capita GNP. The more industrialized nations of the world, such as the United States, Great Britain, Japan, France, the Netherlands and Canada, spent more than one percent of their GNP on research and development, while underdeveloped nations spent less than 0.25 percent. In terms of foreign distribution of the abstracting and indexing services of NSA, STAR, and USGRDR, the highly industrialized nations attained top ranking as recipients of the services.

A close relationship has also been found to exist between the degree of industrialization of U.S. states and regions and the state or regional distribution of the abstracting and indexing services. States and regions having a high proportion of scientists and engineers, research and development funds, manufacturing establishments, have also been found to have a high concentration of recipients of the abstracting and indexing services.

Industries such as Electrical equipment and communications, Chemicals and allied products, Machinery, Professional and scientific instruments, Aircraft and missiles, have been found in other studies to be the primary innovating and economically expanding industries and they are the primary recipients of these abstracting and indexing services.

Evidence gathered on the diffusion and use made of abstracting and indexing services in Soviet bloc countries points to extensive and purposeful exploitation of this medium as a primary means for scientific and technological communication. Not merely the scientist and engineer, but the factory foreman and graduate student is the

Summary

recipient of these services. During 1967, the All-Union Institute of Scientific and Technical Information (VINITI) expects to publish its major abstracting and indexing service, Referativnyĭ Zhurnal, in a total of 25 series, 35 comprehensive subject volumes, and 134 subsections, which are to be disseminated to approximately 375,000 Soviet recipients. This is exclusive of Ekspress Informatsiia (Express Information) and related services. By way of contrast, the total number of U. S. recipients for all four services of NSA, STAR, TAB, and USGRDR amounts to 12,255 recipients.

Need for Purposeful Dissemination

Federal documentation centers may be doing a creditable job in supporting the missions of their agencies. However, it is obvious that thousands of research-oriented industrial organizations, educational and nonprofit institutions and private individuals, do not receive the federally-produced abstracting and indexing services and, what may be more significant, have no knowledge of their existence.

Recognizing, as other countries seem to have recognized, the powerful effect of the "technical progress" variable on national economies, can we as a nation afford a laissez faire attitude toward the dissemination of abstracting and indexing services reporting research results stemming from fifteen billion dollar annual R & D expenditures? Are Federal agency contractors and those having official ties with the Federal government to be the primary and favored recipients of these services? Conversely and examined within a broader context, does not the U. S. Federal government have a responsibility for diffusing nationally the results derived from tax-supported research?

The issue to be considered is whether, in a free society, we should not deliberately adopt measures to attain a high degree of dissemination of scientific and technical information. Testifying on the possible influence of Federal research and development programs on the U. S. business community Eugene P. Foley, Administrator, Small Business Administration, notes:

> It must be recognized that the knowledge gained from Government expenditures in space and military research

> and development can, in many cases, be transferred directly into industrial application. This information contains the potential for creating new industrial techniques, materials, products, and processes. If assimilated properly, it can exert a profound influence on our civilian technology. The Federal Government, therefore, has an obligation to develop a workable system of utilizing this enormous reservoir of scientific information so that its benefits can be transmitted to businessmen both large and small in order to provide the ingredients necessary for an accelerated growth in our civilian economy.[6]

Both from within or outside the Federal government, many individuals have expressed concern over the widening gulf between militarily-oriented research and civilian application. The need to meet competition from nations emphasizing research directed toward civilian product development has become apparent within recent years. In testimony before Congress, the Secretary of Commerce noted that a number of other nations have been able to adopt scientific advances to practical use more speedily than the United States and offered this as a partial explanation why such nations were able to compete against the United States "in both price and quality."[7] A recent Columbia University Seminar on Technology and Social Change,[8] as well as articles in the professional literature,[9] have advanced the theme that the United States is lagging behind a number of European countries in technological inventiveness and innovation in the civilian field. A study for the National Commission on Technology, Automation, and Economic Progress recommends that more effective transfer and utilization of new technology be made a "national goal established at the highest levels" and points out that optimum use of scientific and technical information is not likely to occur naturally. With respect to time lag between development and adoption of new technology, the study notes that "history proves quite emphatically that there will likely be a longer time lag between development of new technology and its civilian application via natural processes than would occur with some form of catalytic action."[10]

Factors Inhibiting Dissemination

In considering various "catalysts" capable of stimulating

Summary

national economic growth, it should be apparent that the economic growth rate when government does little or nothing to influence it is not necessarily the "best" rate. "Certainly," Denison[11] states,

> a democratic society is entitled to make a collective decision to use the instruments of government and other institutions to promote rapid growth. Moreover, if such a policy commands popular assent, a free society can use most, though not quite all, the effective techniques to stimulate growth that are open to a dictatorship, and do so without more impingement on freedom than is implied by the existence of government with the power of compulsory taxation.

The federally-produced abstracting and indexing services of NSA, STAR, TAB, and USGRDR are supported by public funds; the publications which they abstract are primarily technical reports, also stemming from government-sponsored and publicly-supported research. Neither the technical report literature nor the abstracting and indexing services under consideration are subject to copyright restrictions. Utilizing either existing or revised abstracting and indexing service formats, the Federal government can adopt whatever measures it deems appropriate to attain wide diffusion of these services.

While the belief is widespread that information resulting from Government-sponsored research is a national resource and should be fully disseminated to both contractor and noncontractor establishments, no Federal agency has concerned itself with the overall task of national diffusion or dissemination.

Under Title IX of the National Defense Education Act of 1958, the National Science Foundation was authorized to undertake programs to develop new or improved methods and to provide or arrange for the provision of helpful information services. Executive Order 1087 of March 13, 1959 directed the Foundation to provide leadership in efforts to attain coordination and improvement in Federal Government scientific and technical information activities. The Executive Order cited above also directed other Federal agencies "to cooperate" and assist the Foundation in its government-wide responsibility. Regretfully, as noted in the "Crawford" report,[12] the NSF staff, because of its primarily advisory function, was hardly in a position to

establish or implement a vigorous information diffusion program.

Public Law 776 of September 1951 directs the Secretary of Commerce to establish and maintain a scientific clearinghouse for the benefit of the business community. As Congressional testimony elicited from the Director of the Office of Technical Services indicates, the "clearinghouse" role played by the Department of Commerce was, at best, quite limited.[13]

Consistent with security regulations, the Department of Defense seeks to disseminate information resulting from DOD projects. Legally, however, DOD has no obligation to do so. This point was stressed quite emphatically by the Director of Technical Information, Office of Director Defense Research and Engineering, in testimony before Congress.[14] Even if the Department of Defense were to disseminate information relating to its research programs, under present procedures the Defense Documentation Center receives "slightly more than one-half of the total documents being generated."[15] Thus, at best, only about half of the DOD technical reports published are abstracted and indexed in the issues of TAB. Of course, only the open literature, or less than half of the abstracts announced in TAB are announced in USGRDR; during 1963, of a total of 60,436 technical reports generated by Federal agencies, 38,800 were completed by the Department of Defense. Of this total, 62 percent were controlled for various reasons.[16]

The Atomic Energy Commission and the National Aeronautics and Space Administration are among the agencies specifically authorized by Congress to disseminate information resulting from agency-sponsored programs. However, since they are essentially mission-oriented, the agencies emphasize service to contractors, who can aid the respective agencies to fulfill their missions. The tenth and final report of the House Select Committee on Government Research notes:

> In the sense of mission-oriented programs, we are spending greatly on the defense, space, and nuclear missions and virtually nothing on the mission of securing our probable competitive future. That mission is neither the mission of DOD, of NASA, of AEC, nor

> of HEW. If it is the explicit mission of any department or agency - Commerce, for instance - we are not aware of it.[17]

The passage of the State Technical Services Act of 1965, the establishment of federally-supported information centers (more recently called information analysis centers) and the creation of offices such as NASA's Technology Utilization Division or the AEC's Office of Industrial Cooperation, are efforts at more adequate diffusion and utilization of R & D results. These are uncoordinated and fragmented activities. While on the one hand funds are allotted to universities under the State Technical Services Act,[18] which has the avowed purpose of permitting the "benefits of federally financed research, as well as other research [to be] placed more effectively in the hands of American business, commerce and industrial establishments throughout the country,"[19] on the other hand, the withholding of funds by the Department of Commerce (and Department of Defense) forced the closing of twelve Regional Technical Report Centers supposedly established for the purpose of making accessible the technical report literature to the business community. An analogous action by the Defense Documentation Center disbanded five of its regional offices. The subscription price for USGRDR has doubled in 1966 from $15.00 to $30.00, and the cost of the index to that service, GWI, increased from $16.00 to $22.00. While NASA and DOD still provide free photocopies of needed reports to qualified users, the AEC no longer does so. In a report of the Committee on Non-GPO Publications presented before the Association of Research Libraries it was noted that:

> most of the non-GPO publications do not get into the depository library distribution system administered by the Superintendent of Documents, and there is but fragmentary bibliographical control over them. Report literature resulting from Government-sponsored research and commercial printing done on contract directly with Federal agencies also do not get into depository library channels.[20]

An earlier study by Brock[21] shows the Federal government's program of printing, publishing and distribution of relevant publications to be "seriously deficient when measured against the information

requirements of a highly educated, industrialized, complex and space age society." The general problem has been characterized as a quiet crisis which has almost escaped attention, both within and without the government.[22]

Recommendations

Inadequate distribution of abstracting and indexing services and other federally-produced documents, the parsimonious and generally sporadic support of the information dissemination function, information management decisions which often work at cross-purposes, are in no small measure attributable to the lack of a formalized national policy for information dissemination.

If the view is accepted that scientific and technical information is a national resource which can have a profound influence on the nation's security and national well-being, then:

(1) A national policy needs to be formulated which would have as its aim maximum utilization and exploitation of that resource.

However, as in the case of mere investment in research and development, mere formulation of such a policy would not, by itself, be sufficient to attain desired objectives.

(2) Congressional authority needs to be vested in either an existing agency, or a new agency, whose primary goal would be to implement national policy decisions for the dissemination of scientific and technical information derived from publicly-expended funds. Possibly, the responsibility and scope of the committee on Scientific and Technical Information, now serving primarily in an advisory capacity, should be strengthened and expanded to encompass the new tasks.

Under our governmental system, the Constitution delegates power to the Federal government in order to "provide for the common defense." It is primarily this Constitutional clause that has been used in the past as justification for the huge R & D expenditures. However, the same Constitutional clause also empowers the Federal government to "promote the general welfare."

(3) Rather than raising subscription prices for the federally-produced abstracting and indexing services, they should have lower

prices, or should be provided without charge.

(4) Rather than restricting these and related technical report information services, their dissemination should extend to those U. S. graduate students, industrial firms or educational and nonprofit institutions that may derive benefit from their use.

Our investment in research and development cannot be effective without investment in national diffusion of research results.

---

1. Based on average distribution of 2.15 copies per recipient for 12,255 U. S. recipients (Table 20A, Appendix A and Table 5).

2. Based on average distribution of 2.15 copies per recipient for 9,433 non-Federal U. S. and GPO Depository Library recipients (Table 20A, Appendix A and Table 5).

3. U. S. Congress. House. Select Committee on Government Research. Federal Research and Development Programs. Hearings, 88th Cong., 1st Sess., Nov. 18-22, 1963, pt. 1; Dec. 11-12, 1963, and Jan. 22, 1964, pt. 2. Washington, D. C., U. S. Govt. Print. Off., 1964.

4. U. S. Congress. House. Committee on Science and Astronautics. Subcommittee on Science Research and Development. Geographic Distribution of Federal Research and Development Funds. Report, 88th Cong., 2nd Sess. (Government and Science, No. 4). Washington, D. C., U. S. Govt. Print. Off., 1964.

5. In checking technical report services (Table 53), a total of 22.1 percent of Recipient Questionnaire library respondents indicated that they selectively disseminated abstracts.

6. U. S. Congress. House. Select Committee on Government Research. Federal Research and Development Programs. Hearings, 88th Cong., 1st Sess., Dec. 11-12, 1963, and Jan. 22, 1964. pt. 2. Washington, D. C., U. S. Govt. Print. Off., 1964, p. 742.

7. U. S. Congress. House. Committee on Education and Labor. Ad Hoc Subcommittee on National Research Data Processing and Information Retrieval Center. National Information Center. Hearings, 88th Cong., 1st Sess., May 27, 28, July 18, 19, Sept. 17, 19, 1963. v. 1, Pt. 1-3. Washington, D. C., U. S. Govt. Print. Off., 1963, p. 68.

8. Warner, Aaron W., ed., et al. The Impact of Science on Technology. New York, Columbia University Press, 1965.

9. Allison, David. "The Civilian Technology Lag." International Science and Technology. no. 24, Dec. 1963, pp. 24-34.

10. Lesher, Richard L. and Howick, George J. Background, Guidelines, and Recommendations for Use in Assessing Effective Measures of Channeling New Technologies in Promising Directions. (N68-19042). Prepared for the National Commission on Technology,

Automation, and Economic Progress. Washington, D.C., National Aeronautics and Space Administration, Nov. 1965, p. 85.

11. Denison, Edward F. The Sources of Economic Growth in the United States and the Alternatives Before Us. (Supplementary Paper No. 13). New York, Committee for Economic Development, 1952, p. 9.

12. U. S. Task Force to the President's Special Assistant for Science and Technology. Scientific and Technological Communication in the Government. Report. (AD 299 545). Washington, D.C., p. 49.

13. U.S. Congress. House. Committee on Education and Labor. Ad Hoc Subcommittee on National Research Data Processing and Information Retrieval. National Information Center. Hearings, 88th Cong., 1st Sess., May 27, 28, July 18, 19, Sept. 17, 19, 1963. v. 1, Pt. 1-3. Washington, D.C., U.S. Govt. Print. Off., 1963, p. 75.

14. Ibid., p. 126.

15. Stegmaier, Robert B. "DDC Status and Plans." In Air Force Scientific and Technical Information Conference, 2nd, April 28-29, 1965. Proceedings. (AD 621 800). [Washington, C.C.] Air Force Systems Command [1966] p. 27.

16. U.S. Congress. House. Select Committee on Government Research. Documentation and Dissemination of Research and Development Results. Report, 88th Cong., 2nd Sess. (Study No. IV; House Report No. 1932) Washington, D.C., U.S. Govt. Print. Off., 1964, p. 27.

17. U.S. Congress. House. Select Committee on Government Research. National Goals and Policies. Report, 88th Cong., 2nd Sess. (Study No. X, House Report No. 834) Washington, D.C., U.S. Govt. Print. Off., Dec. 1964, p. 46.

18. "Technical Services Grants for 1967 Announced." Washington Science Trends. v. 17, no. 19, Feb. 6, 1967, p. 125-27.

19. "General Regulations Governing Operation and Administration of the State Technical Services Act of 1965." Federal Register, v. 30, no. 250, Dec. 29, 1965, p. 1621.

20. "Report on the Sixty-Ninth Meeting of the Association of Research Libraries, Held in New Orleans, La., Jan. 8, 1967." LC Information Bulletin, v. 26, no. 4, Jan. 26, 1967, p. 70.

21. Brock, Clifton, "The Quiet Crisis in Government Publishing." College and Research Libraries, v. 26, no. 6, Nov. 1965, pp. 477-489, 531.

22. Ibid.

Appendix A - Tables

Table 1A

Percentage Shares of Various Industries in Total Output of Manufacturing Industry, 1899-1959

	1899	1913	1929	1959
Food, drink and tobacco:				
United States	24	20	14	11
United Kingdom	27	20	18	14
Japan	36	26	15	7
Textiles:				
United States	20	19	11	8
United Kingdom	16	19	12	5
Japan	32	30	25	11
Basic metals:				
United States	9	10	10	7
United Kingdom	7	7	7	8
Japan	4	3	7	11
Metal products:				
United States	10	13	33	41
United Kingdom	16	19	25	38
Japan	2	15	15	39
Chemicals:				
United States	5	6	8	15
United Kingdom	6	6	8	13
Japan	11	10	20	15
Other industries:				
United States	32	32	24	18
United Kingdom	28	29	30	22
Japan	15	16	18	17

Source: Maizels, Alfred. Industrial Growth and World Trade, an Empirical Study of Trends in Production, Consumption, and Trade in Manufactures from 1899-1959, with a Discussion of Probable Future Trends. (National Institute of Economic and Social Research. Economic and Social Studies, 21). Cambridge [Eng.] University Press, 1963, pp. 46-47.

Table 2A

Research and Development Expenditure as a Proportion of Net Output and of Sales in Various Industries in Selected Countries, 1958 and 1959

	Research Expenditure as Percentage of Sales[1] 1959			Research Expenditure as Percentage of Net Output[2] 1958		
	Canada	Japan	United States	United States	Sweden 1959	United Kingdom
Group A:						
Aircraft	-	-	20.8	-	-	35.1
Electronics	1.8	2.6	12.8	22.4	14.0	12.8
Other electrical	1.5	2.0	10.1	16.3	3.2	5.5
Chemicals	-	1.9	4.3	6.9[4]	7.9	4.5[4]
Machinery	-	1.2	4.2	6.3	-	2.3
Vehicles	1.9[3]	1.2	3.4	10.2	-	1.4
Instruments	-	1.8	8.3	9.9	-	6.0
Total Group A	-	-	-	13.0	8.3[5]	6.3
Group B:						
Rubber	0.5	1.1	2.0	2.7	2.5	2.1
Ferrous metal	0.4	0.7	0.6	0.8	2.0	0.5
Non-ferrous metals	0.7	1.2	1.0	2.0	-	2.3
Metal products	-	0.9	1.7	1.3	-	0.8
Stone, clay and glass	0.8	1.2	1.4	1.2	2.0	0.6
Paper	0.4	0.5	0.8	0.9	0.8	0.8
Total Group B	-	-	-	1.3	-	0.9
Group C:						
Food	0.1	0.4	0.3	0.5	0.5	0.3
Textiles and apparel	1.2	0.7	0.5	0.2	0.5	0.3
Lumber and furniture	0.2	0.3	0.5	0.2	0.6	0.04
Other manufacturing	0.7	0.9	1.4	0.9	-	0.4
Total Group C	-	-	-	0.5	-	0.3
Total all industries	0.7	1.2	4.2	5.7	4.0	3.1

1. Only for firms reporting R and D expenditures.
2. Net output of whole industry including firms not performing R & D. Sweden and United States "value added."
3. All transportation equipment.
4. Including petroleum refining.
5. Excluding chemicals.

Source: Organization for Economic Cooperation and Development. Science, Economic Growth and Government Policy. Paris, 1963. p. 80.

Table 3 A

Research Performed 1949 and 1951, and Rate of Return 1952 by Industries

Industry	Research Performed As Percent of Sales 1949	1951	Return on Net Worth 1952 (Percent)
Aircraft and parts	5.0	11.9	17.9
Electrical machinery	3.1	3.6	13.1
Instruments	3.0	3.3	11.5
Chemical and allied products	1.7	1.2	10.7
Motor vehicles and other transportation	0.9	1.0	12.9
All Manufacturing	0.8	0.9	10.2
Machinery (except electrical)	0.52	0.51	11.2
Rubber	0.75	0.49	10.6
Petroleum and coal products	0.57	0.42	12.7
Stone, clay, and glass	0.58	0.39	11.5
Fabricated metal products	0.19	0.27	10.0
Paper and allied products	0.32	0.22	10.2
Primary metal	0.14	0.16	9.3
Tobacco	0.03	0.02	8.2
Food and kindred products	0.11	0.08	7.7
Textile mill and apparel	0.07	0.07	4.3
Lumber and furniture	0.06	0.04	8.5
Leather	0.06	0.03	5.[illegible]

Source: Brozen, Yale. "The Future of Industrial Research," Journal of Business (University of Chicago) v. 34, no. 4, October 1961, p. 436

Table 4A
Federal Obligations and Expenditures for
Research and Development, by Agency, 1960-1966

In Millions of Dollars

Agency	Research and Development				
	1960	1963	1964	1965 est.	1966 est.
Total obligations	7,545	12,464	14,133	14,829	15,280
Departments:					
Agricultures	126	168	189	227	233
Commerce	31	52	54	69	76
Defense	5,712	7,286	7,262	7,001	7,091
Army	1,117	1,297	1,377	1,471	1,490
Navy	1,535	1,597	1,621	1,495	1,580
Air Force	2,818	3,945	3,784	3,413	3,365
Other[1]	243	447	480	527	555
Health, Education, and Welfare	320	656	777	879	979
Interior	64	92	108	123	137
Atomic Energy Commission[2]	762	1,078	1,236	1,271	1,292
National Aero. and Space Admin.	369	2,836	4,200	4,882	5,021
National Science Foundation	68	145	165	199	271
All other	93	151	147	178	191
Total expenditures	7,277	11,292	13,650	14,038	14,300
Departments:					
Agriculture	121	164	178	215	235

Commerce	30	48	53	65	[illegible]
Defense	5,553	6,794	7,433	7,113	6,786
Army	1,066	1,408	1,395	1,472	1,435
Navy	1,277	1,565	1,715	1,568	1,517
Air Force	2,958	3,509	3,918	3,554	3,834
Other[1]	252	314	405	521	500
Health, Education, and Welfare	292	590	747	735	866
Interior	63	96	92	113	121
Atomic Energy Commission[2]	762	1,078	1,236	1,271	1,297
National Aero. and Space Admin.	330	2,292	3,637	4,184	4,567
National Science Foundation	51	100	141	152	196
All other	76	151	132	190	174

1. Includes defense agencies such as the Advanced Research Projects Agency, Defense Atomic Support Agency, and the Defense Communication Agency.

2. Data represent "accrued costs" rather than obligations and expenditures, respectively.

Source: U. S. Bureau of the Census. Statistical Abstract of the United States, 1966. 87th ed., Washington, D. C., U. S. Govt. Print. Off., 1966, p. 544.

Table A

Sources of Funds Used for Research and Development by Sector, Distributed by Source, 1954 - 1964

In Millions of Dollars

Performance Sector and Source of Funds	1954	1955	1956	1957
Research and Development				
Total funds used	5,660	6,200	8,370	10,510
Federal Government	1,020	950	1,090	1,280
Federal Funds	1,020	950	1,090	1,280
Industry	4,070	4,640	6,610	7,730
Federal Funds	1,750	2,180	3,350	4,330
Industry Funds	2,320	2,460	3,280	3,400
Colleges and universities	450	480	530	650
Federal Funds	280	300	330	415
Industry Funds	20	20	20	25
College and university funds	130	140	155	190
Other nonprofit institutions funds	20	20	25	30
Other nonprofit institutions	120	130	140	150
Federal Funds	70	70	70	80
Industry Funds	25	30	30	30
Other nonprofit institutions funds	25	30	40	40

Source: U. S. Bureau of the Census. Statistical Abstract of the United States, 1966. 87th ed., Washington, D.C., U. S. Govt. Print. Off., 1966, p. 543.

1958	1959	1960	1961	1962	1963 (prel.)	1964 (prel.)
10,810	12,430	13,620	14,350	15,480	17,240	18,180
1,440	1,730	1,830	1,890	2,220	2,400	2,830
1,440	1,730	1,830	1,890	2,220	2,400	2,890
3,390	9,620	10,510	10,910	11,460	12,890	13,550
4,760	5,640	6,090	6,240	6,430	7,280	7,600
3,630	3,980	4,430	4,670	5,030	5,410	5,750
780	840	1,000	1,200	1,400	1,700	2,100
530	580	730	905	1,075	1,335	1,625
30	30	30	35	35	40	40
190	190	200	210	230	260	360
30	40	40	50	60	65	75
200	240	280	350	400	450	500
115	155	190	255	300	350	380
35	35	35	40	40	40	50
50	50	55	55	60	60	70

Table 8a

Plans for Corporate R & D Expenditure Increases, 1966

Organization	Budget	Staff
Abbott Laboratories	10-15%	10-20%
Acoustica Associates Inc.	5	30
Acton Laboratories	-30	20
Addressograph Multigraph	10	8
Admiral Corp.	15	NA
Alco Chemical Corp.	0	0
American Brake Shoe Co.	20	20
American Cyanamid Co.	2-3	4-5
Am. Machine & Fdry. Corp.	0	0
Amer. Potash & Chem. Corp.	15	NA
Amphenol Corp.	10-15	5-10
Applied Physics Corp.	15	15
Archer Daniels Midland Co.	0.3	4
Armco Steel Corp.	5-10	8
Armour Abrasives Co.	25	25
Armstrong Cork Co.	5	5
Atomics International	-40	NA
Avco Corp.	0	5
Bausch & Lomb	10	10
Baxter Laboratories	15	11
Beech Aircraft Corp.	20	25
Bell Aerosystems Co.	10	10
Bell & Howell Co.	5	NA
Beryllium Corp.	-10	0
Bethlehem Steel Corp.	10	11
Bjerketen Research Labs.	25	20
E. W. Bliss Co.	20	15
Bristol Labs.	15	15
Carpenter Steel Co.	10	5
Calumet & Hecla Inc.	20	8
Carborundum Co.	10	5
Caterpillar Tractor Co.	0	0
Celotex Corp.	12-15	15
Chevron Research Co.	3	0
Chicago Aerial Industries	30	15
Climax Molybdenum	10	15
Combustion Engineering	5-10	8
Continental Can Co.	0	NA
Control Data Corp.	0	Small
Corning Glass Works	5-10	10
Crown Zellerbach Corp.	10	5
Crucible Steel Co. of America	0	8
A. B. Dick Co.	10	10
Dictaphone Corp.	10-20	10-20
Doehler Jarvis Div.	15	20
Deere & Co.	15	10
Dynatech Corp.	10	10-20
Eastman Kodak Co.	5+	NA

[illegible]	20	15
Electric Storage Battery Co.	10	15
Emhart Corp	10	7
FMC Corp	5	5
Fairchild Semiconductor	40	40
Federal-Mogul Div.	3	4
Fisher Scientific Co	20	20
GCA Corp. Technology Div.	10	7
General Cable Corp	20	10
General Mills Inc.	10	12
Gen. Prec. Aero. Res. Center	15	15
General Radio Co.	10	10
General Tel. & Elect. Labs.	10	20
General Tire & Rubber Co.	10-15	8
Gerber Products Co.	3-5	up to 10
Giannini Controls Corp.	10	15
Gould National Batteries	10	10
Hercules Powder Co.	Small	Small
Hiller Aircraft Div.	30	20
Hooker Chemical Co.	4	4
Houdry Process & Chem. Co.	15	10
Ion Physics Corp.	75	50
Interchemical Corp.	5	3
International Nickel Co.	10	0
Keuffel & Esser Co.	10	10
Walter Kidde & Co.	8	6
Latrobe Steel Co.	20	30
Leeds & Northrup Co.	5	5
Libby, McNeill & Libby	0	0
Ling-Temco-Vought Inc.	NA	10
Lockheed-Georgia Co.	12-15	20
Marathon Oil Co.	10	4
Mead Johnson & Co.	7.5	23.5
Mobray Chemical Co.	5	15
National Drug Co.	10	3
Natl. Starch & Chem. Corp.	10	5
Non Linear Systems Inc.	0	0
Norton Co.	5	5
Optics Technology Inc.	NA	25
Owens-Illinois Inc.	8	8
Pittsburgh Chemical Co.	7	7
Pittsburgh Plate Glass Co.	10	10
Quaker Oats Co.	10	NA
Radio Corp. of America Labs.	6-8	1.5
Radiation Inc.	10	10
Rath Packing Co.	−20	−10
Reynolds Metals Co.	10	10-20
Richfield Oil Co.	4-5	1
Sadtler Research Labs.	10	5
St. Regis Paper Co.	5	15
Solar	15	18
Speer Carbon Co.	12	10
Spencer Chemical Div.	15	12

Table 6A continued	Budget	Staff
Sperry Gyroscope Co.	0	0
Sprague Electric Co.	10	12
E. R. Squibb & Sons	7	0.9
Stauffer Chemical Co.	5-8	8.5
A. E. Staley Mfg. Co.	7	7.6
Sunbeam Corp.	10-15	10-15
Timken Roller Bearing Co.	15	20
U.S. Borax Research Corp.	5	NA
United Carbon Co.	13	5
U.S. Rubber Co.	5-10	5
Varian Associates	10	10
Vitro Corp. of America	0	21
Hiram Walker & Sons	0	0
Warner-Lambert Res. Inst.	15	5
West Virginia Pulp & Paper Co.	30	25
Weyerhaeuser Co.	5-10	5
Whirlpool Corp.	11	6
Xerox Corp.	33	33

NA — No answer.

Source: Danilov, Victor J., ed. "$23 Billion for Research Funds; R & D Spending to Increase 8%." Industrial Research, Jan. 1966, p. 34.

Table 7A
Scope and Circulation Figures of the Czechoslovak Abstract Journal "Prehled Technicke A Hospodarske Literatury"
(1958)

Series of Prehled	(1958) Number of Abstracts	Pages	Number of subscribers
Mining	4,049	288	450
Metallurgy and Machine Engineering	9,904	722	889
Power and Energetics	7,075	528	885
Chemistry and Chemical Engineering	8,476	576	737
Building Construction	6,224	528	857
Total	35,728	2,642	3,868[a]

[a] Total subscription figure in 1959 was 4,550.

Source: Slamecka, Vladimir. "The Semi-Centralized System of Technical Documentation and Information of the Czechoslovak Republic and East Germany." Unpublished Doctoral Dissertation, Columbia University, School of Library Service, 1962, p. 112.

Table 8A

"Referat'vnyĭ Zhurnal," Main Series and Sub-Sections, 1967

	No. of Issues	U.S. Price
1. Avtomatika, Telemekhanika i Vychislitelnaia Tekhnika Automation, Telemechanics and Computer Technology	12	$ 25.00
a. Avtomatika i Telemekhanika Automation and Telemechanics	12	14.00
b. Vychislitelnaia Tekhnika Computer Technology	12	10.00
2. Avtomobilnye Dorogi Automobile Highways	12	10.00
a. Inkzhenernye Sooruzhenia Na Avtomobilnykh Dorogakh Building Arts for Automobile Highways	12	4.00
b. Stroitelstvo i Ekspluatatsia Avtomobilnykh Dorog Building and Maintenance of Automobile Highways	12	4.00
3. Avtomobilnyĭ i Gorodskoĭ Transport Automobile and City Transportation	12	24.00
a. Avtomobilestroenie Automobile Construction	12	16.00
b. Avtomobilnyĭ Transport Automobile Transport	12	4.00
c. Gorodskoĭ Transport City Transportation	12	3.00
4. Biologia Biology	12	166.00
a. Biofizika Biophysics	12	8.00
b. Botanika Botany	12	12.00
c. Entomologia Entomology	12	10.00
d Fiziologia Cheloveka i Zhivotnykh (nervnaia sistema, organy chuvstv, vnutrenniaia sekretsia, razmnozhenie) Human and Animal Physiology (nervous system, sense organs internal secretions, reproduction)	12	18.00
e. Fiziologia Cheloveka i Zhivotnykh (obschaia fiziologia, obmen veschestv i energii vnutrennie organy, krov) Human and Animal Physiology (general physiology, change of substances into energy, internal organs, blood)	12	18.00
	12	6.00

f. Fiziologia Rastenii Plant Physiology	12	6.00
g. Morfologia Cheloveka i Zhivotnykh, Antropologia, Genetika Cheloveka Human and Animal Morphology, Anthropology, Human Genetics	12	12.00
h. Obschhaya Biologiya, Tsitologiya, Genetika, Evolutsionnoe Uchenie General Biology, Cytology, Genetics, Evolutionary Science	12	12.00
i. Radiatsionnaia Biologia Radiation Biology	12	2.00
j. Virusologiya i Mikrobiologiya Virology and Microbiology	12	20.00
k. Zoologia Obschaia, Zoologia Bezpozvonochnykh, Gidrobiologia General Zoology, Invertebrate Zoology, Hydrobiology	12	6.00
l. Zoologia Pozvonochnykh Vertebrate Zoology	12	12.00
m. Zooparazitologia Animal Parasitology	12	8.00
5. Ekonomika Promyshlennosti Industrial Economics	12	34.00
a. Ekonomika i Organizatsia Proizvodstva Otraslei Tyazheloy Promyshlennosti Economics and Organization of Production of the Heavy Industry Sector	12	12.00
b. Ekonomika i Organizatsia Proizvodstva Otraslei i Pischevoi Promyshlennosti Economics and Organization of Production of the Light Industry and Food Industry Sectors	12	5.00
c. Mirovaia Ekonomika, Ekonomicheskoe Polozhenia Stran World Economics, Economic Conditions of Nations	12	6.00
d. Obschcotraslevye, Voprosy Ekonomiki i Organizatsii Promyshlennosti General Sector Problems of Economics and Organization of Industry	12	4.00
e. Organizatsia i Finansirovanie Nauchnykh i Issledovat, Rabot, Kadry, Zaniatost Organization and Financing of Scientific and Research Works, Employees, Employment	12	3.00
f. Primenenie Matematicheskikh Metodov v Ekonomicheskikh Issledovaniiakh i Planirovanii Application of Mathematical Methods to Economic Research and Planning	12	4.00
6. Elektronika i Ee Primenenie Electronics and its Application	12	17.00

a. Elektronika, Elektronnye i Ionnye Pribory Electronics, Electron and Ion Apparatus	12	10.00
b. Poluprovodnikovye Pribory Semiconductor Apparatus	12	6.00
7. Elektrotekhnika i Energetika Electrotechnology and Energetics	12	86.00
a. Atomnye Elektrostantsii Nuclear Power Stations	12	3.00
b. Elektricheskie Mashiny i Apparaty Electrical Machinery and Apparatus	12	12.00
c. Elektrotekhnicheskie Materialy, Elektricheskie Kondensatory, Provoda i Kabeli Electrical Materials, Electrical Condensers, Wire and Cable	12	5.00
d. Elektricheskie Stantsii, Seti i Sistemy Electrical Power Stations, Networks and Systems	12	12.00
e. Elektrifikatsia Byta Electrification	12	3.00
f. Elektrifikatsia i Avtomatizatsia Selskogo Khozialstva Rural Electrification and Automation	12	3.00
g. Elektrotekhnologia Electrotechnology	12	4.00
h. Elektrooborudovanie Transporta Electrical Equipment	12	4.00
i. Elektroprivod i Avtomatizatsia Promyshlennykh Ustanovok Electrification and Automation of Industrial Enterprises	12	4.00
j. Gidroenergetika i Vetroenergetika Hydro and Air Energetics	12	5.00
k. Kotelnye Ustanovki i Vodopodgotovka Boiler Installation and Water Treatment	12	4.00
l. Obschie i Teoret. Voprosy Elektrotekhniki, Novye Istochniki Toka General and Theoretical Problems of Electrotechnology; New Sources of Energy	12	5.00
m. Obschie i Teoreticheskie Voprosy Teploenergetiki, Gelioenergetik. General and Theoretical Problems of Thermo-energetics; Solar Energetics	12	3.00
n. Svetotekhnika i Infrakrasnaia Tekhnika Light and Infrared Technology	12	6.00
o. Teplotekhnicheskie Kharakteristiki Topliva, Ispolzovanie Gaza i Mazuta v Promyshlennosti Thermo-technological Characteristics of Fuel, Utilization of Gas and Fuel Oil in Industry	12	3.00
p. Teplovye Elektrostantsii	12	6.00

	Thermal Electrostations		
8.	Fizika Physics	12	105.00
	a. Fizika Atoma i Molekuly, Optika, Magnitnyi Rezonans Atomic and Molecular Physics, Optics, Magnetic Resonance	12	18.00
	b. Fizika Gazov, Zhidkostei, Polimerov i Tverdykh Tel Physics of Gases, Fluids, Polymers, and Hard Solids	12	24.00
	c. Fizika Plazmy Plasma Physics	12	6.00
	d. Iadernaia Fizika Nuclear Physics	12	10.00
	e. Obschie Voprosy Fiziki, Metodika i Tekhnika Fizicheskogo Eksperimenta General Problems in Physics, Methods and Techniques for Physics Experiments	12	10.00
	f. Radiofizika, Fizicheskie Osnovy Elektroniki, Akustika Radio physics, Physical Bases for Electronics, Acoustics	12	12.00
	g. Teoreticheskaia Fizika i Fizika Elementarnykh Chastits Theoretical Physics and Physics of Elementary Particles	12	9.00
9.	Geofizika Geophysics	12	46.00
	a. Fizika Zemli Earth Physics	12	4.00
	b. Geomagnetizm i Vysokie Sloi Atmosfery Geomagnetism and Upper Layer Atmosphere	12	8.00
10.	Geografia Geography	12	76.00
	a. Antropogenovyi Period, Geomorfologia Sushi i Morskogo Dna Anthropogenic Period, Geomorphology of Arids and Ocean Floor	12	8.00
	b. Biogeografia Biogeography	12	8.00
	c. Geografia Ameriki, Avstralii, Okeanii i Antarktiki Geography of America, Australia, Oceania and Antarctic	12	5.00
	d. Geografia SSR Geography of USSR	12	5.00
	e. Geografia Zarubezhnoi Azii i Afriki Geography of non-Soviet Asia and Africa	12	6.00
	f. Geografia Zarubezhnoi Evropy Geography of non-Soviet Europe	12	9.00

g. Kartografia Cartography	12	3.00
h. Meteorologia i Klimatologia Meteorology and Climatology	12	12.00
i. Okeanologia, Gidrologia Sushi, Gliatsiologia Oceanography, Hydrology of Arid Zones, Glaciers	12	10.00
j. Okhrana Prirody i Vosproizvodstvo Prirodnykh Resursov, Kraevedenie Conservation and Replenishment of Natural Resources. Knowledge of Countries	12	5.00
k. Teoreticheskie Voprosy Fizicheskoi i Ekonomicheskoi Geografii Theoretical Problems in Physical and Economic Geography	12	5.00
11. Geologia Geology	12	84.00
a. Geokhimia, Mineralogia, Petrografia Geochemistry, Mineralogy, Petrography	12	14.00
b. Geologicheskie i Geokhimicheskie Metody Poleznykh Iskopaemykh, Metody Razvedki i Otsenka Mestorozhdenii, Razvedochnaia i Promyslovaia Geofizika Geological and Geochemical Methods for Mineral Resources. Prospecting and Mineral Evaluation Methods, Prospecting and Industrial Geophysics	12	8.00
c. Gidrogeologia, Inzhenernaia Geologia, Merzlotovedenie Hydro and Engineering Geology, Permafrost	12	8.00
d. Mestorozhdenia Goriuchikh Poleznykh Iskopaemykh Deposits of Useful Minerals	12	6.00
e. Nemetallicheskie Poleznye Iskopaemye Non-metallic Mineral Resources	12	3.00
f. Obschaia Geologia General Geology	12	10.00
g. Rudnye Mestorozhdenia Mining Deposits	12	4.00
h. Stratigrafia, Paleontologia Stratigraphy, Paleontology	12	9.00
i. Tekhnika Geologo-Razvedochnykh Rabot Technique of Geologic Exploration	12	3.00
12. Gornoe Dello Mining	12	40.00
a. Obogaschnenie Poleznykh Iskopaemykh Dressing of Mineral Resources	12	5.00
b. Razrabotka Neftianykh i Gazovykh Mestorozhdenii Processing of Petroleum and Gas Deposits	12	9.00

	c. Stroitelstvo i Organizatsia Gornykh Predpriatii Building and Organization of Mining Enterprises	12	4.00
	d. Tekhnologia Vspomogatelnykh Protsessov Razrabotki Mestorozhdenii Tverdykh Poleznykh Iskopaemykh Technology of Ancillary Processes for Handling Hard Mineral Resources	12	5.00
	e. Tekhnologia Osnovnykh Protsessov Razrabotki Mestorozhdenii Tverdykh Iskopaemykh Technology of Basic Processes for Handling Hard Mineral Resources	12	12.00
13.	Khimia Chemistry	24	420.00
	a. Analiticheskaia Khimia, Oborudovanie Laboratorii Analytical Chemistry, Laboratory Equipment	24	16.00
	b. Khimia i Pererabotka Drevesiny, Goriuchikh Iskopaemykh i Prirodnykh Gazov Chemistry and Processing of Wood, Minerals, and Natural Gas	24	12.00
	c. Khimia i Tekhnologia Vysokomolekuliarnykh Soedinenii Chemistry and Technology of High Molecular Weight Compounds	24	56.00
	d. Khimia i Tekhnologia Pischevykh Produktov, Poverkhnostnoaktivnykh Materialov i Dushistykh, Veschestv Chemistry and Technology of Food Products, Surface Active Materials and Aromatic Substances	24	24.00
	e. Korrozia i Zaschita Ot Korrozii Corrosion and Corrosion Protection	24	7.00
	f. Obschie Voprosy Khimii. Fizicheskaia Khimia. Neorganicheskaia Khimia General Problems of Chemistry, Physical Chemistry, Inorganic Chemistry	24	56.00
	g. Obschie Voprosy Khimicheskoi Tekhnologii General Problems of Chemical Technology	24	18.00
	h. Organicheskaia Khimia Organic Chemistry	24	72.00
	i. Silikatnye Materialy Silicon Materials	24	12.00
	j. Tekhnologia Neorganicheskikh Veschestv Technology of Inorganic Substances	24	16.00
	k. Tekhnologia Organicheskikh Veschestv Technology of Organic Substances	24	34.00
14.	Kibernetika Cybernetics	12	25.00
	a. Teoria Verolatnostei i Matematicheskaia		

	Statistika. Teoreticheskaia Kibernetika Probability Theory and Mathematical Statistics. Theoretical Cybernetics	12	12.00
	b. Tekhnicheskaia Kibernetika Technical Cybernetics	12	10.00
15.	Legkaia Promyshlennost Light Industry	12	19.00
	a. Mashiny i Oborudovanie Dlia Tekstilnoi Promyshlennosti Machinery and Equipment for the Textile Industry	12	8.00
	b. Tekhnologia i Organizatsia Tekstilnogo Proizvodstva Technology and Organization of the Textile Industry	12	4.00
	c. Trikotazhnaia, Shveinaia i Kozhevenno-Obuvnaia Promyshlennost Knitting, Sewing, Leather and Footwear Industry	12	6.00
16.	Matematika Mathematics	12	50.00
	a. Matematicheskii Analiz Mathematical Analysis	12	16.00
	b. Obschie Voprosy Matematiki. Matematicheskaia Logika. Teoria Chisel. Algebra. Topologia Geometria General Mathematics Problems. Mathematical Logic. Theory of Numbers. Algebra. Topology. Geometry	12	12.00
	c. Teoria Veroiatnostei i Matematicheskaia Statistika. Teoreticheskaia Kibernetika Theory of Probability and Mathematical Statistics. Theoretical Cybernetics.	12	12.00
17.	Mekhanika Mechanics	12	56.00
	a. Gidromekhanika Hydromechanics	12	24.00
	b. Mekhanika Tverdykh Deforiruemykh Mechanics of the Deformation of Solids	12	16.00
	c. Obschie Voprosy Mekhaniki. Obschaia Mekhanika General Problems of Mechanics. General Mechanics	12	4.00
18.	Metallurgiya Metallurgy	12	57.00
	a. Metallovedenie i Termicheskaia Obrabotka Metallurgy and Thermal Metal Working	12	19.00
	b. Metallurgicheskaia Tepotekhnika, Kontrolno-Izmeritelnye Pribory i Avtomatizatsia		

Metallurgicheskogo Proizvodstva	12	3.00
Metallurgical Thermo-Technology, Control and Automation of Metallurgical Production		
c. Metallurgia Tsvetnykh i Redkikh Metallov	12	8.00
Metallurgy of Non-Ferrous and Rare Metals		
d. Proizvodstvo Chuguna i Stali	12	9.00
Production of Castings and Steel		
e. Prokatnoe i Volochilnoe Proizvodstvo	12	8.00
Rolling and Extrusion Processing		
f. Teoria Metallurgicheskikh Protsessov	12	2.00
Theory of Metallurgical Processes		
g. Tekhnicheskii Analiz v Metallurgii	12	3.00
Technical Analysis in Metallurgy		
19. Promyshlennyi Transport	12	14.00
Industrial Transport		
a. Mekhanizatsia i Avtomatizatsia Pogruzochno-Razgruzochnykh Rabot Na Promyshlennom Transporte	12	3.00
Mechanization and Automation of Loading and Unloading in Industrial Transport		
b. Podiemno-Transportnoe Mashinostroenie	12	6.00
Hoisting-Transport Machine Construction		
c. Transportnoe Khoziastvo Promyshlennykh Predpriatii	12	3.00
Transport Economy for Industrial Enterprises		
20. Radiotekhnika	12	38.00
Radiotechnology		
a. Radiotekhnika (Antenny. Volnovody. Ob'emnye Rezonatory. Kvazioptichesskie Ustroistva)	12	5.00
Radiotechnology (Antennas. Volume Resonators, Quasi-optical Instruments)		
b. Radiotekhnika (Priemniki. Usiliteli. Preobrazovateli Chastoty. Generatory. Peredaiuschie Ustroistva. Kvantovaia Radiotekhnika)	12	10.00
Radiotechnology (Receivers. Amplifiers. Transformer Elements. Transmitting Facilities. Quantum Radiotechnology)		
c. Radiotekhnika (Radioveschanie. Elektroakustika. Zvukozapis. Tekhnologia Proizvodstva Apparatura)	12	8.00
Radiotechnology (Radio Broadcasting. Electroacoustics. Sound Recording. Technology of Apparatus Production)		
d. Radiotekhnika (Radiolokatsia. Radionavigatsia. Televidenie. Impulsnaia Tekhnika)	12	6.00
Radiotechnology (Radiolocation. Television. Impulse Technique)		
e. Radiotekhnika (Teoreticheskaia Radiotekhnika.		

Radiosviaz. Radiopomekhi. Radioizmerenia)	12	6.00
Radiotechnology (Theoretical Radiotechnology. Radio Communication. Radio Impedance. Radio Measurement)		
21. Tekhnologia Mashinostroenia	12	55.00
Technology of Machine Construction		
a. Tekhnologia i Oborudovanie Derevoobrabatyvaiuschego Proizvodstva. Lesozagotoviteinoe Oborudovanie	12	6.00
Technology and Equipment of the Wood Working Industry. Forestry Preparatory Equipment		
b. Tekhnologia i Oborudovanie Kuznechno Kuznechnoshtampovochnogo Proizvodstva	12	6.00
Technology and Equipment of the Forging and Stamping Industry		
c. Tekhnologia i Oborudovanie Liteinogo Proizvodstva	12	9.00
Technology and Equipment of the Foundry Industry		
d. Tekhnologia i Oborudovanie Mekhanosborochnogo Proizvodstva	12	30.00
Technology and Equipment for Assembly-Line Production		
22. Teploenergetika	12	18.00
Thermo-energetics		
a. Atomnye Elektrostantsii	12	3.00
Nuclear Power Stations		
b. Kotelnye Ustanovki i Vodopodgotovka	12	4.00
Boiler Stations and Water Treatment		
c. Obschie i Teoreticheskie Voprosy Teploenergetiki. Gelioenergetika	12	3.00
General and Theoretical Problems of Thermo-energetics. Solar-energy		
d. Teplotekhnicheskie Kharakteristiki Topliva. Ispolzovanie Gaza i Mazuta v Promyshlennosti	12	3.00
Thermo-technological Characteristics of Fuel. Utilization of Gas and Fuel Oil in Industry		
e. Teplovye Elektrostantsii	12	6.00
Thermal Electrostations		
23. Vodnyi Transport	12	35.00
Water Transport		
a. Sudostroenie	12	12.00
Shipbuilding		
b. Tekhnicheskaia Ekspluatatsia i Remont Flota, Sudovozhdenie	12	4.00
Technical Exploitation and Repair of the Fleet Ship		

	c. Vodnye Perevozki Puti i Porty Water Travel, Waterways and Ports	12	6.00
24.	Vozdushnyi Transport Air Transportation	12	14.00
	a. Aviastroenie Airplane Construction	12	6.00
	b. Organizatsia Vozdushnykh Perevozok i Oborudovanie Aeroportov Organization of Air Transport and the Outfitting of Airports	12	4.00
	c. Tekhnicheskaia Ekspluatatsia i Remont Samoletov, Vertaletov i Drugikh Letatelnykh Apparatov Technical Maintenance and Repair of Airplanes, Helicopters, and other Flying Vehicles	12	3.00
25.	Zheleznodorozhnyi Transport Railroad Transportation	12	20.00
	a. Avtomatika, Telemekhanika i Sviaz Na Zheleznykh Dorogakh Automation, Telemechanics and Communication on Railroads	12	3.00
	b. Ekspluatatsia Zheleznykh Dorog Railroad Utilization	12	3.00
	c. Lokomotivostroenie i Vagonostroenie Locomotive and Railroad Car Construction	12	5.00
	d. Stroitelstvo Zheleznykh Dorog. Put i Putevoe Khozialstvo Railway Construction. Roads and Road Economy	12	4.00
	e. Tekhnicheskaia Ekspluatatsia Podvizhnogo Sostava i Tiaga Poezdov Technical Maintenance of Rolling Stock and Freight Trains	12	3.00

*Translation by author.

Source: Four Continent Book Corp. Periodicals of the USSR and Referativnye Zhurnaly 1967. New York, 1968, pp. 48-64.

Table 8B

Separately Issued Volumes of "Referativnyi Zhurnal"

		No. of Issues	U. S. Price
1.	Astronomia* Astronomy	12	$ 16.00
2.	Aviatsionnye i Raketnye Dvigateli Aviation and Rocket Engines	12	6.00

3.	Biologicheskaia Khimia Biological Chemistry	24	80.00
4.	Dvigateli Vnutrennego Sgorania Internal Combustions Engines	12	9.00
5.	Farmakologia, Khimoterapevticheskie Sredstva Toksikologia Pharmacology, Chemotherapeutical Means of Toxicology	12	24.00
6.	Electrosviaz Electro-Communication	12	20.00
7.	Foto-Kinotekhnika Photo-Film Technology	12	7.00
8.	Geodezia Geodsy	12	7.00
9.	Gornye Mashiny Mining Machinery	12	7.00
10.	Issledovanie Kosmicheskogo Prostranstva Research on the Cosmic State	12	12.00
11.	Khimicheskoe i Kholodilnoe Mashinostroenie Chemical and Refrigirant Machine Construction	12	17.00
12.	Kommunalnoe, Bytovoe i Torgovoe Oborudovanie Communal, Home and Business Equipment	12	8.00
13.	Kotlostroenie Boiler Construction	12	3.00
14.	Lesovedenie i Lesovodstvo Forest Science and Forestry	12	6.00
15.	Mashinostroitelnye Materialy, Konstruktsii i Raschet Detalei Mashin. Gidroprivod Machine Construction Materials, Construction and Detail Machine Design	12	19.00
16.	Meditsinskaia Geografia Medical Geography	12	6.00
17.	Metrologia i Ameritelnaia Tekhnika Metrology and Measurement Technique	12	28.00
18.	Nasosostroenie i Kompressorostroenie Internal and External Pressure Construction	12	5.00
19.	Nauchnaia i Tekhnicheskaia Informatsia Scientific and Technical Information	6	8.00
20.	Oborudovanie Pischevoi Promyshlennosti Outfitting of the Food Industry	12	11.00
21.	Obschie Voprosy Patologii. Onkologia General Problems of Pathology and Oncology	12	21.00
22.	Organizatsia Upravlenia Promyshlennostiu Organization of Administration in Industry		

23.	Pochvovedenie i Agrokhimia Social Science and Agricultural Chemistry	12	7.00
24.	Raketostroenie Rocket Technology	12	6.00
25.	Rastenievodstvo Plant Science	24	20.00
26.	Stroiteinye i Dorozhyne Mashiny Building and Road Machines	12	6.00
27.	Tekhnologia i Oborudovanie Tsellulozno Bumazhnogo Poligraf. Proizvod Technology and Equipment for the Pulp-Paper-Poligraphy Industry	12	12.00
28.	Svarka Welding		
29.	Traktory i Selskokhoz. Mashiny i Orudia Tractors and Farm Machines and Implements	12	13.00
30.	Truboprovodny Transport Tube Transport	12	5.00
31.	Turbostroenie Turbine Construction	12	4.00
32.	Voprosy Tekhnicheskogo Progressa i Organizatsii Proizvodstva v Mashinostroenii Problems of Technical Progress and Organization of Production in Machine Construction	12	6.00
33.	Vzaimodeistvie Raznykh Vidov Transporta i Konteinernye Perevozki Interaction of Various Types of Transport and the Shipment of Containers	12	5.00
34.	Zhivotnovodstvo. Veterinaria Animal Husbandry - Veterinary Medicine	12	14.00
35.	Yadernye Reaktory Nuclear Reactors	12	4.00

* Translation by author

Source: The Four Continent Book Corp. Periodicals of the USSR and Referativnye Zhurnaly 1967. New York, 1966, pp. 48-64.

Table 9A

Non-Federal U. S. Recipients, by Detailed COSATI Subject Categories (DOD Modified)

Subject Field and Group	No. of Recipients[a]	Percent of Total
01 Aeronautics		
01 Aerodynamics	187	2.41
02 Aeronautics	14	.18
03 Aircraft	1	.01
04 Aircraft Flight Instrumentation	142	1.82
05 Air Facilities	39	.05
02 Agriculture	13	.17
01 Agricultural Chemistry	16	.21
03 Agricultural Engineering	18	.23
04 Agronomy and Horticulture	7	.09
05 Animal Husbandry	8	.10
06 Forestry	9	.11
03 Astronomy and Astrophysics	4	.05
01 Astronomy	52	.67
02 Astrophysics	7	09
04 Atmospheric Sciences	13	.17
01 Atmospheric Physics	18	.23
02 Meteorology	11	.14
05 Behavioral and Social Sciences	17	.22
01 Administration and Management	24	.31
02 Documentation and Information Technology	15	.19
03 Economics	46	.59
04 History, Law, and Political Science	52	.67
05 Human Factors Engineering	7	.09
06 Humanities	3	.04
07 Linguistics	1	.01
08 Man-Machine Relations	2	.03
09 Personnel Selection, Training and Evaluation	16	.21
10 Psychology (Individual and Group Behavior)	10	.13
11 Sociology	27	.35
06 Biological and Medical Sciences	5	.06
01 Biochemistry	88	1.13
02 Bioengineering	15	.19
03 Biology	29	.37
04 Bionics	44	.57
05 Clinical Medicine	3	.04
06 Environmental Biology	214	2.75
07 Escape, Rescue, and Survival	18	.23
08 Food	1	.01
09 Hygiene	32	.41
10 Industrial (Occupational) Medicine	4	.05
11 Life Support	4	.05
	2	.03

	12 Medical and Hospital Equipment and Supplies	15	.19
	13 Microbiology	6	.08
	15 Pharmacology	73	.94
	16 Physiology	17	.22
	17 Protective Equipment	3	.04
	18 Radiobiology	37	.48
	19 Stress Physiology	2	.03
	20 Toxicology	4	.05
07	Chemistry	271	3.49
	01 Chemical Engineering	36	.46
	02 Inorganic Chemistry	9	.13
	03 Organic Chemistry	50	.64
	04 Physical Chemistry	6	.08
	05 Radio and Radiation Chemistry	16	.21
08	Earth Sciences and Oceanography	28	.36
	01 Biological Oceanography	17	.22
	02 Cartography	5	.06
	03 Dynamic Oceanography	5	.06
	04 Geochemistry	1	.01
	05 Geodesy	3	.04
	06 Geography	5	.06
	07 Geology and Mineralogy	12	.15
	08 Hydrology and Limnology	1	.01
	09 Mining Engineering	40	.51
	11 Seismology	3	.04
09	Electronics and Electrical Engineering	255	3.28
	01 Components	274	3.53
	02 Computers	197	2.54
	03 Electronic and Electrical Engineering	256	3.30
	04 Information Theory	5	.06
	05 Subsystems	93	1.20
	06 Telemetry	10	.13
10	Energy Conversion (Non-Propulsive)	9	.12
	01 Conversion Techniques	17	.22
	02 Power Sources	22	.28
	03 Energy Storage	19	.24
11	Materials	62	.80
	01 Adhesives and Seals	16	.21
	02 Ceramics, Refractories, and Glasses	114	1.47
	03 Coatings, Colorants, and Finishes	57	.73
	04 Composite Materials	6	.08
	05 Fibers and Textiles	40	.51
	06 Metallurgy and Metallography	259	3.33
	07 Miscellaneous Materials	8	.10
	08 Oils, Lubricants, and Hydraulic Fluids	100	1.29
	09 Plastics	71	.91
	10 Rubbers	38	.49
	11 Solvents, Cleaners and Abrasives	26	.33
	12 Wood and Paper Products	32	.41
12	Mathematical Sciences	23	.30
	01 Mathematics and Statistics	3	.04
	02 Operations Research	10	.13

13	Mechanical, Industrial, Civil, and Marine Engineering	350	4.51
	01 Air Conditioning, Heating, Lighting, and Ventilating	65	.48
	02 Civil Engineering	98	1.26
	03 Construction Equipment, Materials and Supplies	1	.01
	04 Containers and Packaging	11	.14
	05 Couplings, Fasteners, and Joints	15	.19
	06 Ground Transportation Equipment	87	1.12
	07 Hydraulic and Pneumatic Equipment	46	.59
	08 Industrial Processes	78	1.00
	09 Machinery and Tools	147	1.89
	10 Marine Engineering	52	.67
	11 Pumps, Filters, Pipes, Tubing and Valves	69	.89
	12 Safety Engineering	16	.21
	13 Structural Engineering	9	.12
14	Methods and Equipment	7	.09
	01 Cost Effectiveness	58	.75
	02 Laboratories, Test Facilities, and Test Equipment	83	1.07
	03 Recording Devices	14	.18
	04 Reliability	14	.18
	05 Reprography	81	1.04
15	Military Sciences	17	.22
	03 Defense	13	.17
	05 Logistics	3	.04
	07 Operations, Strategy, and Tactics	4	.05
16	Missile Technology	81	1.04
	01 Missile Launching and Ground Support	10	.13
	02 Missile Trajectories	4	.05
	03 Missile Warheads and Fuzes	1	.01
	04 Missiles	25	.32
17	Navigation, Communications, Detection and Countermeasures	148	1.91
	01 Acoustic Detection	6	.08
	02 Communications	153	1.97
	04 Electromagnetic and Acoustic Countermeasures	4	.05
	05 Infrared and Ultraviolet Detection	13	.17
	07 Navigation and Guidance	42	.54
	08 Optical Detection	12	.15
	09 Radar Detection	6	.08
	10 Seismic Detection	8	.10
18	Nuclear Science and Technology	183	2.36
	02 Isotopes	8	.10
	03 Nuclear Explosions	8	.10
	04 Nuclear Instrumentation	19	.24
	06 Radiation Shielding and Protection	12	.15
	07 Radioactive Wastes and Fission Products	5	.06

	08 Radioactivity	9	.12
	09 Reactor Engineering and Operation	1	.01
	10 Reactor Materials	17	.22
	12 Reactors (Power)	6	.08
19	Ordnance	39	.50
	01 Ammunition, Explosives, and Pyrotechnics	20	.26
	03 Combat Vehicles	8	.10
	04 Explosions, Ballistics, and Armor	4	.05
	05 Fire Control and Bombing Systems	3	.04
	06 Guns	1	.01
	07 Rockets	1	.01
20	Physics	173	2.23
	01 Acoustics	23	.30
	03 Electricity and Magnetism	11	.14
	04 Fluid Mechanics	20	.26
	05 Masers and Lasers	14	.18
	06 Optics	26	.33
	07 Particle Accelerators	14	.18
	08 Particle Physics	25	.32
	09 Plasma Physics	14	.18
	11 Solid Mechanics	20	.26
	12 Solid State Physics	7	.09
	13 Thermodynamics	16	.21
	14 Wave Propagation	4	.05
21	Propulsion and Fuels	36	.46
	01 Air-Breathing Engines	3	.04
	02 Combustion and Ignition	18	.23
	03 Electric Propulsion	2	.03
	04 Fuels	49	.63
	05 Jet and Gas Turbine Engines	14	.18
	06 Nuclear Propulsion	8	.10
	07 Reciprocating Engines	3	.04
	08 Rocket Motors and Engines	39	.50
	09 Rocket Propellants	34	.44
22	Space Technology	260	3.35
	01 Astronautics	3	.04
	02 Spacecraft	6	.08
	03 Spacecraft Trajectories and Reentry	6	.08
	04 Spacecraft Launch Vehicles and Ground Support	2	.03
25	Science	132	1.70
26	Technology	119	1.53
29	General	545	7.02
	Total	7,766[a]	100

[a] Excludes subject analysis for 183 private/official recipients.

Table 10 A

Non-Federal U. S. Recipients, by Type of Institution and COSATI Subject Field

	Industrial	Percent	Educational Nonprofit	Percent	State and Local Govt.	Percent	Private Recipients [a]
Aeronautics (01)	307	5.8	68	3.6	1	1.7	-
Agriculture (02)	26	0.5	36	1.5	-	-	-
Astronomy and Astrophysics (03)	12	0.2	60	2.5	-	-	-
Atmospheric Sciences (04)	24	0.5	22	0.9	-	-	-
Behavioral and Social Sciences (05)	102	1.9	99	4.1	7	11.9	-
Biological and Medical Sciences (06)	213	4.0	369	15.2	29	49.2	-
Chemistry (07)	273	5.2	115	4.7	-	-	-
Earth Sciences and Oceanography (08)	50	0.9	69	2.8	1	1.7	-
Electronics and Electrical Engineering (09)	996	18.8	94	3.9	-	-	-
Energy Conversion (Non-propulsive) (10)	63	1.2	4	0.2	-	-	-
Materials (11)	773	14.6	56	2.[illegible]	-	-	-

Table 10 A - continued

	Industrial	Percent	Educational/ Nonprofit	Percent	State and Local Govt.	Percent	Private Recipients[a]
Mathematical Sciences (12)	16	0.3	20	0.8	-	-	-
Mechanical, Industrial, Civil, and Marine Engineering (13)	733	13.9	296	12.2	15	25.4	-
Methods and Equipment (14)	240	4.5	17	0.7	-	-	-
Military Sciences (15)	29	0.5	8	0.3	-	-	-
Missile Technology (16)	117	2.2	4	0.2	-	-	-
Navigation, Communications, Detection, and Countermeasures (17)	390	7.4	2	0.1	-	-	-
Nuclear Science and Technology (18)	194	3.7	68	2.8	6	10.2	-
Ordnance (19)	73	1.4	3	0.1	-	-	-
Physics (20)	171	3.2	196	8.1	-	-	-
Propulsion and Fuels (21)	194	3.7	12	0.5	-	-	-
Space Technology (22)	245	4.6	32	1.3	-	-	-
Science (25)	3	-	129	5.3	-	-	-

Technology (26)	2	-	117	4.8	-	-	-
General (27)	42	0.8	503	20.8	-	-	-
Total	5,288	99.8	2,419	99.7	59	100.1	183
Percent	66.52		30.43		0.74		2.30

[a] Total only available.

Table 11 A

Non-Federal U. S. Recipients, by Service and COSATI Subject Field

	NSA		STAR		TAB		USGRDR	
	No. of Recipients	Per-cent	No. of Recipients	Per-cent	No. of Recipients	Per-cent	No. of Recipients	Per-cent
Aeronautics (01)	19	1.5	229	8.6	95	5.1	53	1.6
Agriculture (02)	27	2.2	12	0.5	2	0.1	21	1.0
Astronomy and Astrophysics (03)	3	0.2	49	1.8	15	0.8	5	0.2
Atmospheric Sciences (04)	6	0.5	17	0.6	18	1.0	5	0.2
Behavioral and Social Sciences (05)	11	0.9	60	2.3	62	3.3	75	3.7
Biological and Medical Sciences (06)	224	18.1	112	4.2	120	6.5	155	7.7
Chemistry (07)	96	7.8	104	3.9	63	3.4	125	6.2
Earth Sciences and Oceanography (08)	20	1.6	29	1.1	45	2.4	26	1.3
Electronics and Electrical Engineering (09)	78	6.3	337	12.7	370	19.9	306	15.2
Energy Conversion (Non-propulsive) (10)	12	1.0	27	1.0	16	0.9	12	0.6
Materials (11)	121	9.8	196	7.4	131	7.0	381	19.0
Mathematical Sciences (12)	1	0.1	11	0.4	21	1.1	3	0.1
Mechanical, Industrial, Civil, and Marine Engineering (13)	83	6.7	461	17.3	201	10.8	299	14.9

Methods and Equipment (14)	19	1.5	74	2.7	76	4.1	88	4.4
Military Sciences (15)	3	0.2	12	0.5	19	1.0	3	0.1
Missile Technology (16)	12	1.0	49	1.8	40	2.2	20	1.0
Navigation, Communications, Detection, and Countermeasures (17)	21	1.7	130	4.9	161	8.7	80	4.0
Nuclear Science and Technology (18)	111	9.0	71	2.7	49	2.6	37	1.8
Ordnance (19)	4	0.3	26	1.0	29	1.6	17	0.8
Physics (20)	81	6.5	148	5.6	94	5.1	44	2.2
Propulsion and Fuels (21)	30	2.4	78	2.9	54	2.9	44	2.2
Space Technology (22)	38	3.1	122	4.6	73	3.9	44	2.2
Science (25)	20	1.6	55	2.1	42	2.3	15	0.7
Technology (26)	23	1.9	52	2.0	23	1.2	21	1.0
General (27)	174	14.1	203	7.6	41	2.2	127	6.3
Totals[a]	1237	100.0	2664	99.8	1860	100.1	2005	99.9
Percent	15.9		34.3		24.0		25.8	

[a]Excludes subject analysis for 183 private/official recipeints.

Table 12 A

Non-Federal U. S. Recipients, by State

States	Recipients	Percent
Alabama	75	0.94
Alaska	8	0.10
Arizona	64	0.81
Arkansas	14	0.18
California	1,262	15.38
Colorado	106	1.33
Connecticut	213	2.68
Delaware	70	0.88
Dist. of Col.	210	2.64
Florida	134	1.69
Georgia	51	0.64
Hawaii	13	0.16
Idaho	11	0.14
Illinois	390	4.91
Indiana	180	2.27
Iowa	49	0.62
Kansas	61	0.77
Kentucky	46	0.58
Louisiana	46	0.58
Maine	12	0.15
Maryland	237	2.98
Massachusetts	574	7.22
Michigan	271	3.41
Minnesota	126	1.59
Mississippi	19	0.24
Missouri	98	1.23
Montana	5	0.06
Nebraska	13	0.16
Nevada	19	0.24
New Hampshire	24	0.30
New Jersey	435	5.47
New Mexico	50	0.63
New York	1,016	12.78
North Carolina	82	1.03
North Dakota	4	0.05
Ohio	422	5.31
Oklahoma	74	0.93
Oregon	40	0.50
Pennsylvania	553	6.96
Rhode Island	21	0.26
South Carolina	21	0.26
South Dakota	9	0.11
Tennessee	79	0.99
Texas	262	3.30
Utah	30	0.38
Vermont	11	0.14
Virginia	196	2.47
Washington	83	1.04
West Virginia	34	0.43
Wisconsin	122	1.53
Wyoming	4	0.05
Total	7,949	100

Table 13A

R & D Contracts, by State
(Fiscal Year 1964)

California	24,172.4
Massachusetts	20,095.8
New York	17,753.8
Illinois	12,409.5
Pennsylvania	10,113.7
Texas	3,733.2
Maryland	3,689.9
New Jersey	3,547.1
Rhode Island	3,085.6
North Carolina	2,670.4
Michigan	2,584.1
Florida	2,463.8
Ohio	2,157.7
District of Columbia	2,148.0
Wisconsin	1,677.2
Washington	1,629.5
Connecticut	1,575.8
Indiana	1,536.7
Minnesota	1,373.9
Alaska	1,350.9
Iowa	1,150.1
Georgia	1,131.9
Virginia	1,047.7
Oregon	824.6
Missouri	753.2
New Mexico	680.9
Colorado	590.1
Louisiana	536.9
Utah	489.2
Oklahoma	435.2
Arizona	415.0
New Hampshire	322.9
Tennessee	284.1
Kansas	282.1
Hawaii	247.8
Kentucky	243.0
Delaware	231.2
Mississippi	131.2
South Carolina	112.1
Vermont	80.7
Montana	57.6
Alabama	41.0
Nebraska	21.0
Idaho	18.1
South Dakota	17.0
West Virginia	9.9
Maine	5.8
Arkansas	0

Nevada	0
Wyoming	0
North Dakota	0

Source: U. S. Congress. Senate. Committee on Labor and Public Welfare. Subcommittee on Employment and Manpower. Impact of Federal Research and Development Policies on Scientific and Technical Manpower. Hearings. 89th Cong., 1st Sess., June 2, 3, 4, 7, 8, 9, 10, and July 22, 1965. Washington, D. C., U. S. Govt. Print. Off., 1965, p. 449.

Table 14 A

Geographic Distribution of Scientists and Engineers

	Combined Scientists and Engineers		
	Number	Percent of Total	Percent of Labor Force
	Thousands		
All States	1,275.0	100.0	1.8
Alabama	14.0	1.1	1.2
Alaska	1.7	0.1	1.7
Arizona	8.1	0.6	1.8
Arkansas	3.8	0.3	0.6
California	172.8	13.6	2.7
Colorado	16.7	1.3	2.5
Connecticut	27.7	2.2	2.6
Delaware	8.2	0.6	4.6
District of Columbia	15.9	1.4	4.6
Florida	23.0	1.8	1.2
Georgia	15.3	1.2	1.0
Hawaii	2.6	0.2	0.9
Idaho	3.0	0.2	1.2
Illinois	75.7	6.0	1.8
Indiana	29.0	2.3	1.6
Iowa	11.1	0.9	1.0
Kansas	14.5	1.1	1.7
Kentucky	9.3	0.7	0.9
Louisiana	15.0	1.2	1.4
Maine	3.4	0.3	1.0
Maryland	38.0	3.0	3.1
Massachusetts	50.3	3.9	2.3
Michigan	58.6	4.6	2.0
Minnesota	20.1	1.6	1.6
Mississippi	5.2	0.4	0.7
Missouri	23.0	1.8	1.4
Montana	3.5	0.3	1.4
Nebraska	5.2	0.4	0.9
Nevada	1.7	0.1	1.4
New Hampshire	3.4	0.3	1.4

New Jersey	69.0	5.4	2.7
New Mexico	9.4	0.7	2.8
New York	138.8	10.9	2.0
North Carolina	13.7	1.1	0.8
North Dakota	1.7	0.1	0.8
Ohio	74.2	5.8	1.9
Oklahoma	14.6	1.1	1.7
Oregon	10.7	0.8	1.6
Pennsylvania	77.3	6.1	1.8
Rhode Island	4.7	0.4	1.3
South Carolina	6.0	0.5	0.7
South Dakota	1.7	0.1	0.7
Tennessee	16.3	1.3	1.3
Texas	59.9	4.7	1.7
Utah	8.5	0.7	2.7
Vermont	1.7	0.1	1.2
Virginia	24.3	1.9	1.6
Washington	27.7	1.2	2.5
West Virginia	7.6	0.6	1.3
Wisconsin	23.5	1.8	1.5
Wyoming	3.0	0.2	2.3

Source: U.S. Congress. House. Select Committee on Government Research. Statistical Review of Research and Development. Report, 88th Cong., 2nd Sess. (House Report 1940; Study No. IX). Washington, D.C., U.S. Govt. Print. Off., 1964, p. 194.

Table 15 A

Non-Federal U. S. Recipients, by Type of Institution and State

States	Industrial	Per-cent	Education Nonprofit	Per-cent	Private Recipients	Per-cent	State and Local Govt.	Per-cent
Alabama	46	0.86	29	1.19	-	-	-	-
Alaska	1	0.02	6	0.25	-	-	2	3.39
Arizona	41	0.77	22	0.91	1	0.55	-	-
Arkansas	1	0.02	11	0.45	1	0.55	1	1.69
California	962	18.19	259	10.71	32	17.49	9	15.25
Colorado	60	1.13	43	1.78	3	1.64	-	-
Connecticut	157	2.97	45	1.86	11	5.46	-	-
Delaware	53	1.00	15	0.62	2	1.09	-	-
Dist. of Col.	135	2.55	64	2.65	9	4.92	2	3.39
Florida	84	1.59	43	1.78	3	1.64	4	6.78
Georgia	17	0.32	32	1.32	1	0.55	1	1.69
Hawaii	-	-	11	0.45	1	0.55	1	1.69
Idaho	5	0.09	6	0.25	-	-	-	-
Illinois	228	4.31	149	6.16	10	5.46	3	5.08
Indiana	98	1.85	81	3.35	1	0.55	-	-
Iowa	21	0.40	27	1.12	-	-	1	1.69
Kansas	24	0.41	36	1.49	-	-	1	1.69
Kentucky	24	0.41	19	0.79	1	0.55	2	3.39
Louisiana	24	0.41	20	0.83	1	0.55	1	1.69
Maine	7	0.13	5	0.21	-	-	-	-
Maryland	167	3.16	57	2.36	10	5.46	3	5.08
Massachusetts	394	7.45	173	7.19	6	3.28	-	
Michigan	172	3.25	94	3.89	3	1.64	2	3.39
Minnesota	81	1.53	43	1.78	1	0.55	1	1.69
Mississippi	5	0.09	13	0.54	-	-	1	1.69
Missouri	55	1.04	40	1.65	2	1.09	1	1.69
Montana	-	-	5	0.21	-	-	-	-

Nebraska	4	0.08	9	0.37	-	-	-	-
Nevada	11	0.21	7	0.29	1	0.55	-	-
New Hampshire	14	0.26	9	0.37	1	0.55	-	-
New Jersey	373	7.05	49	2.03	13	7.10	-	-
New Mexico	18	0.34	30	1.24	2	1.09	-	-
New York	662	12.52	315	13.01	27	-	12	20.34
North Carolina	37	0.70	42	1.74	2	1.09	1	1.69
North Dakota	-	-	4	0.17	-	-	-	-
Ohio	304	5.75	106	4.38	10	5.46	2	3.39
Oklahoma	37	0.70	35	1.45	1	0.55	1	1.69
Oregon	21	0.40	17	0.70	-	-	2	3.39
Pennsylvania	398	7.53	147	5.87	7	3.83	1	1.69
Rhode Island	3	0.06	18	0.74	-	-	1	1.69
South Carolina	10	0.19	11	0.45	-	-	-	-
South Dakota	2	0.04	7	0.29	-	-	-	-
Tennessee	41	0.78	35	1.45	3	1.64	-	-
Texas	170	3.21	84	3.47	6	3.28	2	3.39
Utah	14	0.26	15	0.62	1	0.55	-	-
Vermont	8	0.15	3	0.12	-	-	-	-
Virginia	153	2.89	38	1.57	5	2.73	-	-
Washington	44	0.83	38	1.57	1	0.55	-	-
West Virginia	22	0.42	11	0.45	-	-	1	1.69
Wisconsin	80	1.51	38	1.61	3	1.64	-	-
Wyoming	-	-	3	0.12	1	0.55	-	-
Totals	5,288		2,419		183		59	
Percent	66.5		30.4		2.3		0.7	

Table 16A

Non-Federal U. S. Recipients, by Service and State

States	NSA		STAR		TAB		USGRDR	
	No. of Recipients	Percent	No. of Recipients	Percent	No. of Recipients	Percent	No. of Recipients	Percent
Alabama	9	0.7	29	1.1	26	1.4	11	0.5
Alaska	4	0.3	1	-	3	0.2	-	-
Arizona	8	0.6	22	0.8	23	1.2	11	0.5
Arkansas	5	0.4	4	0.1	1	0.1	4	0.2
California	151	12.0	469	17.3	376	20.1	266	12.7
Colorado	19	1.5	31	1.1	29	1.6	27	1.3
Connecticut	30	2.4	69	2.5	41	2.2	73	3.5
Delaware	12	1.0	21	0.8	17	0.9	20	1.0
Dist. of Col.	26	2.1	88	3.2	64	3.4	32	1.5
Florida	22	1.7	46	1.7	39	2.1	27	1.3
Georgia	14	1.1	18	0.7	8	0.4	11	0.5
Hawaii	4	0.3	4	0.1	4	0.2	1	-
Idaho	3	0.2	5	0.2	2	0.1	1	-
Illinois	58	4.6	124	4.6	62	3.0	146	7.0
Indiana	20	1.6	73	2.7	25	1.3	62	3.0
Iowa	6	0.5	21	0.8	8	0.4	14	0.7
Kansas	10	0.8	22	0.8	16	0.9	13	0.6
Kentucky	15	1.2	11	0.4	9	0.5	11	0.5
Louisiana	8	0.6	15	0.6	10	0.5	13	0.6
Maine	2	0.2	6	0.2	-	-	4	0.2
Maryland	27	2.1	93	3.4	80	4.3	37	1.8
Massachusetts	80	6.3	183	6.7	180	9.6	131	6.2
Michigan	39	3.1	97	3.6	58	3.1	77	3.7
Minnesota	28	2.2	35	1.3	21	1.1	43	2.0
Mississippi	7	0.6	6	0.2	4	0.2	2	0.1

Missouri	22	1.7	36	1.3	15	0.8	25	1.2
Montana	1	0.1	3	0.1	1	0.1	-	-
Nebraska	5	0.4	4	0.1	-	-	4	0.2
Nevada	7	0.6	5	0.2	2	0.1	5	0.2
New Hampshire	2	0.2	10	0.4	5	0.3	7	0.3
New Jersey	55	4.4	126	4.6	98	5.2	156	7.4
New Mexico	13	1.0	17	0.6	12	0.6	8	0.4
New York	189	15.0	330	12.1	195	10.4	301	14.4
North Carolina	13	1.0	33	1.2	18	1.0	18	0.9
North Dakota	3	0.2	1	-	-	-	-	-
Ohio	71	5.6	130	4.6	95	5.1	126	6.0
Oklahoma	13	1.0	28	1.0	12	0.6	21	1.0
Oregon	8	0.6	14	0.5	8	0.4	10	0.5
Pennsylvania	98	7.8	183	6.7	105	5.6	167	8.0
Rhode Island	3	0.2	7	0.3	9	0.5	2	0.1
South Carolina	5	0.4	5	0.2	5	0.3	6	0.3
South Dakota	2	0.2	5	0.2	2	0.1	-	-
Tennessee	27	2.1	23	0.8	10	0.5	19	0.9
Texas	46	3.6	95	3.5	58	3.1	63	3.0
Utah	5	0.4	14	0.5	10	0.5	1	-
Vermont	2	0.2	2	0.1	4	0.2	2	0.1
Virginia	25	2.0	69	2.5	62	3.3	40	1.9
Washington	13	1.0	34	1.3	18	1.0	18	0.9
West Virginia	8	0.6	11	0.4	2	0.1	13	0.6
Wisconsin	21	1.7	36	1.3	19	1.0	48	2.2
Wyoming	1	0.1	1	-	-	-	2	0.1
Total	1262		2718		1871		2098	
Percent	15.9		34.2		23.5		26.4	

Table 17 A

Industrial Recipients, by Service and State

States	NSA		STAR		TAB		USGRDR	
	No. of Recipients	Percent	No. of Recipients	Percent	No. of Recipients	Percent	No. of Recipients	Percent
Albama	2	0.34	17	1.01	17	1.26	10	0.60
Alaska	-	-	1	0.06	-	-	-	-
Arizona	5	0.85	10	0.59	16	1.19	10	0.60
Arkansas	-	-	-	-	1	0.07	-	-
California	100	17.00	338	20.10	316	23.46	208	12.50
Colorado	5	0.85	19	1.12	17	1.26	19	1.14
Connecticut	16	2.72	50	2.96	34	2.52	57	3.42
Delaware	9	1.53	14	0.83	13	0.97	17	1.02
Dist. of Col.	7	1.19	59	3.49	48	3.56	21	1.26
Florida	7	1.19	28	1.66	27	2.00	22	1.32
Georgia	2	0.34	8	0.47	2	0.15	5	0.30
Hawaii	-	-	-	-	-	-	-	-
Idaho	2	0.34	1	0.06	1	0.07	1	0.06
Illinois	25	4.25	53	3.14	34	2.52	116	6.97
Indiana	8	1.36	37	2.19	14	1.04	39	2.34
Iowa	1	0.17	6	0.36	5	0.37	9	0.54
Kansas	1	0.17	7	0.41	7	0.52	9	0.54
Kentucky	4	0.68	7	0.41	3	0.22	10	0.60
Louisiana	1	0.17	6	0.36	5	0.37	12	0.72
Maine	1	0.17	2	0.12	-	-	4	0.24
Maryland	12	2.04	70	4.14	57	4.23	28	1.68
Massachusetts	36	6.12	122	7.22	132	9.80	104	6.25
Michigan	17	2.89	54	3.20	41	3.04	60	3.61
Minnesota	10	1.70	19	1.12	14	1.04	38	2.28

Mississippi	1	0.17	1	0.06	2	0.15	1	0.06
Missouri	8	1.36	16	0.95	10	0.74	21	1.26
Montana	-	-	-	-	-	-	-	-
Nebraska	1	0.17	-	-	-	-	3	0.18
Nevada	3	0.51	2	0.17	3	0.22	3	0.18
New Hampshire	-	-	6	0.36	2	0.22	6	0.36
New Jersey	42	7.14	106	6.26	86	6.38	139	8.35
New Mexico	3	0.51	4	0.24	7	0.52	4	0.24
New York	90	15.31	197	11.66	134	9.95	241	14.48
North Carolina	4	0.68	13	0.77	8	0.59	12	0.72
North Dakota	-	-	-	-	-	-	-	-
Ohio	37	6.29	94	5.57	70	5.20	103	6.19
Oklahoma	6	1.02	10	0.59	7	0.52	14	0.84
Oregon	3	0.51	6	0.36	4	0.30	8	0.48
Pennsylvania	52	8.84	129	7.63	74	5.49	143	8.47
Rhode Island	-	-	1	0.06	1	0.07	1	0.05
South Carolina	2	0.34	1	0.06	2	0.15	5	0.30
South Dakota	-	-	1	0.06	1	0.07	-	-
Tennessee	8	1.36	11	0.65	8	0.59	14	0.84
Texas	22	3.74	58	3.43	41	3.04	49	2.94
Utah	1	0.17	7	0.41	6	0.45	-	-
Vermont	-	-	2	0.12	4	0.30	2	0.12
Virginia	15	2.55	51	3.02	52	3.86	35	2.10
Washington	4	0.68	18	1.07	10	0.74	12	0.72
West Virginia	4	0.68	6	0.36	1	0.07	11	0.66
Wisconsin	11	1.87	21	1.24	10	0.74	38	2.28
Wyoming	-	-	-	-	-	-	-	-
Total	588		1689		1347		1664	
Percent	11.12		31.94		25.47		31.47	

Table 18A

Educational/Nonprofit Recipients, by Service and State

State	NSA		STAR		TAB		USGRDR	
	No. of Recipients	Percent	No. of Recipients	Percent	No. of Recipients	Percent	No. of Recipients	Percent
Alabama	7	1.13	12	1.24	9	1.76	1	0.31
Alaska	4	0.65	1	0.10	1	0.20	-	-
Arizona	3	0.48	11	1.14	7	1.38	1	0.31
Arkansas	4	0.65	4	0.41	-	-	3	0.93
California	45	7.26	118	12.19	54	10.61	42	13.04
Colorado	13	2.10	12	1.24	12	2.36	6	1.86
Connecticut	14	2.26	17	1.76	7	1.38	7	2.18
Delaware	3	0.48	6	0.62	4	0.79	2	0.62
Dist. of Col.	17	2.74	27	2.79	16	3.14	4	1.24
Florida	11	1.77	16	1.65	12	2.36	4	1.24
Georgia	11	1.77	10	1.03	6	1.18	5	1.56
Hawaii	3	0.48	4	0.41	4	0.79	-	-
Idaho	1	0.16	4	0.41	1	0.20	-	-
Illinois	32	5.16	69	7.13	27	5.30	21	6.52
Indiana	12	1.94	36	3.72	11	2.16	22	6.83
Iowa	5	0.81	15	1.55	3	0.59	4	1.24
Kansas	8	1.29	15	1.55	9	1.77	4	1.24
Kentucky	9	1.45	4	0.41	5	0.98	1	0.31
Louisiana	6	0.97	9	0.93	5	0.98	-	-
Maine	1	0.16	4	0.41	-	-	-	-
Maryland	10	1.61	17	1.76	22	4.32	8	2.48
Massachusetts	42	6.77	61	6.30	48	9.43	22	6.83
Michigan	21	3.39	40	4.13	17	3.34	16	4.97
Minnesota	17	2.74	16	1.65	7	1.38	3	0.93

Mississippi	5	0.81	5	0.52	2	0.39	1	0.31
Missouri	12	1.94	20	2.07	5	0.98	3	0.93
Montana	1	0.16	3	0.31	1	0.20	-	-
Nebraska	4	0.65	4	0.41	-	-	1	0.31
Nevada	3	0.48	3	0.31	-	-	1	0.31
New Hampshire	2	0.32	4	0.41	3	0.59	-	-
New Jersey	12	1.94	17	1.76	10	1.96	10	3.11
New Mexico	9	1.45	12	1.24	5	0.98	4	1.24
New York	90	14.52	122	12.60	61	11.98	42	13.04
North Carolina	8	1.29	19	1.96	10	1.96	5	1.56
North Dakota	3	0.48	1	0.10	-	-	-	-
Ohio	32	5.16	34	3.51	24	4.71	16	4.97
Oklahoma	7	1.13	18	1.86	5	0.98	5	1.55
Oregon	4	0.65	7	0.72	4	0.79	2	0.62
Pennsylvania	44	7.10	51	5.27	30	5.89	22	6.83
Rhode Island	3	0.48	7	0.72	8	1.57	-	-
South Carolina	3	0.48	4	0.41	3	0.59	1	0.31
South Dakota	2	0.32	4	0.41	1	0.20	-	-
Tennessee	16	2.58	12	1.24	2	0.39	5	1.55
Texas	21	3.39	36	3.72	17	3.34	10	3.11
Utah	4	0.65	7	0.72	4	0.79	-	-
Vermont	2	0.32	1	0.10	-	-	-	-
Virginia	10	1.61	15	1.55	10	1.96	3	0.93
Washington	9	1.45	16	1.65	8	1.57	5	1.55
West Virginia	4	0.65	5	0.52	1	0.30	1	0.31
Wisconsin	10	1.61	12	1.24	8	1.57	8	2.48
Wyoming	1	0.16	1	0.10	-	-	1	0.31
Total	620		968		509		322	
Percent	25.63		40.02		21.04		13.31	

Table 19A

Non-Federal U. S. Recipients, by Region

State	Recipients	Percent
New England	855	10.75
Maine	12	0.15
New Hampshire	24	0.30
Vermont	11	0.14
Massachusetts	574	7.22
Rhode Island	21	0.26
Connecticut	213	2.68
Middle Atlantic	2,004	25.21
New York	1,018	12.78
New Jersey	435	5.47
Pennsylvania	553	6.96
East North Central	1,385	17.43
Ohio	422	5.31
Indiana	180	2.27
Illinois	390	4.91
Michigan	271	3.41
Wisconsin	122	1.53
West North Central	360	4.53
Minnesota	126	1.59
Iowa	49	0.62
Missouri	98	1.23
North Dakota	4	0.05
South Dakota	9	0.11
Nebraska	13	0.16
Kansas	61	0.77
South Atlantic	1,035	13.02
Delaware	70	0.88
Maryland	237	2.98
District of Columbia	210	2.64
Virginia	196	2.47
West Virginia	34	0.43
North Carolina	82	1.03
South Carolina	21	0.26
Georgia	51	0.64
Florida	134	1.69
East South Central	219	2.75
Kentucky	46	0.58
Tennessee	79	0.99
Alabama	75	0.94
Mississippi	19	0.24
West South Central	396	4.99
Arkansas	14	0.18
Louisiana	46	0.58
Oklahoma	74	0.93
Texas	262	3.30

Mountain	222	3.64
Montana	5	0.06
Idaho	11	0.14
Wyoming	4	0.05
Colorado	106	1.33
New Mexico	50	0.63
Arizona	64	0.81
Utah	30	0.38
Nevada	19	0.24
Pacific	1,406	17.66
Washington	83	1.04
Oregon	40	0.50
California	1,262	15.86
Hawaii	13	0.16
Alaska	8	0.10

Table 20 A

Non-Federal U.S. Recipients, Average Number of Copies Received

No. of Copies	No. of Recipients NSA	TAB	USGRDR	Total	Percent
1	87.4[a]	58.5	96.8		
	1103	1094	2026	4223	80.7
2	5.6	18.0	2.2		
	71	336	47	454	8.7
3	1.5	11.7	0.5		
	19	220	11	250	4.8
4	1.3	2.2	0.2		
	16	41	5	62	1.2
5	1.0	1.2	0.1		
	12	23	3	38	0.7
6	0.3	1.7	0.0		
	4	31	1	36	0.7
7	0.1	0.4			
	1	7	-	8	0.2
8	0.2	0.4			
	3	8	-	11	0.2
9	0.1	0.3			
	1	5	-	6	0.1
10-100	2.2	5.6			
	27	104	-	131	2.5
Over 100	0.4	0.1			
	5	2	-	7	0.1
Total	1262	1871	2098	5231	99.9

Percent based on column sum.

Table 21 A

Number of Copies, NSA, TAB, UNCLASSIFIED, by State

State	Copies	Percent
Alabama	69	0.61
Alaska	9	0.08
Arizona	80	0.71
Arkansas	14	0.12
California	2403	21.37
Colorado	124	1.10
Connecticut	267	2.38
Delaware	69	0.61
Dist. of Col.	150	1.33
Florida	164	1.46
Georgia	75	0.67
Hawaii	9	0.08
Idaho	46	0.41
Illinois	706	6.28
Indiana	165	1.47
Iowa	94	0.84
Kansas	57	0.51
Kentucky	41	0.36
Louisiana	41	0.36
Maine	6	0.05
Maryland	298	2.65
Massachusetts	689	6.13
Michigan	253	2.25
Minnesota	199	1.77
Mississippi	16	0.14
Missouri	82	0.72
Montana	3	0.03
Nebraska	9	0.08
Nevada	20	0.18
New Hampshire	21	0.19
New Jersey	520	4.63
New Mexico	106	0.94
New York	1523	13.55
North Carolina	72	0.64
North Dakota	3	0.03
Ohio	576	5.14
Oklahoma	61	0.54
Oregon	45	0.40
Pennsylvania	662	5.89
Rhode Island	18	0.16
South Carolina	29	0.26
South Dakota	4	0.04
Tennessee	433	3.85
Texas	272	2.42
Utah	32	0.28
Vermont	9	0.08

Virginia	273	2.43
Washington	269	2.40
West Virginia	26	0.23
Wisconsin	127	1.13
Wyoming	3	0.03
Total	11,243	100.00

Table 22A

Number of Copies, NSA, TAB, USGRDR, by Type of Institution and State

States	Industrial	Per-cent	Educational/ Nonprofit	Per-cent	Private Recipients	Per-cent	State and Local Govt.	Per-cent
Alabama	48	0.6	21	0.7	-	-	-	-
Alaska	1	-	6	0.2	-	-	2	4.0
Arizona	61	0.8	19	0.6	-	-	-	-
Arkansas	1	-	11	0.4	1	0.7	1	2.0
California	1972	24.2	403	13.1	18	13.5	9	18.0
Colorado	74	0.9	45	1.5	5	3.8	-	-
Connecticut	227	2.8	31	1.0	9	6.8	-	-
Delaware	59	0.7	9	0.3	1	0.7		-
Dist. of Col.	101	1.3	40	1.3	7	5.3		4.0
Florida	124	1.6	35	1.1	2	1.5	3	6.0
Georgia	33	0.4	40	1.3	1	0.7		2.0
Hawaii	-	-	7	[illegible]	1	0.7	1	2.0
Idaho	25	0.3	21	0.7	-	-	-	-
Illinois	349	4.4	346	11.2	9	6.8	2	4.0
Indiana	101	1.3	63	2.0	1	0.7	-	-
Iowa	23	0.3	70	2.3	-	-	1	2.0
Kansas	25	0.3	31	1.0	-	-	1	2.0
Kentucky	21	0.3	18	0.6	-	-	2	[illegible]
Louisiana	24	0.3	15	0.5	1	0.7	1	2.0
Maine	5	0.1	1	-	-	-	-	-
Maryland	200	2.5	91	3.0	5	3.8	2	4.0
Massachusetts	534	6.7	149	4.8	6	4.5	-	-
Michigan	173	2.2	78	2.5	1	0.7	1	2.0
Minnesota	159	2.0	38	1.2	1	0.7	1	2.0
Mississippi	6	0.1	9	0.3	-	-	1	2.0

Missouri	58	0.7	21	0.7	2	1.5	1	2.0
Montana	-	-	3	0.1	-	-	-	-
Nebraska	4	0.1	5	0.2	-	-	-	-
Nevada	14	0.2	5	0.2	1	0.7	-	-
New Hampshire	15	0.2	5	0.2	1	0.7	-	-
New Jersey	469	5.9	40	1.3	11	8.3	-	-
New Mexico	36	0.5	69	2.2	1	0.7	-	-
New York	964	13.0	531	17.2	19	14.3	9	18.0
North Carolina	32	0.4	38	1.2	1	0.7	1	2.0
North Dakota	-	-	3	0.1	-	-	-	-
Ohio	403	5.1	165	5.3	8	6.0	2	4.0
Oklahoma	33	0.4	26	0.8	1	0.7	1	2.0
Oregon	27	0.3	17	0.6	-	-	1	2.0
Pennsylvania	535	6.7	122	4.0	4	3.0	1	2.0
Rhode Island	5	0.1	12	0.4	-	-	1	2.0
South Carolina	20	0.3	9	0.3	-	-	-	-
South Dakota	1	-	3	0.1	-	-	-	-
Tennessee	381	4.8	49	1.6	3	2.2	-	-
Texas	202	2.5	63	2.0	5	3.8	2	4.0
Utah	18	0.2	13	0.4	1	0.7	-	-
Vermont	7	0.1	2	0.1	-	-	-	-
Virginia	217	2.7	54	1.8	2	1.5	-	-
Washington	92	1.2	176	2.5	1	0.7	-	-
West Virginia	17	0.2	8	0.3	-	-	1	2.0
Wisconsin	73	0.9	52	1.7	2	1.5	-	-
Wyoming	-	-	2	0.1	1	0.7	-	-
Total	7969		3090		133		51	
Percent	70.9		27.5		1.2		0.5	

Table 23 A

Number of Copies, NSA, TAB, and USGRDR, by COSATI Subject Field

	NSA		TAB		USGRDR	
	Copies	Percent	Copies	Percent	Copies	Percent
Aeronautics (01)	25	0.8	453	7.7	60	2.9
Agriculture (02)	35	1.1	3	-	21	1.0
Astronomy and Astrophysics (03)	5	0.2	22	0.4	6	0.3
Atmospheric Sciences (04)	6	0.2	24	0.4	5	0.2
Behavioral and Social Sciences (05)	11	0.3	94	1.6	75	3.6
Biological and Medical Sciences (06)	237	7.5	182	3.1	155	7.5
Chemistry (07)	125	3.9	160	2.7	135	6.0
Earth Sciences and Oceanography (08)	21	0.7	64	1.1	26	1.2
Electronics and Electrical Engineering (09)	82	2.6	1359	23.4	315	15.2
Energy Conversion (Non-propulsive) (10)	14	0.4	21	0.4	13	0.6
Materials (11)	152	4.8	286	4.9	385	18.5
Mathematical Sciences (12)	1	-	31	0.5	3	0.1
Mechanical, Industrial, Civil, and Marine Engineering (13)	97	3.1	314	5.4	297	14.3
Methods and Equipment (14)	21	0.7	139	2.4	90	4.3
Military Sciences (15)	3	0.1	58	1.0	3	0.1
Missile Technology (16)	13	0.4	313	5.4	27	1.3
Navigation, Communications, Detection and Countermeasures (17)	26	0.8	628	10.8	83	4.0
Nuclear Science and Technology (18)	1522	48.1	111	1.9	44	2.1
Ordnance (19)	4	0.1	112	1.9	17	0.8
Physics (20)	319	10.1	234	4.0	48	2.3
Propulsion and Fuels (21)	56	1.8	311	5.3	52	2.4
Space Technology (22)	55	1.7	639	11.0	57	2.7
Science (25)	23	0.7	149	2.6	15	0.7
Technology (26)	32	1.0	37	0.6	23	1.1
General (27)	281	8.9	72	1.2	127	6.1
Totals[a]	3166		5818		2076	
Percent	28.6		52.6		18.7	

(a) Excludes distribution for 183 private/official recipients.

Table 24A

Industrial Recipient Establishments, by Detailed SIC Groups

	No. of Industries		Percent of Total	
10. Metal Mining	5		.18	
102 Copper Ores		1		.04
103 Lead and Zinc Ores		2		.07
109 Miscellaneous Metal Ores		2		.07
12. Bituminous Coal and Lignite Mining	2		.07	
121 Bituminous Coal		2		.07
13. Crude Petroleum and Natural Gas	13		.46	
131 Crude Petroleum and Natural Gas		11		.39
132 Natural Gas Liquids		1		.04
138 Oil and Gas Field Service		1		.04
15. Building Construction -- General Contractors	1		.04	
151 General Building Contractors		1		.04
16. Construction Other Than Building Construction -- General Contractors	1		.04	
162 Heavy Construction, Except Highway and Street Construction		1		.04
17. Construction -- Special Trade Contractors	1		.04	
171 Plumbing, Heating, and Air Conditioning		1		.04
19. Ordnance and Accessories	2		.07	
195 Small Arms		2		.07
20. Food and Kindred Products	29		1.03	
201 Meat Products		3		.11
202 Dairy Products		1		.04

Table 24A - continued

		No. of Industries		Percent of Total
	203 Canning and Preserving Fruits, Vegetables and Sea Foods		4	.14
	204 Grain Mill Products		6	.21
	206 Sugar		1	.04
	207 Confectionery and Related Products		1	.04
	208 Beverage Industries		2	.07
	209 Miscellaneous Food Preparations and Kindred Products		4	.14
21.	Tobacco Manufactures	6		.21
	211 Cigarettes		4	.14
22.	Textile Mill Products	13		.46
	221 Broad Woven Fabric Mills, Cotton		3	.11
	222 Broad Woven Fabric Mills, Man-Made Fiber and Silk		3	.11
	223 Broad Woven Fabric Mills, Wood: Including Dyeing and Finishing		1	.04
	228 Yarn and Thread Mills		1	.04
	229 Miscellaneous Textile Goods		2	.07
23.	Apparel and Other Finished Products Made From Fabrics and Similar Materials	2		.07
	232 Men's, Youths', and Boys' Furnishings, Work Clothing, and Allied Garments		1	.04
	234 Women's, Misses', Children's, and Infants' Under Garments		1	.04
24.	Lumber and Wood Products, Except Furniture	4		.14
	242 Sawmills and Planing Mills		2	.07
	243 Millwork, Veneer, Plywood, and Prefabricated Structural Wood Products		1	.04

	249 Miscellaneous Wood Products		1		.04
25.	Furniture and Fixtures	1		.04	
	251 Household Furniture		1		.04
26.	Paper and Allied Products	23		.82	
	261 Pulp Mills		1		.04
	262 Paper Mills, Except Building Paper Mills		3		.11
	263 Paperboard Mills		3		.11
	264 Converted Paper and Paperboard Products, Except Containers and Boxes		8		.28
	265 Paperboard Containers and Boxes		4		.14
27.	Printing, Publishing, and Allied Industries	80		2.84	
	271 Newspapers: Publishing, Publishing and Printing		4		.14
	272 Periodicals: Publishing, Publishing and Printing		47		1.67
	273 Books		3		.11
	274 Miscellaneous Publishing		1		.04
	275 Commercial Printing		1		.04
	276 Manifold Business Forms Manufacturing		1		.04
	279 Service Industries for the Printing Trade		1		.04
28.	Chemicals and Allied Products	196		6.95	
	281 Industrial Inorganic and Organic Chemicals		67		2.38
	282 Plastics Materials and Synthetic Resins, Synthetic Rubber, Synthetic and Other Man-Made Fibers, Except Glass		19		.67
	283 Drugs		33		1.17
	284 Soap, Detergents and Cleaning Preparations, Perfumes, Cosmetics, and Other Toilet Preparations		24		.85
	285 Paints, Varnishes, Lacquers, Enamels, and Allied Products		15		.53
	286 Gum and Wood Chemicals		1		.04
	287 Agricultural Chemicals		4		.14
	289 Miscellaneous Chemical Products		32		1.13

Table 24 A - continued

		No. of Industries		Percent of Total	
29.	Petroleum Refining and Related Industries	32		1.13	
	291 Petroleum Refining		21		.74
	295 Paving and Roofing Materials		1		.04
	299 Miscellaneous Products of Petroleum and Coal		7		.25
30.	Rubber and Miscellaneous Plastics Products	33		1.17	
	301 Tires and Inner Tubes		4		.14
	306 Fabricated Rubber Products, Not Elsewhere Classified		11		.39
	307 Miscellaneous Plastics Products		14		.50
32.	Stone, Clay, and Glass Products	36		1.28	
	321 Flat Glass		3		.11
	322 Glass and Glassware, Pressed or Blown		7		.25
	323 Glass Products, Made of Purchased Glass		2		.07
	325 Structural Clay Products		4		.14
	326 Pottery and Related Products		3		.11
	327 Concrete, Gypsum and Plaster Products		1		.04
	328 Cut Stone and Stone Products		1		.04
	329 Abrasive, Asbestos, and Miscellaneous Non-metallic Mineral Products		14		.50
33.	Primary Metal Industries	87		3.08	
	331 Blast Furnaces, Steel Works, and Rolling and Finishing Mills		32		1.13
	332 Iron and Steel Foundries		9		.32
	333 Primary Smelting and Refining of Nonferrous Metals		8		.28
	334 Secondary Smelting and Refining of Nonferrous Metals				

	and Alloys		1	.04
	335 Rolling, Drawing and Extruding of Nonferrous Metals		25	.89
	336 Nonferrous Foundries		6	.21
	339 Miscellaneous Primary Metal Industries		6	.21
34.	Fabricated Metal Products, Except Ordnance, Machinery, and Transportation Equipment	81		2.87
	341 Metal Cans		3	.11
	342 Cutlery, Hand Tools, and General Hardware		8	.28
	343 Heating Apparatus (Except Electric) and Plumbing Fixtures		10	.35
	344 Fabricated Structural Metal Products		19	.67
	345 Screw Machine Products, and Bolts, Nuts, Screws, Rivets and Washers		5	.18
	346 Metal Stampings		1	.04
	347 Coating, Engraving, and Allied Services		8	.28
	348 Miscellaneous Fabricated Wire Products		2	.07
	349 Miscellaneous Fabricated Metal Products		17	.60
35.	Machinery, Except Electrical	195		6.91
	351 Engines and Turbines		11	.39
	352 Farm Machinery and Equipment		3	.11
	353 Construction, Mining, and Materials Handling Machinery and Equipment		17	.60
	354 Metalworking Machinery and Equipment		32	1.13
	355 Special Industry Machinery, Except Metalworking Machinery		22	.78
	356 General Industrial Machinery and Equipment		44	1.56
	357 Office, Computing, and Accounting Machines		40	1.42
	358 Service Industry Machines		12	.43
	359 Miscellaneous Machinery, Except Electrical		11	.39
36.	Electrical Machinery, Equipment, and Supplies	389		13.79
	361 Electric Transmission and Distribution Equipment		28	.99
	362 Electrical Industrial Apparatus		32	1.13

Table 24A - continued

		No. of Industries		Percent of Total
	363 Household Appliances		10	.35
	364 Electric Lighting and Wiring Equipment		17	.60
	365 Radio and Television Receiving Sets, Except Communication Types		27	.78
	366 Communication Equipment		96	3.37
	367 Electronic Components and Accessories		162	5.74
	369 Miscellaneous Electrical Machinery, Equipment, and Supplies		21	.74
37.	Transportation Equipment	168		5.96
	371 Motor Vehicles and Motor Vehicles Equipment		24	.85
	372 Aircraft and Parts		130	4.61
	373 Ship and Boat Building and Repairing		6	.21
	374 Railroad Equipment		6	.21
	375 Motorcycles, Bicycles, and Parts		1	.04
	379 Miscellaneous Transportation Equipment		1	.04
38.	Professional, Scientific, and Controlling Instruments; Photographic and Optical Goods; Watches and Clocks	164		5.81
	381 Engineering, Laboratory, and Scientific and Research Instruments and Associated Equipment		58	2.06
	382 Instruments for Measuring, Controlling, and Indicating Physical Characteristics		46	.07
	383 Optical Instruments and Lenses		21	.74
	384 Surgical, Medical, and Dental Instruments and Supplies		17	.60
	385 Ophthalmic Goods		2	.07

	386 Photographic Equipment and Supplies		15		.53
	387 Watches, Clocks, Clockwork Operated Devices, and Parts		4		.14
39.	Miscellaneous Manufacturing Industries	11		.39	
	391 Jewelry, Silverware, and Plated Ware		1		.04
	393 Musical Instruments and Parts		1		.04
	394 Toys, Amusement, Sporting and Athletic Goods		1		.04
	395 Pens, Pencils, and Other Office and Artists' Materials		2		.07
	396 Costume Jewelry, Costume Novelties, Buttons, and Miscellaneous Notions, Except Precious Metal		2		.07
	398-99 Miscellaneous Manufacturing Industries		3		.11
40.	Railroad Transportation	2		.07	
	401 Railroads		2		.07
42.	Motor Freight Transportation and Warehousing	1		.04	
	421 Trucking, Local and Long Distance		1		.04
45.	Transportation by Air	13		.46	
	451 Air Transportation, Certificated Carriers		12		.43
	458 Fixed Facilities and Services Related to Air Transportation		1		.04
47.	Transportation Services	1		.04	
	478 Miscellaneous Services Incidental to Transportation		1		.04
48.	Communication	4		.14	
	481 Telephone Communication (Wire or Radio)		2		.07
	482 Telegraph Communication (Wire or Radio)		1		.04
	483 Radio Broadcasting and Television		1		.04
49.	Electric, Gas and Sanitary Services	22		.78	
	491 Electric Companies and Systems		13		.46
	492 Gas Companies and Systems		4		.14
	493 Combination Companies and Systems		4		.14

Table 24A - continued

		No. of Industries		Percent of Total	
50.	Wholesale Trade	6		.21	
	502 Drugs, Chemicals, and Allied Products		2		.07
	506 Electrical Goods		1		.04
	509 Miscellaneous Wholesalers		1		.04
53.	Retail Trade -- General Merchandise	4		.14	
	532 Mail Order Houses		4		.14
62.	Security and Commodity Brokers, Dealers, Exchanges, and Services	2		.07	
	628 Services Allied with the Exchange of Securities or Commodities		2		.07
63.	Insurance Carriers	1		.04	
	631 Life Insurance		1		.04
67.	Holding Companies	1		.04	
	679 Miscellaneous Investing Institutions		1		.04
73.	Miscellaneous Business Services	383		13.58	
	731 Advertising		2		.07
	739 Business Services, Not Elsewhere Classified		381		13.51
80.	Medical and Other Health Services	42		1.49	
	806 Hospitals		42		1.49
81.	Legal Services	1		.04	
	811 Legal Services		1		.04

82.	Educational Services	486		17.23	
	822 Colleges, Universities, Professional Schools, Junior Colleges, and Normal Schools		366		12.97
	823 Libraries		56		1.99
	829 Schools and Educational Services, Not Elsewhere Classified		64		2.27
84.	Museums, Art Galleries, Botanical and Zoological Gardens	4		.14	
	841 Museums		4		.14
86.	Nonprofit Membership Organizations	83		2.94	
	861 Business Associations		43		1.53
	862 Professional Membership Organizations		40		1.42
89.	Miscellaneous Services	137		4.86	
	891 Engineering and Architectural Services		102		3.62
	892 Nonprofit Educational and Scientific Research Agencies		4		.14
	893 Accounting, Auditing, and Bookkeeping Services		2		.07
	899 Services, Not Elsewhere Classified		29		1.03
92.	State Government	41		1.45	
	920 State Government		41		1.45
93.	Local Government	5		.18	
	930 Local Government		5		.18
	Total	2,154		100%[a]	

[a] May not equal to 100 percent because of rounding.

Establishments covering more than one SIC subdivision are included in the generic heading only.

Table 25 A

Funds for R & D Performance, by Industry, 1964

Industry	Size of R&D Program (Thousands of Dollars) Total	Percent
Total	$13,353	100
Food and kindred products	135	1.01
Textiles and apparel	32	0.26
Lumber, wood products and furniture	11	0.08
Paper and allied products	73	0.55
Chemicals and allied products	1,284	9.62
Industrial chemicals	856	6.41
Drugs and medicines	235	1.76
Other chemicals	193	1.45
Petroleum refining and extraction	337	2.52
Rubber products	150	1.12
Stone, clay and glass products	133	1.06
Primary metals	191	1.43
Primary ferrous products	113	0.85
Nonferrous and other metal products	78	0.58
Fabricated metal products	152	1.14
Machinery	1,028	7.70
Electrical equipment and communication	2,635	19.73
Communication equipment and electronic components	1,480	11.08
Other electrical equipment	1,154	8.64
Motor vehicles and other transportation equipment	1,189	8.90
Aircraft and missiles	5,097	38.17
Professional and scientific instruments	483	3.62
Scientific and mechanical measuring instruments	210	1.57
Optical, surgical, photographic, and other instruments	273	2.04
Other manufacturing industries	96	0.72
Nonmanufacturing industries	328	2.46

Source: U. S. National Science Foundation. Basic Research, Applied Research, and Development in Industry, 1964. (NSF 66-28). Washington, D. C., U. S. Govt. Print. Off., 1966, p. 21.

Table 26 A

Non-Federal U. S. Recipients, by Attention Line and COSATI Subject Field

	Attn: Library	Percent	Attn: Information Center	Percent	Attn: Security Officer	Percent	Attn: Individual	Percent	Attn: None	Percent
Aeronautics (01)	156	39.4	6	1.5	3	1 [illegible]	[illegible]	48.5	39	9.8
Agriculture (02)	29	46.7	1	1.6	-	-	[illegible]	[illegible]	15	24.1
Astronomy and Astrophysics (03)	18	24.7	1	1.4	-	-	41	[illegible]	[illegible]	7.[illegible]
Atmospheric Sciences (04)	11	23.9	-	-	-	-	26	58.[illegible]	9	19.[illegible]
Behavioral and Social Sciences (05)	47	22.7	3	.4	3	1.4	88	42.5	66	31.9
Biological and Medical Sciences (06)	258	42.5	1	0.2	4	0.7	249	41.1	95	15.7
Chemistry (07)	152	39.7	2	0.5	4	1.0	161	41.6	68	17.5
Earth Sciences and Oceanography (08)	38	31.6	1	0.8	4	3.3	53	44.2	24	20.0
Electronics and Electrical Engineering (09)	472	43.3	7	0.6	17	1.6	409	37.5	184	16.9
Energy Conversion (Non-propulsive) (10)	35	52.2	-	-	2	3.0	28	41.8	2	3.0
Materials (11)	349	42.1	13	1.6	11	1.3	314	37.9	142	17.1
Mathematical Sciences (12)	9	25.0	-	-	3	8.3	18	50.0	6	16.6
Mechanical, Industrial, Civil, and Marine Engineering (13)	324	31.0	6	0.6	10	1.0	571	54.7	133	12.7
Methods and Equipment (14)	89	34.7	2	0.8	4	1.6	106	41.4	55	21.5
Military Sciences (15)	18	48.6	1	2.7	1	2.7	12	32.4	5	13.5
Missile Technology (16)	70	57.9	7	5.8	2	1.7	31	25.6	11	9.1
Navigation, Communications, Detection, and Countermeasures (17)	223	56.9	10	2.5	11	2.6	97	24.7	51	13.0
Nuclear Science and Technology (18)	113	42.1	7	2.6	7	2.6	93	34.7	48	17.9
Ordnance (19)	20	26.3	1	1.3	6	9.2	34	44.7	15	19.7
Physics (20)	125	34.1	5	1.4	2	0.5	179	48.8	56	15.3
Propulsion and Fuels (21)	120	58.3	6	2.9	3	1.5	55	26.7	22	10.7
Space Technology (22)	133	48.0	19	6.9	4	1.4	96	34.7	25	9.0
Science (25)	54	44.3	-	-	3	2.5	55	45.1	20	16.4
Technology (26)	72	60.5	-	-	1	0.8	39	32.8	7	5.9
General (27)	422	78.1	-	-	1	0.2	81	15.0	36	6.7

Percent based on row sum.

Table 27 A

STAR Domestic Subscribers

States	Total	Industrial	Educational/ Nonprofit	State and Local Govt.	Private
Alabama	1	1	-	-	-
Alaska	-	-	-	-	-
Arizona	3	1	2	-	-
Arkansas	-	-	-	-	-
Calif.	13	12	-	-	1
Colorado	2	2	-	-	-
Connecticut	5	5	-	-	-
Delaware	-	-	-	-	-
Dist. of Col.	2	2	-	-	-
Florida	3	2	1	-	-
Georgia	-	-	-	-	-
Hawaii	-	-	-	-	-
Idaho	1	-	-	1	-
Illinois	5	5	-	-	-
Indiana	3	3	-	-	-
Iowa	-	-	-	-	-
Kansas	-	-	-	-	-
Kentucky	1	1	-	-	-
Louisiana	-	-	-	-	-
Maine	-	-	-	-	-
Maryland	4	1	-	3	-
Massachusetts	10	9	1	-	-
Michigan	6	5	-	-	1
Minnesota	1	-	1	-	-
Mississippi	-	-	-	-	-
Missouri	2	-	2	-	-
Montana	-	-	-	-	-
Nebraska	-	-	-	-	-
Nevada	-	-	-	-	-
New Hampshire	-	-	-	-	-
New Jersey	12	11	1	-	-
New Mexico	-	-	-	-	-
New York	20	16	2	1	1
North Carolina	1	1	-	-	-
North Dakota	-	-	-	-	-
Ohio	6	5	-	-	1
Oklahoma	-	-	-	-	-
Oregon	1	-	1	-	-
Pennsylvania	7	4	3	-	-
Rhode Island	-	-	-	-	-
South Carolina	-	-	-	-	-
South Dakota	-	-	-	-	-
Tennessee	3	-	2	1	-
Texas	6	6	-	-	-
Utah	-	-	-	-	-
Vermont	-	-	-	-	-
Virginia	3	1	-	1	1

Washington	3	9	-	-	-
West Virginia	-	-	-	-	-
Wisconsin	1	1	--	-	-
Wyoming	-	-	-	-	-
Total	125	97	16	7	5

Table 28 A

Federal Recipients (Non-Military), by Service and Agency

	NSA	STAR	TAB	USGRDR	Total
Arms Control & Disarmament Agency	-	1	1	-	2
Atomic Energy Commission	40	12	4	-	56
Civil Aeronautics Board	-	1	2	-	3
Civil Service Commission	-	1	5	-	6
Dept. of Agriculture	11	4	30	12	57
Dept. of Commerce	19	52	54	5	130
Dept. of Health, Education & Welfare	24	10	43	12	89
Dept. of Justice	2	3	3	1	9
Dept. of Labor	-	-	3	-	3
Dept. of State	2	2	2	3	9
Dept. of Interior	25	16	54	14	109
Executive Office of the President	2	6	1	2	11
Federal Aviation Agency	2	14	8	5	29
Federal Communications Commission	-	-	1	-	1
Federal Deposit Insurance	-	-	1	-	1
Federal Power Commission	-	-	1	-	1
General Services Administration	-	-	5	-	5
Government Printing Office	-	-	1	-	1
Housing & Home Finance Agency	-	1	1	-	2
Interstate Commerce Commission	-	-	1	-	1
Library of Congress	3	7	6	3	19
National Academy of Sciences	3	5	9	2	19
National Aeronautics & Space Administration	11	238	16	5	270
National Science Foundation	1	2	3	-	6
Securities & Exchange Commission	-	-	1	-	1
Small Business Administration	-	10	4	-	14
Smithsonian Institution	1	3	5	1	10
Tennessee Valley Authority	3	2	3	2	10
Treasury Dept.	2	-	2	1	5
U. S. Congress. House of					

Table 28 A - continued

	NSA	STAR	TAB	USGRDR	Total
Representatives	-	2	-	-	2
United States Information Agency	1	2	2	-	5
Veterans Administration	37	5	24	2	68
Miscellaneous Agencies	3	10	3	-	7
Totals	192	409	299	70	970
Percent	19.7	42.1	30.8	7.2	

Table 29 A

Federal Recipients (Non-Military) - Number of Copies NSA, TAB, and USGRDR, by Service and Agency

	NSA	TAB	USGRDR	Total
Arms Control & Disarmament Agency	-	1	-	1
Atomic Energy Commission	142	46	-	188
Civil Aeronautics Board	-	2	-	2
Civil Service Commission	-	5	-	5
Dept. of Agriculture	12	30	12	54
Dept. of Commerce	38	75	5	118
Dept. of Health, Education & Welfare	34	52	13	99
Dept. of Justice	2	3	1	6
Dept. of Labor	-	5	-	5
Dept. of State	2	2	3	7
Dept. of the Interior	28	67	14	109
Executive Office of the President	9	1	7	17
Federal Aviation Agency	3	114	5	122
Federal Communications Commission	-	1	-	1
Federal Deposit Insurance	-	1	-	1
Federal Power Commission	-	1	-	1
General Services Administration	-	5	-	5
Government Printing Office	-	1	-	1
Housing & Home Finance Agency	-	1	-	1
Interstate Commerce Commission	-	1	-	1
Library of Congress	9	10	17	36
National Academy of Sciences	3	10	3	16
National Aeronautics & Space Administration	36	168	5	209
National Science Foundation	2	3	-	5
Securities & Exchange Commission	-	1	-	1
Small Business Administration	-	4	-	4
Smithsonian Institution	2	5	2	9
Tennessee Valley Authority	3	3	2	8
Treasury Dept.	2	2	1	5
U. S. Congress. House of Representatives	-	-	-	-

United States Information Agency	1	2	-	3
Veterans Administration	39	31	2	72
Miscellaneous Agencies	3	3	-	6
Totals	370	650	92	1118

Table 30A

Federal Recipients (Military), by Service and State

States	TAB	STAR	NSA Off.	NSA Subscr.	USGRDR Subscr.
Alabama	28	9	4	-	6
Alaska	-	-	-	-	-
Arizona	7	2	-	1	1
Arkansas	1	-	-	-	-
California	158	42	15	6	14
Colorado	13	6	3	-	-
Connecticut	5	2	1	-	2
Delaware	-	-	-	-	-
Dist. of Col.	252	66	22	4	17
Florida	39	6	2	3	5
Georgia	20	2	1	-	2
Hawaii	-	-	-	-	-
Idaho	-	-	-	-	-
Illinois	28	6	1	-	1
Indiana	6	2	2	-	-
Iowa	1	1	-	-	-
Kansas	4	-	1	-	2
Kentucky	7	2	1	-	2
Louisiana	2	-	-	-	1
Maine	-	-	-	-	-
Maryland	59	18	11	-	12
Massachusetts	33	9	5	2	3
Michigan	10	2	1	-	1
Minnesota	1	-	-	-	-
Mississippi	4	1	1	-	1
Missouri	9	4	1	-	1
Montana	1	1	1	1	-
Nebraska	6	2	1	-	-
Nevada	1	-	-	-	-
New Hampshire	4	1	2	-	2
New Jersey	30	9	3	1	3
New Mexico	22	5	4	2	4
New York	91	15	7	2	8
North Carolina	7	3	1	-	-
North Dakota	2	-	-	-	-
Ohio	204	21	11	5	4
Oklahoma	4	5	-	-	-
Oregon	-	-	-	-	-
Pennsylvania	61	4	4	1	3
Rhode Island	4	1	-	-	2

Table 30 A - continued

States	TAB	STAR	NSA Off.	NSA Subscr.	USGRDR Subscr.
South Carolina	7	1	1	-	-
South Dakota	-	-	-	-	-
Tennessee	5	3	-	-	1
Texas	67	12	4	2	7
Utah	13	1	1	-	2
Vermont	-	-	-	-	-
Virginia	71	18	5	2	6
Washington	15	1	2	-	3
West Virginia	-	-	-	-	-
Wisconsin	1	-	-	-	-
Wyoming	-	-	1	-	-
Total	1303	283	120	32	114
Percent	70.36	15.28	8.19		6.16

Table 31 A

Federal Recipients (Military) - Number of Copies, NSA, TAB, and USGRDR, by State and Service

States	TAB	NSA Off.	NSA Subscr.	USGRDR
Alabama	37	68	-	10
Alaska	-	-	-	-
Arizona	7	-	1	1
Arkansas	1	-	-	-
California	249	35	8	16
Colorado	28	3	-	-
Connecticut	6	1	-	2
Delaware	-	-	-	-
Dist. of Col.	400	52	5	20
Florida	49	3	3	8
Georgia	22	1	-	2
Hawaii	-	-	-	-
Idaho	-	-	-	-
Illinois	39	1	-	1
Indiana	8	2	-	-
Iowa	1	-	-	-
Kansas	4	1	-	-
Kentucky	7	1	-	2
Louisiana	2	-	-	1
Maine	-	-	-	-
Maryland	134	23	-	15
Massachusetts	110	8	3	4
Michigan	57	1	-	1
Minnesota	1	-	-	-
Mississippi	7	1	-	1
Missouri	15	1	-	1
Montana	1	1	1	-
Nebraska	6	1	-	-
Nevada	1	-	-	-
New Hampshire	7	2	-	2
New Jersey	54	6	5	4
New Mexico	73	7	2	5

New York	140	9	2	11
North Carolina	7	1	-	-
North Dakota	2	-	-	-
Ohio	231	14	5	5
Oklahoma	4	-	-	-
Oregon	-	-	-	-
Pennsylvania	87	9	1	3
Rhode Island	5	-	-	2
South Carolina	9	1	-	-
South Dakota	-	-	-	-
Tennessee	5	-	-	2
Texas	81	4	2	7
Utah	15	1	-	2
Vermont	-	-	-	-
Virginia	118	7	2	6
Washington	16	2	-	3
West Virginia	-	-	-	-
Wisconsin	1	-	-	-
Wyoming	-	1	-	-
Total	2047	268	39	137

Table 32 A

GPO Depository Libraries, Number of Libraries and Number of Recipients, by State

States	No. Libraries	Recipients	
		No. of Libraries	Percent
Alabama	18	13	72.2
Alaska	4	3	75.0
Arizona	7	5	71.4
Arkansas	12	7	58.3
California	65	45	69.2
Colorado	15	14	93.3
Connecticut	12	9	75.0
Delaware	4	3	75.0
Dist. of Col.	20	17	85.0
Florida	20	17	85.0
Georgia	16	8	50.0
Hawaii	7	4	57.1
Idaho	7	5	71.4
Illinois	39	24	61.5
Indiana	26	20	76.9
Iowa	12	6	50.0
Kansas	12	9	75.0
Kentucky	14	9	64.3
Louisiana	17	13	76.5
Maine	9	6	66.7
Maryland	11	8	72.7
Massachusetts	22	16	72.7

Table 32 A - continued

States	No. Libraries	Recipients No. of Libraries	Percent
Michigan	33	20	60.6
Minnesota	17	11	64.7
Mississippi	7	6	85.7
Missouri	22	15	68.2
Montana	5	4	80.0
Nebraska	11	6	54.5
Nevada	3	3	100.0
New Hampshire	5	3	60.0
New Jersey	24	15	62.5
New Mexico	5	5	100.0
New York	57	45	78.9
North Carolina	22	17	77.3
North Dakota	8	3	37.5
Ohio	37	33	89.2
Oklahoma	16	13	81.2
Oregon	11	11	100.0
Pennsylvania	37	27	73.0
Rhode Island	7	4	57.1
South Carolina	10	5	50.0
South Dakota	9	3	33.3
Tennessee	12	11	91.7
Texas	37	32	86.5
Utah	7	4	57.1
Vermont	8	4	50.0
Virginia	17	15	88.2
Washington	14	11	78.6
West Virginia	11	9	81.8
Wisconsin	25	16	64.0
Wyoming	4	2	50.0
Puerto Rico	2	2	-
Canal Zone	1	1	-
American Samoa	1	-	-
Marianas	1	-	-
Totals	854	616	

Table 33 A

GPO Depository Library Recipients, by Service and State

States	NSA	STAF	USGRDR
Alabama	12	4	11
Alaska	2	2	2
Arizona	3	4	4
Arkansas	3	1	1
California	40	32	42
Colorado	11	7	10

Connecticut	8	6	9
Delaware	3	1	2
Dist. of Col.	3	5	10
Florida	14	13	11
Georgia	6	4	8
Hawaii	4	2	2
Idaho	4	2	3
Illinois	19	19	15
Indiana	17	10	14
Iowa	4	4	5
Kansas	6	6	7
Kentucky	9	5	3
Louisiana	12	12	12
Maine	4	3	4
Maryland	7	5	3
Massachusetts	15	13	13
Michigan	19	13	16
Minnesota	7	6	9
Mississippi	5	4	4
Missouri	10	10	10
Montana	4	3	4
Nebraska	5	4	5
Nevada	3	3	2
New Hampshire	2	3	3
New Jersey	13	11	9
New Mexico	4	3	4
New York	41	31	39
North Carolina	12	12	14
North Dakota	1	2	3
Ohio	30	18	24
Oklahoma	9	10	11
Oregon	8	6	9
Pennsylvania	25	16	19
Rhode Island	2	3	4
South Carolina	4	2	2
South Dakota	3	3	3
Tennessee	9	6	8
Texas	27	28	25
Utah	4	3	3
Vermont	3	2	3
Virginia	11	9	6
Washington	10	8	11
West Virginia	8	6	5
Wisconsin	14	10	11
Wyoming	2	2	2
Puerto Rico	1	1	2
Canal Zone	1	-	1
American Samoa	-	-	-
Marianas	-	-	-
Total	502	398	459

Table 34 A

Foreign Recipients, by Country, Service and Source of Receipt

	USGRDR				NSA				STAR				
	LC Exchange	Subscribers	Smithsonian Recipients	AEC Official Recipients	LC Exchange	Subscribers	Smithsonian Recipients	NASA Official Recipients	LC Exchange	Smithsonian Recipients	Subscribers (a)	Totals	Percent
Algeria						1						1	0.03
Angola						1						1	0.03
Argentina		2	1	4		3	1	8		1		20	0.62
Australia	1	27	7	16		16	7	20		7		101	3.13
Austria		2	1	7		3	1	10		1		25	0.77
Belgian Congo				1		2		1				4	0.12
Belgium	1	1[illegible]	1	13		27	1	29		1		83	2.57
Bolivia				1				1				2	0.06
Brazil		2	1	9		8	1	12		1		34	1.05
Bulgaria	2	3			4							9	0.28
Burma			1	1			1	1		1		5	0.15
Canada		99	5	23		60	5	35		1		228	6.97
Ceylon			1	1			1	1		1		5	0.15
Chile		2	1	7		1		4		1		16	0.50
China (Mainland)		1										1	0.03
China: Taiwan		2	2			6	2	3		2		17	0.53
Colombia		1	1	1			1	4		1		9	0.28
Costa Rica			1	3			1	1		1		7	0.22

Cuba			1				1			1	3	0.09
Czechoslovakia	3	1	1	6	2		1	3		1	18	0.56
Denmark		12	1	7		13		16		1	50	1.55
Dominican Republic				1				1			2	0.06
Ecuador				1				2			3	0.09
Egypt			1	1		7	1	2		1	13	0.40
El Salvador				1				1			2	0.06
Finland		2	1	2	1	8	1	4		1	20	0.62
France	2	79	1	28		140	1	61	1	1	314	9.73
Germany East / Germany West	1	58	3	36	1	132	3	65		3	302	9.36
Ghana		1		1		1		2			5	0.15
Greece				2		1		7			10	0.31
Guatemala				3				1			4	0.12
Haiti				1				1			2	0.06
Hong Kong	1	1				1					3	0.09
Hungary	1	1		8	1	20					31	0.96
Iceland				1				3			4	0.12
India	2	15	3	17		16	3	15		3	74	2.29
Indonesia		1	1				1	4		1	8	0.25
Iran				1		2		2			5	0.15
Iraq		1		1				1			3	0.09
Ireland		3	1	3			1	10		1	19	0.59
Israel	1	10	1	2	1	14	1	25		1	66	2.05
Italy	1	18	1	20	1	59	1	44		1	146	4.53
Jamaica				1		1					2	0.06
Japan	3	89	1	40	5	170	1	22		1	332	10.29
Kenya								1			1	0.03
Korea	2			3	2			2			9	0.28
Lebanon				1				2			3	0.09
Luxembourg				1				1			2	0.06

Table 34 A - continued

	USGRDR			NSA				STAR					
	LC Exchange	Subscribers	Smithsonian Recipients	AEC Official Recipients	LC Exchange	Subscribers	Smithsonian Recipients	NASA Official Recipients	LC Exchange	Smithsonian Recipients	Subscribers (a)	Totals	[illegible]
Malaya				1				1				2	[illegible]
Mexico		9	1	2	1	4	1	4		1		23	[illegible]
Monaco		1		1		2						4	[illegible]
Morocco					1							1	[illegible]
Mozambique						1						1	[illegible]
Netherlands		24	1	17		41	1	20		1		105	[illegible]
New Guinea								1				1	[illegible]
New Zealand		3	1	5		2	1	5		1		19	[illegible]
Nigeria						4		1				5	[illegible]
Norway		5	1	6		6	1	9		1		29	[illegible]
Pakistan				4		4		3				11	[illegible]
Panama	1											1	[illegible]
Paraguay				1								1	[illegible]
Peru			1	1		2	1	3		1		9	[illegible]
Philippines		4	1	3		2	1	4		1		16	[illegible]
Poland	2	2		4	2	2		3	1			16	[illegible]
Portugal			1	5		3	1	3		1		14	[illegible]
Portuguese Guinea						1						1	[illegible]
Puerto Rico		3		4				4				11	[illegible]
Republic of South Africa	1	4	1	4		6	1	8		1		26	[illegible]

Rumania	2	1		4	2	1		2			12	0.37
Southern Rhode		1									1	0.03
Spain		1	1	2		10	1	15		1	31	0.96
Sweden		38	1	6		26	1	33		1	106	3.29
Switzerland		16	1	20	1	21	1	15		1	76	2.36
Thailand	1	1		2		1		2			7	0.22
Tunisia						1					1	0.03
Turkey		2	1	4		2	1	4		1	15	0.46
U. S. S. R.	5	11	1	19	3	7	1	1		1	49	1.52
United Kingdom	7	218	2	56	2	153	2	122	1	2	565	17.51
Uruguay	1		1	1			1	1		1	6	0.19
Venezuela		1	1	1		4	1	1		1	10	0.31
Viet-Nam				1							1	0.03
Yugoslavia	2	1	1	5		12	1	1	1	1	25	0.77
Zambia						1					1	0.03
International Orgnizations	1		1		1		1		1	1	6	0.19
Totals	44	789	59	455	31	1032	59	693	5	59	175	3401 100%
Percent		892 26.23				1577 46.37				932 27.40		3401 100

(a) Total foreign subscriber figures available.

Table 35 A

Foreign Recipients - Number of Copies, by Country, Service and Source of Receipt

	USCRDR			NSA				STAR[a]		
	LC Exchange	Subscribers	Smithsonian Recipients	AEC Official Recipients	LC Exchange	Subscribers	Smithsonian Recipients	LC Exchange	Smithsonian Recipients	Totals
Algeria						1				1
Angola						1				1
Argentina		2	1	5		3	1		1	13
Australia	1	27	7	22		17	7		7	94
Austria		2	1	12		4	1		1	21
Belgian Congo				1		2				3
Belgium	1	11	1	32		46	1		1	93
Bolivia				1					1	2
Brazil		2	1	9		8	1		1	22
Bulgaria	2	3			4					9
Burma			1	1			1		1	4
Canada		101	5	61		61	5		1	234
Ceylon				1			1			2
Chile		2	1	7		1	1		1	13
China (Mainland)		1								1
China (Taiwan)		2	2			6	2		2	14
Colombia		1	1	1			1		1	5

Costa Rica			1	3			1		1	6
Cuba			1				1		1	3
Czechoslovakia	3	1		6	2		1			13
Denmark		12	1	7		29	1		1	51
Dominican Republic				1						1
Ecuador				1						1
Egypt			1	1		7	1		1	11
El Salvador				1						1
Finland		2	1	2	1	8	1		1	16
France	2	128	1	31		233	1	1	1	299
Germany (East) } Germany (West) }	1	75	3	38	1	195	3		3	317
Ghana		1		1		1				3
Greece				2		1				3
Guatemala				4						4
Haiti				1						1
Hong Kong	1	1				2				4
Hungary	1	1		11	1	20				44
Iceland				1						1
India	2	15	3	17		19	3		3	63
Indonesia		1	1				1		1	4
Iran				1		2				3
Iraq		1		1						2
Ireland		3	1	3			1		1	9
Israel	1	10	1	3	1	23	1		1	41
Italy	1	18	1	22	1	71	1		1	116
Jamaica				1		1				2
Japan	3	104	2	44	5	189	2		1	350
Kenya										
Korea	2			4	2					8
Lebanon				1						1

Table 35 A - continued

	USGRDR			NSA				STAR[a]		
	LC Exchange	Subscribers	Smithsonian Recipients	AEC Official Recipients	LC Exchange	Subscribers	Smithsonian Recipients	LC Exchange	Smithsonian Recipients	Totals
Luxembourg				1						1
Malaya				1						1
Mexico		9	1	3	1	4	1		1	20
Monaco		1		1		2				4
Morroco					1					1
Mozambique						1				1
Netherlands		28	1	20		50	1		1	101
New Guinea										-
New Zealand		3	1	7		2	1		1	15
Nigeria						4				4
Norway		5	1	6		6	1		1	20
Pakistan				4		4				8
Panama	1									1
Paraguay				1						1
Peru			1	2		2	1		1	7
Philippines		4	1	3		2	1		1	12
Poland	2	6		6	2	18		1		33
Portugal			1	5		3	1		1	11
Portuguese Guinea						1				1

Puerto Rico		3		4						7
Republic of South Africa	1	4	1	4		9	1		1	21
Rumania	2	1		4	2	9				18
Southern Rhodesia		1								1
Spain		1	1	3		10	1		1	17
Sweden		57	1	7		51	1		1	118
Switzerland		16	1	22	1	21	1		1	63
Thailand	1	1		2		2				6
Tunisia						1				1
Turkey		2	1	4		2	1		1	11
U. S. S. R.	5	11	1	30	3	18	1		1	70
United Kingdom	7	229	2	83	2	214	2		2	541
Uruguay	1		1	1			1			5
Venezuela		1	1	2		4	1		1	10
Viet-Nam				1						1
Yugoslavia	2	1	2	5		13	2		1	26
Zambia						1				1
International Organizations	1		1		1		1	1	1	6
Totals	44	924	61	593	31	1403	61	2	31	

(a) Excludes STAR official and subscriber copy distribution.

Table 38 A

Recipient Questionnaire Respondents,
by State

States	Non-Federal U.S. Respondents	Percent
Alabama	7	0.9
Alaska	-	-
Arizona	7	0.9
Arkansas	3	0.4
California	132	17.0
Colorado	9	1.2
Connecticut	16	2.1
Delaware	4	0.5
Dist. of Col.	16	2.1
Florida	12	1.5
Georgia	5	0.6
Hawaii	-	-
Idaho	1	0.1
Illinois	41	5.3
Indiana	19	2.4
Iowa	5	0.6
Kansas	5	0.6
Kentucky	4	0.5
Louisiana	6	0.8
Maine	2	0.3
Maryland	25	3.2
Massachusetts	57	7.3
Michigan	32	4.1
Minnesota	14	1.8
Mississippi	1	0.1
Missouri	13	1.7
Montana	1	0.1
Nebraska	1	0.1
Nevada	1	0.1
New Hampshire	1	0.1
New Jersey	45	5.8
New Mexico	5	0.6
New York	82	10.6
North Carolina	5	0.6
North Dakota	1	0.1
Ohio	44	5.7
Oklahoma	5	0.6
Oregon	3	0.4
Pennsylvania	58	7.5

Rhode Island	1	0.[illegible]
South Carolina	4	0.5
South Dakota	1	0.1
Tennessee	8	1.0
Utah	3	0.4
Vermont	-	-
Virginia	18	2.3
Washington	10	1.3
West Virginia	3	0.4
Wisconsin	11	1.4
Wyoming	-	-
Total	778	100.0

Table 37 A
Total Industrial U. S. Establishments, Nonrecipient Questionnaire Sample, and Nonrecipient Questionnaire Returns, by State

	Industrial Establishments[1]	Percent	Nonrecipient Sample	Percent	Nonrecipient Returns	Percent
Alabama	4,100	1.33	-	-	-	-
Alaska	295	0.09	-	-	-	-
Arizona	1,512	0.49	5	1.04	3	1.28
Arkansas	2,838	0.92	-	-	-	-
California	31,709	10.32	69	14.37	27	11.49
Colorado	2,409	0.78	8	1.67	3	1.28
Connecticut	5,516	1.80	13	2.71	6	2.55
Delaware	548	0.18	1	0.21	-	-
District of Columbia	557	0.18	7	1.46	2	0.85
Florida	7,331	2.39	8	1.67	4	1.70
Georgia	6,237	2.03	2	0.42	-	-
Hawaii	657	0.21	-	-	-	-
Idaho	1,104	0.36	-	-	-	-
Illinois	18,135	5.90	64	13.33	27	11.49
Indiana	6,786	2.21	3	0.62	4	1.70
Iowa	3,451	1.12	5	1.04	5	2.13
Kansas	2,440	0.79	1	0.21	1	0.43
Kentucky	2,886	0.94	2	0.42	1	0.43
Louisiana	3,193	1.04	1	0.21	-	-
Maine	2,509	0.82	1	0.21	-	-
Maryland	3,451	1.12	9	1.87	6	2.55
Massachusetts	11,170	3.64	42	8.75	25	10.64
Michigan	13,965	4.55	17	3.54	3	1.28

Minnesota	5,438	1.77	15	3.12	7	2.98
Mississippi	2,366	0.77	1	0.21	-	-
Missouri	6,392	2.08	8	1.67	2	0.85
Montana	973	0.32	-	-	-	-
Nebraska	1,590	0.52	1	0.21	1	0.43
Nevada	282	0.09	-	-	-	-
New Hampshire	1,510	0.49	-	-	-	-
New Jersey	14,906	4.85	29	6.04	17	7.23
New Mexico	735	0.24	3	0.62	2	0.85
New York	46,163	15.03	73	15.21	33	14.04
North Carolina	7,760	2.53	1	0.21	-	-
North Dakota	458	0.15	-	-	-	-
Ohio	15,177	4.94	16	3.33	10	4.26
Oklahoma	2,544	0.83	4	0.83	3	1.28
Oregon	4,813	1.57	1	0.21	1	0.43
Pennsylvania	19,089	6.21	30	6.25	19	8.09
Rhode Island	2,692	0.88	3	0.62	2	0.85
South Carolina	3,028	0.99	-	-	-	-
South Dakota	582	0.19	-	-	-	-
Tennessee	4,718	1.54	3	0.62	1	0.43
Texas	11,402	3.71	11	2.29	6	2.55
Utah	1,095	0.36	1	0.21	-	-
Vermont	964	0.31	-	-	-	-
Virginia	4,493	1.46	5	1.04	3	1.28
Washington	5,198	1.69	3	0.62	2	0.85
West Virginia	1,817	0.59	4	0.83	1	0.43
Wisconsin	7,817	2.54	10	2.08	8	3.40
Wyoming	345	0.11	-	-	-	-
Total	307,176	99.9	480]	99.9	235	99.9

1. Source: U.S. Bureau of the Census. Statistical Abstract of the United States: 1966. 87th ed. Washington, D.C., U.S. Govt. Print. Off., 1966, p. 774.

Appendix B - Definitions

Applied Research - Research which represents investigation directed to discovery of new scientific knowledge and which has specific commercial objectives with respect to either products or processes.

Basic Research - Research which represents original investigation for the advancement of scientific knowledge and which does not have specific commercial objectives, although it may be in fields of present or potential interest to the investigating company.

Company - An organization consisting of one or more establishments under common ownership or control. This includes all establishments, subsidiaries, and affiliates.

Depository - An organization designated to receive, maintain, and make available to requesters all documents distributed by a particular source, e.g. Government Printing Office (GPO), Atomic Energy Commission (AEC), etc.

Development - Systematic use of scientific knowledge directed toward the production of useful materials, devices, systems or methods, including design and development of prototypes and processes.

Educational Institutions - Institutions of higher learning comprising the following: (1) colleges and universities proper, consisting of colleges of liberal arts, schools of arts and sciences, professional schools such as medicine and engineering, and affiliated research institutions, hospitals, and like organizations; (2) agricultural experiment stations and associated schools of agriculture; (3) Federal contract research centers administered by educational institutions.

Expenditures - Payments made during a given period, regardless of when the funds were appropriated.

Gross National Product - Total national output of goods and services at market prices. (GNP differs from "national income," mainly in that GNP includes allowances for depreciation and for indirect taxes, such as sales and excise taxes).

Indicative Abstract - Textual notation about document contents, sometimes using words from a controlled vocabulary that are also used for indexing. Does not summarize contents.

Industrial Organizations - Manufacturing and non-manufacturing companies, including commercial laboratories and engineering services, and Federal contract research centers administered by these firms.

Informative Abstract - Textual summary of document contents echoing the viewpoint of the document author, but sometimes including commentary by peer abstracter.

National Income - Aggregate of earnings by labor and property from the Nation's current production of goods and services. It is the sum represented by compensation of employees, proprietors' income, net interest, and corporate profits.

Nonprofit Institutions - Private philanthropic foundations, nonprofit research institutes, voluntary health agencies, professional societies, academies of science, museums, zoological gardens, botanical gardens, arboretums, and Federal contract research centers administered by nonprofit organizations.

Nonrecipient - An individual, company, or institution receiving none of the services of NSA, STAR, TAB, or USGRDR.

Obligations - Amounts for orders placed, contracts awarded, services received, and similar transactions during a given period, regardless of when the funds were appropriated and when future payment of money is required.

Official Distribution - Federal agency gratis distribution of NSA, STAR, TAB or USGRDR on the basis of the recipient's official connection with the respective authorizing agency.

Personal Income - Current income received by individuals by unincorporated businesses, and by nonprofit institutions from all sources net of personal contributions for social insurance.

Proprietary Information - Information to which some individual, company or institution has property rights.

Recipient - An individual, departmental unit, institution or industrial organization on the mailing list to receive one or more copies of any one of the abstracting and indexing services of NSA, STAR, TAB, or USGRDR.

Research - Systematic, intensive study directed toward fuller scientific knowledge of the subject studied. Such study covers both basic and applied research in the natural sciences, including medical sciences and engineering. It does not include design and development of prototypes and processes.

Research and Development - Basic and applied research in the sciences and engineering and the design and development of prototypes and processes.

Scientists and Engineers - Persons engaged in scientific and engineering work at a level requiring a knowledge of sciences equivalent at least to that acquired through completion of a 4-year college course.

Site - Specific geographic location housing one or more buildings (usually having a common address) all reachable within easy walking distance from one another.

Users - Individuals, companies or institutions that can apply information in an abstract to their research work.

Appendix C

1. Recipient Questionnaire Cover Letter

Columbia University in the City of New York
New York, N. Y. 10027
School of Library Service Butler Library

Dear Sir:

The enclosed questionnaire, "Abstracting and Indexing Services for Government-Sponsored Research," is being mailed to a small, carefully selected group of research-oriented organizations and individuals. As one of those included in our sample, you or your library have no doubt been receiving one or more of the following services considered in our study: NSA (Nuclear Science Abstracts), STAR (Scientific and Technical Aerospace Reports), TAB (Technical Abstracts Bulletin), USGRDR (U. S. Government Research & Development Reports).

The questionnaire is designed to elicit information on user background and real use made of the abstracting and indexing services mailed to your organization. For the purposes of this study, we seek only information relating to the service(s) circled in red on the first page of the questionnaire. The primary user of the service should answer the questionnaire. If you are not the primary user, please forward this letter and questionnaire to the person who is the primary user. If addressed to a library or information center, the questionnaire should be completed by the librarian or information scientist most knowledgeable about the use made of the service.

This study is being carried out at the Columbia University School of Library Service with the support of the Directorate of Information Sciences, U. S. Air Force Office of Scientific Research (Contract AF-49(638) 1741). Professor Maurice F. Tauber of the School of Library Service, Columbia University, is directing this study, which has as its objective more effective dissemination and utilization of the technical report literature resulting from government-sponsored research.

We shall be most grateful if you will complete the enclosed questionnaire and return it in the self-addressed, stamped envelope. Negative responses are as significant as positive responses. Since most questions call for check-off answers, a minimum of your time (approximately ten minutes) will be required. Please feel assured that all data supplied will be kept in strict confidence. We seek your cooperation and earnestly hope that you will participate in this research effort.

Very truly yours,

Irving M. Klempner
Principal Investigator

IMK:mgb
Enclosures

Appendix C

2. Recipient Questionnaire

Code__ (1-7)

User Survey
Abstracting and Indexing Services
for Government-Sponsored Research

Instructions:

Please note the address on the cover letter. Copies of one or more of the following serices are mailed to this address:

NSA	(Nuclear Science Abstracts)	1	(8)
STAR	(Scientific and Technical Aerospace Reports)	2	
TAB	(Technical Abstract Bulletin)	3	
USGRDR	(U. S. Government Research and Development Reports)	4	

For the purposes of this study, please confine your replies only to the service(s) circled in red above. The primary user of the service(s) should complete the questionnaire. If you are not the primary user of the circled service(s), please forward this letter and questionnaire to the person who is the primary user. If the service is addressed to and used by a library or information center, the librarian or information scientist most knowledgeable about the use made of the service should complete the questionnaire. Many thanks for your cooperation!

1 (9)

Name of person completing questionnaire Title

Name of employer

Department or sub-unit

Address

Part 1: Background Information

1. Which of the following best characterizes your primary activity? (If several, please check the activity to which you devote most time.)

1 __ Research and Development (10)
2 __ Teaching--College or University
3 __ Graduate or Undergraduate study
4 __ Library or Information Service
5 __ Technical Sales and Service
6 __ Production and Operation
7 __ Management and Administration

1 __ Company or institution offical (President, Vice-

President, General Manager, Assistant General Manager) (11)

2 __ Operations Manager (Works Manager, Superintendent, Assistant Works Manager, Assistant Superintendent)

3 __ Research Director (Chief Engineer, Chief Chemist, Chief Metallurgist, Chief Physicist)

4 __ Project Scientist or Engineer

5 __ Foreman, Supervisor, Department Head

6 __ Other management (Please specify)_____

10 X___ Other (Please specify)_____

2. Which of the following best characterizes your subject specialty? (If several, please check the specialty to which you devote most time.) (12)

1 __ Aeronautics
2 __ Agriculture
3 __ Astronomy and Astrophysics
4 __ Atmospheric Sciences
5 __ Behavioral and Social Sciences (includes Humanities)
6 __ Biological and Medical Sciences
7 __ Chemistry and Chemical Engineering
8 __ Earth Sciences and Oceanography
9 __ Electronics and Electrical Engineering
0 __ Energy Conversion (non-propulsive)
X __ Engineering (Mechanical, Industrial, Civil, and Marine)
Y __ Library or Information Sciences (13)
1 __ Materials and Metallurgy
2 __ Mathematical Sciences
3 __ Methods and Equipment
4 __ Military Science
5 __ Missile Technology
6 __ Navigation, Communication, Detection, Countermeasures
7 __ Nuclear Science and Technology
8 __ Ordnance
9 __ Physics
0 __ Propulsion and Fuels
X __ Space Technology
Y __ Other (Please specify)_____

3. Are you personally engaged at present in carrying out any research and development (R&D)* activity?

1 __ Yes 2 __ No (14)

4. If the answer to question No. 3 is "Yes," please estimate the percentage of time that you devote to R&D.

1 __ Over 75% (15)

* R&D activity is defined to include both basic and applied research in the sciences and engineering, and design and development of prototypes and processes.

2 __ 50%-74%
3 __ 20%-49%
4 __ 1%-19%

5. To the best of your knowledge, does your company* or institution* now have contracts for R&D with any of the following? (Please check all that apply.)

1 __ Atomic Energy Commission (AEC) (16)
2 __ Department of Defense (Army, Navy, Air Force) (DOD)
3 __ National Aeronautics and Space Administration (NASA)
4 __ Other Federal agency (Please specify) _____
5 __ None
6 __ Don't know

6. If you personally carry out R&D for any of the above agencies, please check those that apply:

1 __ AEC (17)
2 __ DOD
3 __ NASA
4 __ None
5 __ Other (Please specify) _____

7. Does your company or institution conduct in-house or internally sponsored research and development?

1 __ Yes 2 __ No (18)

8. Does your company or institution perform research and development for other private organizations and institutions?

1 __ Yes 2 __ No (19)

9. Were you an author, co-author, or editor of a technical report written within the last twelve months?

1 __ Yes 2 __ No (20)

10. Were you an author, co-author, or editor of a professional paper published in the journal literature within the last twelve months?

1 __ Yes 2 __ No (21)

11. Have you submitted a patent application within the last twelve months?

1 __ Yes 2 __ No (22)

12. Have any of the scientists or engineers (other than yourself) employed by your company or institution published any professional paper(s) in the journal literature within the last twelve months?

1 __ Yes 2 __ No 3__ Don't know (23)

13. Have any of the scientists or engineers (other than yourself)

* "Company" or "institution" is defined as an organization consisting of one or more establishments under common ownership or control. This includes all establishments, subsidiaries, and affiliates.

employed by your company or institution submitted patent applications within the last twelve months?

1 __ Yes 2 __ No 3 __ Don't know (24)

14. Please estimate the number of scientists and engineers (includes faculty members) currently employed in your:

1 Company or institution _____ (25)

2 Organizational unit, as addressed in cover letter _____.

15. Does your company or institution maintain a library or information center?

1 __ Yes 2 __ No (26)

3 __ Other (Please specify) _____

16. Is the library or information center staffed by a professional librarian or information scientist?

1 __ Yes 2 __ No (27)

3 __ Other (Please specify) _____

17. Is the library or information center readily accessible to you?

1 __ Yes 2 __ No 3 __ Does not apply (28)

18. What is your highest earned degree?

Degree		Year Earned		Major	
1 __ B. A. /B. S.	(30-31)	_____	(38)	_____	(29-41)
2 __ M. A. /M. S.	(32-33)	_____	(39)	_____	
3 __ Ph. D./D.Sc.	(34-35)	_____	(40)	_____	
4 __ Other	(36-37)	_____	(41)	_____	

(Please specify) _____

19. Why are the abstracting and indexing services sent to you?

	Service*				
	NSA	STAR	TAB	USGRDR	
Don't know the reason	(42) __1	(44) __1	(46) __1	(48) __1	(42-49)
Ordered company or institutional subscription	__2	__2	__2	__2	
Ordered personal subscription	__3	__3	__3	__3	
Requested routing from library	__4	__4	__4	__4	

* NSA—Nuclear Science Abstracts, STAR—Scientific & Technical Aerospace Reports, TAB—Technical Abstract Bulletin, USGRDR—U. S. Government Research & Development Reports

	NSA	STAR	TAB	USGRDR
Placed on routing by library without specific request	___5	___5	___5	___5
AEC, DOD, or NASA contractor	(43)___1	(45)___1	(47)___1	(49)___1
Requested direct distribution	___2	___2	___2	___2
Did not request direct distribution	___3	___3	___3	___3
Other (Please specify)	___4	___4	___4	___4
Depository library distribution	___5	___5	___5	___5
GPO Depository	___6	___6	___6	___6
AEC Depository	___7	___7	___7	___7
Other (Please specify)	___8	___8	___8	___8

Part II: Use Made of Abstracting and Indexing Services

20. Have you yourself had any occasion within the last six months to make any use whatever of the abstracting and indexing service(s)?

1 __ Yes 2 __ No (50)

21. If you have not personally made use of the service(s), has someone else made use of them for you? (51)

1 __ Yes 2 __ No 3 __ Does not apply

If the answer to questions 20 and 21 are "No," you may skip the rest of the questions. Any comments you may wish to make regarding the usefulness, relevance, or nonrelevance of the service(s) to your present activities will be carefully considered. (Use the space below for your comments, if any.) Please mail the questionnaire in the enclosed envelope. Thank you very much.

---

22. If you answered "Yes" to question 21, what indivdual or office made use of the service(s) for you? (9) (-2)

1 __ Colleague

2 __ Research Assistant

3 __ Secretary

4 __ Library

5 __ Does not apply

6 __ Other (Please specify) _____

23. Generally, what do you use the service(s) for? (Please check all the reasons that apply and frequency of use.)

		Frequency of Use		
		Frequently	Occasionally	Rarely or never
(10) 1 __	To scan for specific information directly pertinent to your current project or research	____1	____2	____3 (11)
2 __	To keep abreast of current literature in your primary field of interest	____1	____2	____3 (12)
3 __	To keep abreast of current literature in your secondary field(s) of interest	____1	____2	____3 (13)
4 __	For quick retrospective reference or information retrieval	____1	____2	____3 (14)
5 __	For exhaustive literature searches	____1	____2	____3 (15)
6 __	For "browsing" in fields related or unrelated to your specialty	____1	____2	____3 (16)
7 __	Other (Please specify)	____1	____2	____3 (17)

24. If you checked more than one item in question 23, please record the numbers of the checked items in decending order of importance.

Item number:

(18)	(19)	(20)	(21)	(22)	(23)	(24)	(18-24)
(Most important)						(Least important)	

25. When making use of abstracting and indexing service(s), do you generally look for: (Please check all that apply, and for each frequency of use and field scanned)

		Frequency of Use			Field Scanned		
		Frequently	Occasionally	Rarely or never		Own Field(s)	Related Field(s)
(25) 1 __	Specific data or findings	(26) ___1	___2	___3	(27)	___1	___2 (26-27)
2 __	Information relating to						

	Frequency of Use			Field Scanned	
	Frequently	Occasionally	Rarely or never	Own Field(s)	Related Field(s)
Laboratory methods, techniques, procedures, apparatus, etc.	(28) ___1	___2	___3	(29) ___1	___2 (28-29)
3 __ Theoretical or conceptual statements or ideas	(30) ___1	___2	___3	(31) ___1	___2 (30-31)
4 __ Reviews, state-of-the-art surveys	(32) ___1	___2	___3	(33) ___1	___2 (32-33)
5 __ Other (Please specify)	(34) ___1	___2	___3	(35) ___1	___2 (34-35)

26. When scanning an issue of the abstracting and indexing service, do you generally: (Please check all that apply)

1 __ Check the Table of Contents and scan exclusively the section relating to your primary field of interest (36)
2 __ Check the Table of Contents and scan the sections relating to your primary and secondary field(s) of interest
3 __ Scan exclusively secondary field(s) of interest
4 __ Scan or "browse" through whole issue
5 __ Use the indexes and look up specific items of interest
6 __ Other (Please specify) _____

27. The most recent use you made of the abstracting and indexing service(s) was for: (Please check the one that applies.)

1 __ Keeping abreast of newly published literature (37)
2 __ Information needed for the preparation of a report
3 __ Information needed for the preparation of a lecture
4 __ Information needed for the preparation of a proposal
5 __ Information needed for project experiment
6 __ Retrospective literature search
7 __ General "browsing"
8 __ Other (Please specify) _____

28. After seeing an item of interest in the abstracting and indexing service(s), do you usually: (Please check all that apply and for each, whether of immediate or long-term value.)

	If of immediate use or value	If not of immediate use or value
(38) 1 __ Make a mental note of its		

	contents only	1	2 (39)
2 __	Make or have made a written note of its contents	1	2 (40)
3 __	Seek to obtain original and, if obtained, read it as soon as possible	1	2 (41)
4 __	Seek to obtain original, and if obtained, have it filed for future use (without reading)	1	2 (42)
5 __	Other (please specify)	1	2 (43)

29. If desired, how difficult is it for you to acquire the original or photocopy of the item cited in the abstracting and indexing service?

1 __ Very difficult

2 __ Rather difficult

3 __ Rather easy

30. For the indexes listed below, please indicate how useful each is in your work.

	Very useful	Rather useful	Occasionally useful	Of little or no use	
Personal Author Index	1	2	3	4	(45)
Corporate Author Index	1	2	3	4	(46)
Subject Index	1	2	3	4	(47)
Report Number Index	1	2	3	4	(48)
Contract Number Index	1	2	3	4	(49)

31. For the indexes listed below, please check the frequency with which you have used each within the last six months.

	Frequency of Use					
	Daily	Weekly	Monthly	Rarely	Never	
Personal Author Index	1	2	3	4	5	(50)
Corporate Author Index	1	2	3	4	5	(51)
Subject Index	1	2	3	4	5	(52)
Report Number Index	1	2	3	4	5	(53)
Contract Number Index	1	2	3	4	5	(54)

32. Within the last twelve months, have you had to undertake a line of research that was definitely outside the field of your specialization?

1 __ Yes 2 __ No (55)

33. Within the last twelve months, have you had a need for data, techniques, processes, equipment, etc. from outside the field of your specialization?

1 __ Yes 2 __ No (56)

34. Please estimate the time that you personally devote on the average to scanning a single issue of the abstracting and indexing service:

	Service*				
	(57) NSA	(58) STAR	(59) TAB	(60) USGRDR	(57-60)
Less than 5 minutes	___1	___1	___1	___1	
5-14 minutes	___2	___2	___2	___2	
15-29 minutes	___3	___3	___3	___3	
30-44 minutes	___4	___4	___4	___4	
45-59 minutes	___5	___5	___5	___5	
60-120 minutes	___6	___6	___6	___6	
More than 2 hours	___7	___7	___7	___7	

35. After scanning an issue of the abstracting and indexing service, what do you do with it? (Please check the one that applies best.)

	Service*				
	(8) NSA	(9) STAR	(10) TAB	(11) USGRDR	
__File and keep last 5 years or longer	___1	___1	___1	___1	(8-11) (—3)
__File and keep 3-4 years	___2	___2	___2	___2	
__File and keep 1-2 years	___3	___3	___3	___3	
__Keep current issues only	___4	___4	___4	___4	
__Discard immediately after scanning	___5	___5	___5	___5	
__Clip or note issue and discard	___6	___6	___6	___6	
__Route issue directly to library	___7	___7	___7	___7	
__Route to other individuals on routing slip	___8	___8	___8	___8	
__Other (Please specify)	___9	___9	___9	___9	

36. Do you maintain a personal file of citations pertinent to your subject specialty?

1 __ Yes 2 __ No (12)

37. For the services listed below, please check the titles used and frequency of your use, if any, within the last six months.

	Frequency of Use				
	Daily	Weekly	Monthly	Occa-sionally	Never
(13) 1 Nuclear Science Abstracts	1	2	3	4	5 (14)
2 Scientific & Technical Aerospace Reports	1	2	3	4	5 (15)
3 Technical Abstract Bulletin	1	2	3	4	5 (16)
4 U. S. Government Research & Development Reports	1	2	3	4	5 (17)
5 Applied Mechanics Reviews	1	2	3	4	5 (18)
6 Biological Abstracts	1	2	3	4	5 (19)
7 Chemical Abstracts	1	2	3	4	5 (20)
8 Electrical Engineering Abstracts	1	2	3	4	5 (21)
9 Engineering Index	1	2	3	4	5 (22)
0 Index Medicus	1	2	3	4	5 (23)
X Physics Abstracts	1	2	3	4	5 (24)
Y Other (Please spec.)	1	2	3	4	5 (25)

38. If your issue of the abstracting and indexing service is routed or seen by others in your immediate group, please estimate the number of individuals who are on the routing list or that make use of your issue:

	Service *			
	NSA	STAR	TAB	USGRDR
Number on routing list	(26-27)	(31-32)	(36-37)	(42-42) (26-45)
Number that make use of issue in your immediate group	(28-29)	(33-34)	(38-39)	(43-44)
Does not apply	(30-1)	(35-1)	(40-1)	(45-1)
Other (Please specify)	(30-2)	(35-2)	(40-2)	(45-2)

39. As a recipient of one of the Federal abstracting and indexing services, would you be interested in getting information about any of the following? (Please check all that apply.)

---

* NSA—Nuclear Science Abstracts, STAR—Scientific & Technical Aerospace Reports, TAB—Technical Abstract Bulletin, USGRDR—U. S. Government Research & Development Reports

1 __ Nuclear Science Abstracts (issued by the U. S. Atomic Energy Commission) (46)
2 __ Scientific and Technical Aerospace Reports (issued by the National Aeronautics and Space Administration)
3 __ Technical Abstract Bulletin (issued by the Defense Documentation Center, U. S. Department of Defense)
4 __ U. S. Government Research & Development Reports (issued by the Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce
5 __ None desired

40. Given a choice, and in lieu of the present contents found in the abstracting service(s) mailed to you, would you prefer to receive abstracts of reports covering subjects that are:

1 __ Exclusively from within your own subject specialty? (47)

2 __ Within the broad primary field encompassing your subject specialty?
3 __ Covering exclusively secondary fields, i.e., excluding subject specialty?
4 __ Covering selected developments, ideas, techniques, etc. from all fields applicable to your subject specialty?
5 __ Prefer present format as is

6 __ Other (Please specify)_____

_____ (48)

If you are a member of a library or information service staff, kindly complete questions 41-50. If you are not a member of a library or information service staff, please check here __ and then return the questionnaire in the enclosed self-addressed envelope. Thank you very much.

41. Which of the following does the library or information center perform? (Please check all that apply.)

1 __ Catalogs technical reports (49)

2 __ Selectively disseminates incoming technical reports

3 __ Prepares abstracts for newly acquired technical reports

4 __ Selectively disseminates abstracts

5 __ Issues acquisitions or announcement bulletin

6 __ Other technical report service: (Please specify)_____

42. If your library issues an acquisitions or announcement bulletin, its frequency is:
1 __ Daily 2 __ Weekly 3 __ Biweekly 4 __ Monthly (50)

5 __ Other (Please specify)_____

43. Technical reports are cataloged because: (Please check all that apply.)

1__More detailed subject approach is needed than that provided in the abstracting and indexing services (51)

2__Subject approach is adequate, but indexes are issued too late

3__The only reports cataloged are those not listed in the services

4__Descriptive cataloging inadequate

5__Does not apply

6__Other (Please specify)_____

44. In descriptive cataloging of reports, entries are prepared for: (Please check all that apply.)

1__Personal authors (52)

2__Corporate authors

3__Report number

1__Issuing agency (53)

2__Monitoring agency

3__AD, PB, TID, etc. documentation center accession number

4__Contract number (52)

5__Project number

6__Does not apply

7__Other (Please specify)_____

45. In subject analyses of technical reports, your library or information center uses on the average:

1__ 1-2 subjects/descriptors/uniterms, etc. per report (54)

2__ 3-4 subjects/descriptors/uniterms, etc. per report

3__ 5-6 subjects/descriptors/uniterms, etc. per report

4__ 7-9 subjects/descriptors/uniterms, etc. per report

5__10-15 subjects/descriptors/uniterms, etc per report

6__ Over 15 subjects/descriptors/uniterms, etc. per report

7__ Does not apply

46. What is the total number of full-time employees in your library or information center?

1 Professional (Full time equivalent)_____ (55-57)

2 Clerical and Sub-professional (Full time equivalent_____

3 __Don't know

47. Please estimate the total (i.e., potential) library or information center clientele to be serviced by your library or information center:

1 Total scientists and engineers_____ (58-60)

2 Other Professional/Managerial_____

3 Technical and supporting personnel _____

4 ___ Don't know

48. Please estimate the number of technical reports held by your library or information center. (Consider titles only. Include microreproductions in title estimate.)

1. Total number of technical report titles _____ (61-62)
2. ___ Don't know

49. Of the total number of technical report titles held in your library or information service, please estimate the percentage of:

1 ___% DOD reports (63-70)

2 ___% AEC reports

3 ___% NASA reports

4 ___% Other

100% Total

50. For each of the services listed below, please indicate the number of copies received by your library or information center, whether circulation or routing is permitted, and distribution or disposition of copies received.

	Service*			
	NSA	STAR	TAB	USGRDR
Copies Received				
Total number	___(11-12)	___(27-28)	___(43-44)	___(60-61) (11) (-4)
Circulation or Routing				
Permitted	___(13)	___(29)	___(44-45)	___(62-63)
Not permitted	___(14)	___(30)	___(46-47)	___(64-65)
Distribution or Disposition				
Reference	___(15-16)	___(31-32)	___(48-49)	___(66-67)
Acquisitions	___(17-18)	___(33-34)	___(50-51)	___(68-69)
Circulation	___(19-20)	___(35-36)	___(52-53)	___(70-71)
Sub-libraries	___(21-22)	___(37-38)	___(54-55)	___(72-73)
Routing	___(23-24)	___(39-40)	___(56-57)	___(74-75)
Other (Please spec.)	___(25-26)	___(41-42)	___(58-59)	___(76-77)

Please feel free to make additional comments relating to any phase of this questionnaire. Your comments and suggestions will be given careful consideration. Kindly mail the questionnaire in the enclosed self-addressed, stamped envelope.

Thank you very much. Your cooperation is greatly appreciated.

* NSA—Nuclear Science Abstracts
STAR—Scientific & Technical Aerospace Reports
TAB—Technical Abstract Bulletin
USGRDR—U. S. Government Research & Development Reports

Appendix D

1. Nonrecipient Questionnaire Cover Letter

Columbia University in the City of New York - New York, N. Y. 10027
School of Library Service Butler Library

Dear Sir:

You are no doubt aware of the considerable sums of money that the Federal Government spends annually on research and development activity. The research results stemming from these expenditures are frequently made available to industry and educational institutions in the form of technical reports.

The Directorate of Information Sciences, U. S. Air Force Office of Scientific Research, under contract AF 49(638) 1741, is supporting a study carried out at the Columbia University School of Library Service, aimed at discovering more effective means for disseminating and utilizing the technical reports literature.

The enclosed questionnaire is designed to elicit information regarding your organization's familiarity with certain federally published abstracting and indexing services which announce the existence and availability of technical reports derived from government-sponsored research. The information supplied to us in the questionnaire will be interpreted in the light of the background and over-all information needs of the respondents.

Though research-oriented and having a capability to perform research and development tasks for Federal agencies, it is quite likely that your firm or institution does not now receive any of the abstracting and indexing services referred to in the questionnaire. Negative responses are as significant as positive responses. Please feel assured that all data supplied will be kept in strict confidence.

The efficient transfer of scientific and technical information from defense-oriented industries and institutions to the broader, private sector of our economy is of vital interest to the business community and the Federal Government. We seek your cooperation in completing the enclosed questionnaire. A self-addressed return envelope is enclosed for your convenience. We hope that you will participate in this research effort.

Very truly yours,

Irving M. Klempner
Principal Investigator

IMK:mgb
Enclosures

Appendix D

2. Nonrecipient Questionnaire

Code_____ (1-7)

Abstracting and Indexing Services
for Government-Sponsored Research

Instructions:

For the purposes of this study, this questionnaire should be completed by the individual concerned with the acquisition and dissemination of scientific and technical information needed by your organization in support of research and development activity.

Many thanks for your cooperation.

(8)

Name of person completing questionnaire Title

Name of employer

Department or sub-unit

Address

Part 1: Background Information

1. Which of the following best characterizes your company's* or institution's* field of specialization? (If several, please check the field to which the major portion of staff time is devoted.)

(9)

1___Aeronautics

2___Agriculture

3___Astronomy and Astrophysics

4___Atmospheric Sciences

5___Behavioral and Social Sciences (includes Humanities)

6___Biological and Medical Sciences

7___Chemistry and Chemical Engineering

8___Earth Sciences and Oceanography

9___Electronics and Electrical Engineering

0___Energy Conversion (non-propulsive)

X___Engineering (Mechanical, Industrial, Civil, and Marine)

Y___Library or Information Sciences

* "Company" or "institution" is defined as an organization consisting of one or more establishments under common ownership or control. This includes all establishments, subsidiaries, and affiliates.

1___Materials and Metallurgy (10)

2___Mathematical Sciences

3___Methods and Equipment

4___Military Science

5___Missile Technology

6___Navigation, Communication, Detection, Countermeasures

7___Nuclear Science and Technology

8___Ordnance

9___Physics

0___Propulsion and Fuels

X___Space Technology

Y___Other (Please specify)_____

2. Does your company or institution conduct in-house or internally sponsored research and development (R&D)**?

1___Yes 2___No (11)

3. Does your company or institution perform R&D for other private organizations and institutions? (12)

1___Yes 2___No

4. To the best of your knowledge, does your company or institution now have contracts for R&D with any of the following? (Please check all that apply.)

1___Atomic Energy Commission (AEC) (13)

2___Department of Defense (Army, Navy, Air Force) (DOD)

3___National Aeronautics and Space Administration (NASA)

4___Don't know

5___None

6___Other Federal agency (Please specify)_____

5. Please estimate the number of scientists and engineers (including faculty members) currently employed in your company or institution.

1___1-9 3___20-49 5___100-199 7___300-499 (14)

2___10-19 4___50-99 6___200-299 8___Over 500

6. Please estimate the percentage of total staff time devoted to R&D.

1___Over 75% 2___50%-74% 3___20%-49% 4___1%-19% (15)

** R&D activity includes both basic and applied research in the sciences and engineering, and the design and development of prototypes and processes.

7. Does your company or institution maintain a library or information center?

1___Yes 2___No (16)

3___Other (Please specify)_____

8. If so, is the library or information center staffed by a professional librarian or information scientist?

1___Yes 2___No 3___Does not apply (17)

4___Other (Please specify)_____

9. Is the library or information center readily accessible to you?

1___Yes 2___No 3___Does not apply (18)

10. In general, is it your opinion that the scientific and technical information needs of your company or institution are being met?

1___Fairly well (19)

2___Well

3___Very Well

4___Excellently

5___Inadequately

Part 11: Use Made of Abstracting and Indexing Services

11. Are you personally acquainted with any of the abstracting and indexing services, NSA, STAR, TAB, USGRDR*?

Service*	Acquainted Yes	Acquainted No	
NSA	___	___	
STAR	___1	___2	(20)
TAB	___1	___2	(21)
USGRDR	___1	___2	(22)

12. If acquainted, have you had any occasion within the last six months to make any use whatever of these abstracting and indexing services?

1___Yes 2___No 3___Does not apply (23)

13. If you have not personally made use of the service(s), has someone else made use of them for you?

1___Yes 2___No 3___Does not apply (24)

---

* NSA—Nuclear Science Abstracts
STAR—Scientific & Technical Aerospace Reports
TAB—Technical Abstract Bulletin
USGRDR—U. S. Government Research and Development Reports

14. If you answered "Yes" to question 13, what individual or office made use of the service(s) for you?

1___Colleague (25)

2___Research Assistant

3___Secretary

4___Library

5___Does not apply

6___Other (Please specify)_____

15. To the best of your knowledge, does your company or institution currently receive any of the following services?

Service	Received: Yes	No	Don't know	
(26) 1___Nuclear Science Abstracts	___1	___2	___3	(27)
2___Scientific and Technical Aerospace Reports	___1	___2	___3	(28)
3___Technical Abstract Bulletin	___1	___2	___3	(29)
4___U. S. Government Research & Development Reports	___1	___2	___3	(30)
5___Applied Mechanics Reviews	___1	___2	___3	(31)
6___Biological Abstracts	___1	___2	___3	(32)
7___Chemical Abstracts	___1	___2	___3	(33)
8___Electrical Engineering Abstracts	___1	___2	___3	(34)
9___Engineering Index	___1	___2	___3	(35)
0___Index Medicus	___1	___2	___3	(36)
X___Physics Abstracts	___1	___2	___3	(37)
Y___Other (Please specify)	___1	___2	___3	(38)

16. Would you be interested in getting information about any of the following? (Please check all that apply.)

1___Nuclear Science Abstracts (issued by the U. S. Atomic Energy Commission) (39)

2___Scientific and Technical Aerospace Reports (issued by the National Aeronautics and Space Administration)

3___Technical Abstract Bulletin (issued by the Defense Documentation Center, U. S. Department of Defense)

4___U. S. Government Research & Development Reports (issued by the Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce)

17. Within the last twelve months, have you or your company had to undertake a line of research that was definitely outside the field of your specialization?

1__ Yes 2__ No (40)

18. Within the last twelve months, have you or your company had a need for data, techniques, processes, equipment, etc. from outside the field of your specialization?

1__ Yes 2__ No (41)

19. When seeking information, do you generally look for: (Please check those that apply, frequency of use, and field scanned.)

	Frequency of Use			Field Scanned		
	Frequently	Occasionally	Rarely or Never	Own Field(s)	Related Field(s)	
(42) 1__ Specific data or findings	(43)__1	__2	__3	(44)__1	__2	(43-44)
2__ Information relating to laboratory techniques, procedures, apparatus, etc.	(45)__1	__2	__3	(46)__1	__2	(45-46)
3__ Theoretical or conceptual statements or ideas	(47)__1	__2	__3	(48)__1	__2	(47-48)
4__ Reviews, state-of-the-art surveys	(49)__1	__2	__3	(50)__1	__2	(49-50)
5__ Other (Please Specify)	(51)__1	__2	__3	(52)__1	__2	(51-52)

20. Would you prefer to receive an abstracting and indexing service covering subjects that are:

1__ Exclusively within your own subject specialty? (53)

2__ Within the broad primary field encompassing your subject specialty?

3__ Covering exclusively secondary fields, i.e., excluding subject specialty?

4__ Covering selected developments, ideas, techniques, etc. from other fields applicable to your subject specialty?

5__ Prefer format as is

6__ Other (Please specify)_____

21. In making use of published materials, do you generally use these materials: (Please check those that apply and frequency of use.)

		Frequency of Use			
		Frequently	Occasionally	Rarely or never	
(54)	1___ To scan for specific information directly pertinent to your current project or research	___1	___2	___3	(55)
	2___ To keep abreast of current literature in your primary field of interest	___1	___2	___3	(56)
	3___ To keep abreast of current literature in secondary field(s) of interest	___1	___2	___3	(57)
	4___ For quick retrospective reference or information retrieval	___1	___2	___3	(58)
	5___ For exhaustive literature searches	___1	___2	___3	(59)
	6___ For "browsing" in fields related or unrelated to your specialty	___1	___2	___3	(60)
	7___ Other (Please specify)	___1	___2	___3	(61)

22. If you checked more than one item in question 21, please record the numbers of the checked items in descending order of importance.

Item number:

___	___	___	___	___	___	___	(62-68)
(62)	(63)	(64)	(65)	(66)	(67)	(68)	
Most important						Least important	

Please feel free to make additional comments relating to any question posed in the questionnaire. Of particular interest would be comments relating to your successes or failures in obtaining needed information. Your comments and suggestions will be welcome and will be given careful consideration.
Please mail the questionnaire in the enclosed return envelope.
Thank you very much. Your cooperation is greatly appreciated.

Bibliography

"An Act to Establish a Department of Agriculture." U.S. Statutes at Large, v. 12, 1859-1865, pp. 387-388.

Album, Hyman H. and Hoshovsky, Alexander G. Threat of Communist Technology. Proposals for Free World Cooperation in R&D and Information Transfer. (OAR-018; AD 430 598). Washington, D.C., Office of Aerospace Research, U. S. Air Force, Sept. 1963.

Allison, David. "The Civilian Technology Lag." International Science and Technology, no. 24, Dec. 1963, pp. 24-34.

American Psychological Association. Reports of Project on Scientific Information Exchange in Psychology. v. 2. Washington, D.C., Dec. 1965.

American Psychological Association. The Role of the Technical Report in the Dissemination of Scientific Information. (APA-PSIEP Report No. 13). Washington, D.C., April 1965.

American Psychological Association. A Study of the Use and Current Operations of Psychological Abstracts with a View Toward Innovation. (APA-PSIEP Report No. 15). Washington, D.C., Dec. 1965.

Arutyunov, N.B. "O opatrenich k dalsimu zdokonalovani soustavy vedeckotechnichyich informaci v SSSR." Metodika a technika informaci, no. 6, 1965, pp. 12-25.

Arutyunov, N.B. "On Measures for Further Improvement of System of Scientific and Technical Information in Our Country." Scientific and Technical Information (Selected Articles). No. 6, 1964. (FTD-MT-65-07; AD 619 553) Wright-Patterson Air Force Base, Ohio, Foreign Technology Division, 1965.

Auerbach Corp. DOD User Needs Study. Final Technical Report 1151-TR-3. Phase I. Submitted to Advance Research Projects Agency, Department of Defense. 2 vols. (AD 615 601; AD 615 502). Philadelphia, Pa., May 14, 1965.

Baker, Dale D. "Growth of Chemical Literature; Past, Present and Future." Chemical and Engineering News, v. 39, no. 29, July 17, 1961, pp. 78-81.

Baker, Dale B. and others. Some Counterparts in Perspective: A Report on Research Data Processing and Information Retrieval in Other Countries, Including Poland and the Soviet Union. Prepared by Task Force of Visiting Scientists. Washington, D.C., National Federation of Science Abstracting and Indexing Services, 1960.

Berkov, P. N. Bibliograficheskaia evristika; k teorii i metodike bibliograficheskikh razyskanii. Moskva, Izd-vo Vsesoiuznoi knizhnoi palaty, 1960.

Bernard, Jesse and Shilling, Charles. Accuracy of Titles in Describing Content of Biological Science Articles. Washington, D.C., American Institute of Biological Sciences, 1963.

Bernier, Charles L. "Accelerating Information Transfer in Science and Technology." Paper presented at the Congress of International Federation for Documentation, Washington, D.C., Oct. 10-15, 1965.

Bourne, Charles P. "The World's Technical Journal Literature: An Estimate of Volume, Origin, Language, Field, Indexing, and Abstracting." American Documentation, v. 13, no. 2, April 1962, pp. 162-168.

Brock, Clifton. "The Quiet Crisis in Government Publishing." College and Research Libraries, v. 26, no. 6, Nov. 1965, pp. 477-489, 531.

Brozen, Yale. "The Future of Industrial Research." Journal of Business (University of Chicago), v. 34, no. 4, Oct. 1961, pp. 434-441.

Carter, C. F. and Williams, B. R. Industry and Technical Progress: Factors Governing Speed of Application of Science. London, Oxford University Press, 1957.

Carter, Luther J. "Technical Services Act; Industry to Benefit from New Programs Paralleling Farm Extension Service." Science, v. 149, no. 3691, Sept. 24, 1965, pp. 1485-1486, 1547-1550.

Chernova, T. V. "O referativnom zhurnale 'Khimiia'." Akademiia nauk SSR. Vestnik, v. 25, no. 1, Jan. 1955, pp. 127-132.

Columbia University. Bureau of Applied Social Research. The Flow of Information Among Scientists. New York, May 1958.

Conference on the Communication of Scientific and Technical Knowledge to Industry, Stockholm, October 7-9, 1963. Proceedings. Paris, Organization for Economic Cooperation and Development, 1965.

D. S. I. R. - Aslib Delegation to Moscow and Leningrad. Scientific and Technical Information in the Soviet Union. Report. London, Department of Industrial and Scientific Research, 1964.

Danilov, Victor J., ed. "$23 Billion for Research Funds; R&D Spending to Increase 8%." Industrial Research, v. 8, no. 1, Jan. 1966, pp. 32-47.

Denison, Edward F. The Sources of Economic Growth in the United States and the Alternatives Before Us. (Supplementary Paper No. 13). New York, Committee for Economic Development, 1962.

Dutta, S. and Das Gupta, A. K. "National/Regional Abstracting Services as Feeders for Tertiary Services." Annals of Library Science and Documentation, v. 13, no. 1, March 1966, pp. 25-33.

"Działalność CIINTE v roku 1962." Aktualne Problemy Informacji i Dokumentacji, v. 8, no. 1, 1963, pp. 32-34.

Ewell, Raymond H. "Role of Research in Economic Growth." Chemical and Engineering News, v. 33, no. 29, July 18, 1955, pp. 2980-2985.

First National City Bank of New York. Monthly Economic Letter. Aug. 1965, pp. 85-95.

Fokin, S. IA. "O dvukh formakh izdaniia referativnoĭ informatsii." Nauchno-tekhnicheskaia informatsiia, no. 6, 1966, pp. 8-9.

Fomin, A. A. "Referativnye zhurnaly Vsesoiuznovo instituta nauchnoĭ i tekhnicheskoĭ informatsii ("Abstract Journals for the All-Union Institute of Scientific and Technical Information") In Voprosy otraslevoĭ bibliografii po estestvennym naukam (Bibliographic Problems in the Natural Sciences; Reports Delivered at the VI Scientific Conference of the Library of the Academy of Sciences USSR, Leningrad, March 2-4, 1960). (Tr. by Adam Kahane). Cambridge, Mass., Massachusetts Institute of Technology, 1962, pp. 32-33.

_____. "Vsesoiuznyĭ Institut Nauchnoĭ i Tekhnicheskoĭ Informatsii; evo struktura i soderzhanie raboty." In Voprosy organizatsii i metodiki nauchno-tekhnicheskoĭ informatsii i propagandy. Po materialam seminara rabotnikov nauchno-tekhnicheskoĭ informatsii i propagandy, Moskva, 16 Maia - 11 Iiunia 1960g. Moskva, TSINTI, 1960, pp. 15-28.

Four Continent Book Corp. Periodicals of the USSR and Referativnye Zhurnaly, 1967. New York. 1966.

"The Function and Effectiveness of Abstracting and Indexing Services: Area II [papers]" In International Conference on Scientific Information, Washington, D.C., Nov. 16-22, 1958. Proceedings, v. 1. Washington, D.C., National Academy of Sciences, National Research Council, 1958, pp. 315-535.

Gavin, James. "Military Power: The Limits of Persuasion." Saturday Review, v. 49, no. 31, July 30, 1966, pp. 18-30, 64.

"General Regulations Governing Operation and Administration of the State Technical Services Act of 1965." Federal Register, v. 30, no. 250, Dec. 29, 1965, p. 1621.

Glass, Bentley. "Survey of Biological Abstracting." AIBS Bulletin, v. 5, January 1955, pp. 20-24; April 1955, pp. 18-21.

Gorokhoff, Boris I. Publishing in the U. S. S. R. [Washington, D.C., Council on Library Resources, 1959]

Gray, Dwight E. "The American Institute of Physics Study of Physics Abstracting." Revue de la Documentation, v. 18, no. 1, March 31, 1951, pp. 17-20.

Great Britain. Advisory Council on Scientific Policy. "Survey of Information Needs of Physicists and Chemists." Journal of Documentation, v. 21, no. 2, June 1965, pp. 83-112.

Green, John C. "Comparison of Methods of Technical Communication in the U.S. and Russia." IRE Transactions Engineering Writing and Speech, v. 5, no. 2, 1962, pp. 94-98.

Herner, Saul. "The Information-Gathering Habits of American Medical Scientists." In International Conference on Scientific Information, Washington, D.C., Nov. 16-21, 1958. Proceedings, v. 1, Washington, D. C., National Academy of Sciences, National Research Council, 1959, pp. 277-285.

Herner, Saul and Herner, Mary. The Use of Atomic Energy Commission Technical Information Tools and Services. Oak Ridge, Tenn., Division of Technical Information, U.S. Atomic Energy Commission, Feb. 1962.

Herner and Co. Factors Governing the Announcement and Publication of United States Government Research Reports. (PB-160 555). Prepared by Saul and Mary Herner under National Science Foundation Contract NSF-C-153. Washington, D.C., Dec. 1961.

Herner and Co. Speed of Announcement of United States Government Research Reports in Technical Abstract Bulletin, U.S. Government Research Reports, and Nuclear Science Abstracts, 1961-1962. (PB-160 556). Prepared by Mary Herner and Barbara Kolber under National Science Foundation Contract NSF-C-213. Washington, D.C., March 1962.

Hoffmann, Walther G. The Growth of Industrial Economies. Tr. from German by W.O. Henderson and W.H. Chaloner. [Manchester, Eng.] Manchester University Press [c. 1958]

Hollomon, J. Herbert. "Science, Technology and Economic Growth." Physics Today, v. 16, no. 3, March 1963, pp. 38-42.

Ĭankovskiĭ, IA. "O deiatelnosti chekhoslovatskogo Instituta Tekhnicheskoĭ i Ekonomicheskoĭ Informatsii." Nauchno-tekhnicheskaia informatsiia, no. 8, 1965, pp. 45-46.

Janszky, L. "Informacja naukowo-techniczna w Węgierskiej Republice Ludowej." Aktualne Problemy Informacji i Dokumentacji, v. 10, no. 4, Aug./Sept. 1965, pp. 5-8.

Korol, Alexander G. Soviet Research and Development; Its Organization, Personnel, and Funds. Cambridge, Mass., M.I.T. Press, 1965.

Lazar, P. "Organization of Documentation in Hungary." Annals of Library Science and Documentation, v. 11, no. 1-3, March-Sept. 1964, pp. 3-13.

Leibnitz, Eberhard and Koblitz, Josef. "Zehn Jahr Dokumentations- und Informationsnetz in der DDR." Dokumentation, v. 9, no. 1, Feb. 1962, pp. 1-3.

Lesher, Richard L. and Howick, George J. Background, Guidelines and Recommendations for Use in Assessing Effective Measures of Channeling New Technologies in Promising Directions. (N66-19042). Prepared for the National Commission on Technology, Automation, and Economic Progress. Washington, D.C., National

Aeronautics and Space Administration, Nov. 1965.

Little (Arthur D.) Inc. Patterns and Problems of Technical Innovation in American Industry. (C-65344; PB-181573). Report to the National Science Foundation [Cambridge, Mass.] Sept. 1963.

Machlup, Fritz. The Production and Distribution of Knowledge in the United States. Princeton, N.J., Princeton University Press, 1962.

McLaughlin, Curtis P. et al. Technology Transfer and the Flow of Technical Information in a Large Industrial Corporation. 2 vols. Sponsored by the Committee on Space, American Academy of Arts and Sciences under NASA Grant NsG-253-62. [Cambridge, Mass., Graduate School of Business Administration, Harvard University] March 1965.

Maizels, Alfred. Industrial Growth and World Trade: An Empirical Study of Trends in Production, Consumption and Trade in Manufactures from 1899-1959, with a Discussion of Probable Future Trends. (National Institute of Economic and Social Research. Economic and Social Studies, 21). Cambridge [Eng.] University Press, 1963.

Malov, V.S. "Results of a Check of Fulfillment of Resolution of Council of Ministers of USSR 'About Measures for Improvement of Organization of Scientific and Technical Information in this Country.'" Scientific and Technical Information (Selected Articles), no. 6, 1964. (FTD-MT-65-07; AD 619 553). Wright-Patterson Air Force Base, Ohio, Foreign Technology Division, 1965.

Mansfield, Edwin. "Diffusion of Technological Change." Reviews of Data on Research and Development, no. 31, Oct. 1961, pp. 1-6. (NSF 61-52).

_____. "The Process of Technical Change." Paper presented at Symposium on the Diffusion of Technological Change, Nov. 1, 1962. (Summary published in Special Libraries, v. 54, no. 6, July-Aug. 1963, pp. 353-355.)

Martyn, John and Slater, Margaret. "Tests on Abstracts Journals." Journal of Documentation, v. 20, no. 4, Dec. 1964, pp. 212-235.

Menzel, Herbert. "The Information Needs of Current Scientific Research." Library Quarterly, v. 34, no. 1, Jan., 1964, pp. 4-19.

Michajlow, A.I. "Organizacja działalności naukowo-informacyjnej w Związku Radzieckim." Aktualne Problemy Informacji i Dokumentacji, v. 9, no. 5, Sept./Oct., 1964, pp. 1-5.

Mikesova, Ludmila. "Referatova periodika dulezity zdroj informaci." Metodika a technika informaci, no. 3-4, 1962, pp. 36-64.

Mikhaĭlov, A.I. and others. Osnovy nauchnoĭ informatsii. Moskva, Izd-vo nauka, 1965.

Mikhaĭlov, A.I. "Otvet nedrugu." Ekonomicheskaya gazeta, June 20, 1961, p. 4.

Minasian, Jora R. "The Economics of Research and Development." In National Bureau of Economic Research. The Rate and Direction

of Inventive Activity: Economic and Social Factors. Conference of the Universities-National Bureau Committee for Economic Research and the Committee on Economic Growth of the Social Science Research Council. Princeton, N. J., Princeton University Press, 1962, pp. 93-141.

National Federation of Science Abstracting and Indexing Services. A Guide to the World's Abstracting and Indexing Services in Science and Technology. (Report No. 102). Washington, D. C., 1963.

Organization for Economic Cooperation and Development. Science, Economic Growth and Government Policy. Paris, 1963.

Organization of Scientific and Technical Information in the Communist World. (ATD Report 66-11; AD 627 802) Washington, D. C., Aerospace Technology Division, Library of Congress, Jan. 24, 1966.

Pas, Ryszard, comp. Informator Służby Informacji Naukowo-Technicznej i Ekonomicznej. Warszawa, Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, 1960.

Pirog, Wojciech. "Aktualne problemy informacji naukowo-technicznej i ekonomicznej w Polsce." Aktualne Problemy Informacji i Dokumentacji, v. 10, no. 3, May-June 1965, pp. 5-10.

_____. "Nowa 5-lecie 1966-1970 w działalności informacyjnej w Polsce." Aktualne Problemy Informacji i Dokumentacji, v. 11, no. 3, May-June 1966, pp. 1-5.

Pittermann, R. "Technicke knihovny a vedeckotechnicke informace." v. 15, roce sveho rozvoje. Knihovnik, no. 5-6, 1960, pp. 172-177.

Polzovich, I. "K 200-letiiu referativhogo zhurnala po estestvennym naukam." Nauchno-tekhnicheskaia informatsiia, no. 10, 1965, pp. 8-11.

"President Signs State Technical Services Act." Washington Science Trends, v. 14, no. 25, Sept. 20, 1965, p. 369.

Price, Derek J. "The Exponential Curve of Science." Discovery, v. 17, no. 6, June 1956, pp. 240-243.

"Report of the Sixty-Ninth Meeting of the Association of Research Libraries, Held in New Orleans, La., January 8, 1967." LC Information Bulletin, v. 26, no. 4, Jan. 26, 1967, pp. 69-76.

"Research and Development and the Gross National Product." Reviews of Data on Science Resources, v. 1, no. 4, May 1965, p. 9. (NSF 65-11).

Rubel, John H. "Trends and Challenge in Research and Development." In National Security Industrial Association. The Impact of Government Research and Development Expenditures on Industrial Growth. Proceedings of R&D Symposium, 13-14 March 1963. Washington, D.C., 1963, pp. 9-36.

Russia. Sovet Ministrov. Gosudarstvennyi Nauchno-Tekhnicheski Komitet. Photocopies, Microfilms, Prospectus. (Tr. from Russian

by Medical Documentation Service, Philadelphia). Moscow, 1959.

Ryan, Bryce and Gross, Neal C. "The Diffusion of Hybrid Seed Corn in Two Iowa Communities." Rural Sociology, v. 8, no. 1, March 1943, pp. 15-24.

Sauter, Hubert E. Private Communication, July 26, 1965.

Schon, Donald A. "Innovation by Invasion." International Science and Technology, no. 27, March 1964, pp. 52-60.

Schultz, Theodore W. The Economic Value of Education. New York, Columbia University Press, 1963.

Scott, Christopher. The Use of Technical Literature by Industrial Technologists: A Study of Technical Information in the Electrical Industry. Rev. ed. London, Central Office of Information, 1960.

Slamecka, Vladimir. "The Semi-Centralized Systems of Technical Documentation and Information of the Czechoslovak Republic and East Germany." Unpublished Doctoral Dissertation, Columbia University, School of Library Service, 1962.

Sorokin, Y. N. Private Communication (No. 64-645/5). Jan. 25, 1967.

Spirit, Jiri. "Ceskoslovenske 'Prehledy technicke a hospodarske literatury' ve srovnani a celosvetovu orovni referatovych casopisu." Technicka knihovne, v. 9, 1959, pp. 157-161.

"Statut ustavu pro technicke a ekonomicke informace." Metodika a technika informaci, v. 2, no. 1, 1960, pp. 35-40.

Stegmaier, Robert B. "DDC Status and Plans." In Air Force Scientific and Technical Information Conference, 2nd, April 28-29, 1965. Proceedings. (AD 621 800). [Washington, D.C.] Air Force Systems Command [1966] pp. 24-27.

Sullivan, Walter. "World's Scientists Press Drive to Translate Data." New York Times, Dec. 26, 1961, p. 1, col. 2-3, p. 22, col. 4.

System Development Corporation. A System Study of Abstracting and Indexing in the United States. (Technical Memorandum, TM-WD-394; PB 174 249). Falls Church, Va., Dec. 1966.

System Development Corporation. Recommendations for National Document Handling Systems in Science and Technology. Appendix A. Background Study, vol. II. (AD 624 560; PB 168 267). Santa Monica, Calif., 1966.

"Technical Notes." Reviews of Data on Science Resources. (NSF 65-11). v. 1, no. 4, May 1965, p. 10.

"Technical Service Grants for 1967 Announced." Washington Science Trends, v. 17, no. 19, Feb. 6, 1967, pp. 125-127.

Teplov, D. I. IU. Informatsionno-tekhnicheskaia bibliografiia v SSSR. Moskva, Izd-vo Akademii nauk SSSR, 1962.

Thompson (John I.) and Co. Study of the Federal Government's System for Distributing Its Unclassified R&D Reports. Prepared by T. R. O'Donnell, J. L. Lewis, and J. I. Glendinning under National Science Foundation Contract NSF-C-224. Washington, D.C., June 20, 1962.

"The Trouble with ASTIA." Sci-Tech News. v. 13, no. 2, Summer 1959, p. 1.

U. S. Clearinghouse for Federal Scientific and Technical Information User Feedback Study of the Utilization of CFSTI Materials and Services. Springfield, Va., Aug. 1965.

U. S. Congress. House. Committee on Education and Labor. Ad Hoc Subcommittee on National Research Data Processing and Information Retrieval Center. National Information Center. Hearings, 88th Cong., 1st Sess., May 27, 28, July 18, 19, Sept. 17, 19, 1963. v. 1, pt. 1-3. Washington, D.C., U.S. Govt. Print. Off., 1963.

U. S. Congress. House. Committee on Science and Astronautics. Dissemination of Scientific Information. Hearings, 86th Cong., 1st Sess., May 25, 26, 28, June 2, and 17, 1959. Washington, D. C., U. S. Govt. Print. Off., 1959.

U. S. Congress. House. Committee on Science and Astronautics. Dissemination of Scientific Information. Report, 86th Cong., 1st Sess. (House Report No. 1179). Washington, D.C., U. S. Govt. Print. Off., 1959.

U. S. Congress. House. Committee on Science and Astronautics. Subcommittee on Science Research and Development. Geographic Distribution of Federal Research and Development Funds. Report, 88th Cong., 2nd Sess. (Government and Science, No. 4). Washington, D.C., U. S. Govt. Print. Off., 1964.

U. S. Congress. House. Select Committee on Government Research. Documentation and Dissemination of Research and Development Results. Report, 88th Cong., 2nd Sess. (Study No. IV; House Report No. 1932). Washington, D.C., U. S. Govt. Print. Off., 1964.

U. S. Congress. House. Select Committee on Government Research. Federal Research and Development Programs. Hearings, 88th Cong., 1st Sess., Nov. 18-22, 1963. pt. 1. Washington, D.C., U. S. Govt. Print. Off., 1964.

U. S. Congress. House. Select Committee on Government Research. Federal Research and Development Programs. Hearings, 88th Cong., 1st Sess., Dec. 11-12, 1963, and Jan. 22, 1964. pt. 2. Washington, D.C., U. S. Govt. Print. Off., 1964.

U. S. Congress. House. Select Committee on Government Research. Impact of Federal Research and Development Programs. Report 88th Cong., 2nd Sess. (Study No. VI; House Report No. 1938). Washington, D.C., U. S. Govt. Print. Off., 1964.

U. S. Congress. House. Select Committee on Government Research. National Goals and Policies. Report, 88th Cong., 2nd Sess. (Study No. X; House Report No. 834). Washington, D.C., U. S. Govt. Print. Off., Dec. 1964.

U. S. Congress. House. Select Committee on Government Research. Statistical Review of Research and Development. Report, 88th Cong., 2nd Sess. (Study No. IX; House Report No. 1940). Washington, D.C., U. S. Govt. Print. Off., 1964.

U. S. Congress. Senate. Committee on Government Operations. Documentation, Indexing, and Retrieval of Scientific Information. Report, 86th Cong., 2nd Sess., May 24, 1960. Washington, D.C., U. S. Govt. Print. Off., 1960.

U. S. Congress. Senate. Committee on Government Operations. Subcommittee on Reorganization and International Organizations. Defense Department Scientific and Technical Information... and Other Federal Agencies' Programs for Scientific and Technical Information... (Memorandum S-10-1-63). Washington, D.C., 1963.

U. S. Congress. Senate. Committee on Government Operations. Subcommittee on Reorganization and International Organizations. Interagency Coordination of Information. Hearings, 87th Cong., 2nd Sess., Sept. 21, 1962, pt. 1. Washington, D.C., U. S. Govt. Print. Off., 1963.

U. S. Congress. Senate. Committee on Labor and Public Welfare. Subcommittee on Employment and Manpower. Impact of Federal Research and Development Policies on Scientific and Technical Manpower. Hearings, 89th Cong., 1st Sess., June 2, 3, 4, 7, 8, 9, 10 and July 22, 1965. Washington, D.C., U. S. Govt. Print. Off., 1965.

U. S. Congress. Senate. Select Committee on Small Business. The Role and Effect of Technology in the Nation's Economy. Hearings before a Select Subcommittee, 88th Cong., 1st Sess., May 20, June 5, 6, and 20, and Dec. 17 and 18, 1963. pt. 1-6. Washington, D.C., U. S. Govt. Print. Off., 1963-64.

U. S. Defense Documentation Center. COSATI Subject Category List (DOD Extended). (AD 624 000). Alexandria, Va., Dec. 1965.

U. S. Department of State. Scientific and Technical Developments Report: United Kingdom, 1962-63. (A-3658). [London, Eng.] 1964.

U. S. Federal Council for Science and Technology. Committee on Scientific Information. Status Report on Scientific and Technical Information in the Federal Government. (AD 411 939). Washington, D.C., June 18, 1963.

U. S. National Science Foundation. Basic Research, Applied Research, and Development in Industry, 1964. (NSF 66-28). Washington, D.C., U. S. Govt. Print. Off., 1966.

U. S. National Science Foundation. Federal Funds for Research, Development, and Other Scientific Activities, 1966. (NSF 65-19). Washington, D.C., U. S. Govt. Print. Off., 1966.

U. S. National Science Foundation. Federal Funds for Research, Development, and Other Scientific Activities, 1967. (NSF 66-25). Washington, D.C., U. S. Govt. Print. Off., 1966.

U. S. National Science Foundation. Publication of Basic Research Findings in Industry, 1957-59. (NSF 61-62). Washington, D.C., U. S. Govt. Print. Off., 1961.

U. S. Naval Research Advisory Committee. Basic Research in the Navy; a Report to the Secretary of the Navy. Vol. 1-2. (PB-151925)

Prepared by Arthur D. Little, Inc. under Contract Nonr-2516 (00). Washington, D.C., June 1959.

U. S. Office of Education. Earned Degrees Conferred 1962-1963. Bachelor's and Higher Degrees. (OE-54013-63; Circular No. 777). Washington, D.C., U.S. Govt. Print. Off., [1965]

U. S. Office of the Director of Defense Research and Engineering. Defense Science Board Subcommittee. Final Report on Scientific and Technical Information. (AD 416 655), Washington, D.C., July 16, 1963.

U. S. President's Science Advisory Committee. Science, Government, and Information. Report. Washington, D.C., U.S. Govt. Print. Off., 1963.

U. S. Task Force to the President's Special Assistant for Science and Technology. Scientific and Technological Communication in the Government. Report. (AD 299 545). Washington, D.C., 1962.

Urquhart, D.J. "Physics Abstracting - Use and Users." Journal of Documentation, v. 21, no. 2, June 1965, pp. 113-121.

Voigt, Melvin J. Scientists' Approaches to Information. (ACRL Monograph No. 24). Chicago, American Library Association, 1961.

Warner, Aaron W., ed., et al. The Impact of Science on Technology, New York, Columbia University Press, 1965.

Williams, B.R. "Research and Economic Growth - What Should We Expect?" Minerva, v. 3, no. 1, Autumn 1964, pp. 56-71.

"Yardstick for Management." Chemical and Engineering News, v. 33, no. 35, August 29, 1955, p. 3606.

Directories and General Reference Works

Frost & Sullivan, Inc. Roster of U.S. Government Research and Development Contracts in Aerospace and Defense. Washington, D.C., Bowker Associates, 1965.

Government Data Publications. Research and Development Directory for 1965. Washington, D.C., [c. 1965]

Industrial Research Laboratories of the United States. 12th ed. Edited by William W. Buchanan. Washington, D.C., Bowker Associates, 1965.

Research Centers Directory. 2nd ed. Edited by Archie M. Palmer and Anthony T. Kruzas. Detroit, Gale Research Co., [1965]

U. S. Bureau of the Census. Statistical Abstract of the United States: 1966. 87th ed. Washington, D.C., U.S. Govt. Print. Off., 1966.

U. S. Office of Education. Education Directory, Pt. 3, Higher Education, 1965-1966. (OE-50000-66). Washington, D.C., U.S. Govt. Print Off., 1966.

U. S. Small Business Administration. A List of Small Business Concerns Interested in Performing Research and Development. 4th ed. Washington, D.C., May 1963.

Name Index

ASTIA (see Armed Services Technical Information Agency)
Abidan, G. W., vii
Album, H. H., 65, 74
Allison, D., 182, 194
All-Union Institute of Scientific and Technical Information, USSR, 50, 59-60, 63, 66-67
American Nuclear Society, 31
American Psychological Association, 30-31
Armed Services Technical Information Agency (ASTIA), 29
Arutyunov, N. B., 75
Association of Research Libraries Committee on Non-GPO Publications, 192
Auerbach Corp., 30
Baker, D. B., 71-72, 74
Berkov, P. N., 29
Bernard, J., 71
Bernier, C. L., 71
Bourne, C. P., 50, 71
Brock, C., 192, 195
Brozen, Y., 199
Bryan, A., vii
Buckley, C. W., vii
CIINTE (see Central Institute for Scientific, Technical and Economic, Information, Poland)
Carter, C. F., 49
Carter, L. J., 49
Center for Scientific, Technical and Economic Information, Czechoslovakia, 56-57, 72
Central Institute for Scientific, Technical and Economic Information, Poland, 54-55, 72
Central Institute of Information and Documentation, East Germany, 58-59
Central Technical Library and Technical Documentation Center, Hungary, 57-58
Centralny Instytut Informacji (Naukowo-Technicznej i Ekonomicznej (see Central Institute for Scientific, Technical and Economic Information, Poland)
Chernova, T. V., 73
Clearinghouse for Federal Scientific and Technical Information, 21, 30
Columbia University, vii, 189
Bureau of Applied Social Research, 30, 161
DDC (see Defense Documentation Center)
D. S. I. R. - Aslib Delegation to Moscow and Leningrad, 75
Danilov, V. J., 48, 206
Defense Documentation Center, 21, 192
Denison, E. F., 47, 195
Dutta, S., 71
Ewell, H. H., 34, 47-48
First National City Bank of New York, 47
Fokin, S. IA., 75
Foley, E. P., 188-189
Fomin, A. A., 70, 74
Four Continent Book Corp., 218
Frost & Sullivan, Inc., 182
Fry, B. M., vii
Gavin, J. M., 47
Glass, B., 30
Gorokhoff, B. I., 73
Gray, D. E., 30
Great Britain, Advisory Council on Scientific Policy, 29
Green, J. C., 73
Herner, S., 23, 29-30
Herner and Co., 31
Hines, T. C., vii
Hoffmann, W. G., 33, 47, 305
Hollomon, J. H., 48
Humphrey, H. H., 21
Iankovskii, IA., 72
Janszky, J., 72
Johnson, L. B., 22
King, A. 43-44

Korol, A. G., 48
Laughlin, T. W., vii
Lazar, P., 73
Leibnitz, E., 73
Lesher, R. L., 194
Little (Arthur D) Inc., 45, 49
Machlup, F., 48
McLaughlin, C., 30
Maizels, A., 33, 47, 197
Malov, V. S., 68, 75
Mansfield, E., 48-49
Martyn, J., 71
Menzel, H., 31
Mikesova, L., 73
Mikhaĭlov, A. I., 62, 73-74
Minasian, J. R., 33, 48
National Aeronautics and Space Administration, 21
National Association of Manufacturers, 45
National Commission on Technology, Automation and Economic Progress, 22, 189
National Committee for Technological Development, Hungary, 57-58
National Federation of Science Abstracting and Indexing Services, 71
North American Aviation, Autonetics Division, 31
OECD (see Organization for Economic Cooperation and Development)
OMKDK (see Central Technical Library and Technical Documentation Center, Hungary)
Organization for Economic Cooperation and Development, 37, 43, 47, 198
Országös Müszaki Fejlesztesi Bizttsag (see National Committee for Technological Development, Hungary)
Országös Muszaki Könyvtar es Dokumentacios Központ (see Central Technical Library and Technical Documentation Center, Hungary)
Pas, R., 72
Pirog, W., 72
Pittermann, R., 72
Polzovich, I., 70
Price, D. J., 51
Rubel, J. H., 43
Ryan, B., 49
Sauter, H. E., 106
Schon, D. A., 49
Schultz, T. W., 47
[illegible], 13
[illegible], R., vii
[illegible], R. R., viii
[illegible]rrod, J., vii
[illegible]ecka, V., 72-73, 208
S[illegible]kin, Y. N., 66, 74
Sp[illegible]t, J., 72
[illegible]tegmaier, R. B., 195
Sullivan, W., 73
Swan[illegible]on, R., vii
System Development Corporation, 24, 31, 74
Tauber, M. F., vii
Teplov, [illegible]. IU., 62
Thomps[illegible] (John I) and Co. 31
U. S. Congress, House, Committee on Education and Labor, 194-195
Committee on Science and Astronautics, 29, 71
Select Committee on Government Research, 48, 106, 191-192, 194-195, 231
Select Committee on Small Business, 182
U. S. Congress, Senate, Committee on Government Operations, 29
Committee on Labor and Public Welfare, 48, 106, 230
Select Committee on Small Business, 42
U. S. Department of Defense, 23, 76, 191
U. S. Department of State, 11
U. S. Federal Council for Science and Technology, 76, 105-106
U. S. Library of Congress, 79
U. S. National Science Foundation, 39-40, 48, 77, 106, 190
U. S. Naval Research Advisory Committee, 71
U. S. Office of Education, 182
U. S. Office of the Director of Defense Research and Engineering, 29, 105, 191
U. S. President's Science Advisory

Committee, 29, 76, 105
U. S. Small Business Administration, 182, 188-189
U. S. Smithsonian Institution, 79
U. S. Task Force to the President's Special Assistant for Science and Technology, 29, 195
United States Chamber of Commerce, 45
Urquhart, D. J., 30, 71
Ústredni vedeckých, technických a ekonomických informací (see Center for Scientific, Technical and Economic Information, Czechoslovakia)
VINITI (see All-Union Institute of Scientific and Technical Information, USSR)
Voigt, M. J., 30
Vsesoiuznyĭ Institut Nauchnoĭ i Tekhnicheskoĭ Informatsiĭ (see All-Union Institute of Scientific and Technical Information, USSR)
Warner, A. W., 194
Wiesner, J. B., 41
Williams, B. R., 48
Wooster, H., vii
Zentralinstitut für Information und Dokumentation (see Central Institute of Information and Documentation, East Germany)

ASM Review of Metal Literature, 52
Abstracting and indexing services, as diffusion media, 50-75; attention-line distribution, 96-98, 257; combination distribution, 95-96, copy distribution, 90-92, 242-243, 246, 260-263, 270-273; evaluation, 51-52; foreign distribution, 79-80, 100-101, 266-273; frequency of use, 128-132, 134, 140; geographic distribution, 88-90, 94-96, 228-243, 261-265, 274-277; growth estimates, 50-52; in relation to other variables, 186-189; subject field distribution, 83, 85-88, 92-94, 219-227, 246, 257, 276-277; use by nonrecipient population, 173-176, 180; use by recipient population, 124-132
Acquisitions bulletins, 148-150
Agricultural extension services, 44
Analytical Abstracts, 52
Applied Mechanics Reviews, 52, 128, 180
Applied research, 34
Attention-line distribution, 96-98, 257
Basic research, 34
Biological Abstracts, 52, 128, 180
COSATI subject field distribution, 83, 85-88, 219-227, 246, 257
Capital, human, effect on productivity, 32-33
Chemical Abstracts, 52, 125, 128, 141, 180
Citation file maintenance, 116, 118
Colleges and universities R & D funds, 202-203
Contract number index, 134, 139-140
Copy distribution, 90-92, 242-243, 246, 260-263, 270-273
Corporate author index, 134, 139-140
Corporate R & D projections, 204-206
Czechoslovakia, 56-57, 206
DOD User Survey, 23
Distribution, by attention-line, 96-98, by COSATI subject field, 83, 85-88, 219-227; by site, 94-96; by state and region, 88-93
Domestic recipients (see Non-Federal U.S. recipients, Federal recipients, GPO Depository Library recipients)
Economic growth, and technical progress, 32-33
Education, effect on productivity, 32-33; of recipient population, 116, 119
Educational/nonprofit recipients, 82-84; by service and state, 238-239; R & D fund sources, 202-203
Ekspress Informatsiya, 63, 68
Electrical Engineering Abstracts, 52, 128, 180
Engineering Index, 52, 129, 180
Exchange distribution, 79
Fast Announcement Service, 25
Federal recipients, 80, 99, 259-263
Federally-sponsored R & D, 37-41, 113, 115, 122-123, 200-201
Foreign recipients, 79-80, 100-101, 266-273
Frequency of use, abstracting and indexing services, 128-132, indexes to abstracts, 134
GPO Depository Libraries, 80, 99-100, 263; distribution lists, 78-79; services received, 264-265
Geographic distribution, 88-90,

238-243, 261-262, 264-265, 274-277
Germany, East, 58-59
Gross National Product, 32, 35-37, 39-40, 42-43
Growth industries, 33, 95
Human capital (see Capital, human)
Hungary, 57-58
Index Medicus, 25, 129, 180
Indexes to abstracts, frequency of use, 134, 140
Industrial recipients, 82-84; by SIC classification, 92-94, 247-255; by service and state, 236-237, 276-277
Industrial R & D, 41, 122, 256, and rate of return, 34, 199, sources of funds, 202-203
Industrial Research Laboratories of the United States, 26-27, 162-163, 182
Information, as economic resource, 32-49; as innovation factor, 43-44; dissemination inadequacy, 21, 192; needs of nonrecipients, 171, 175-179; needs of recipients, 116, 118, 130, 134-136
Information centers (see Library and information centers)
Information transfer, 21, 32-49, 188-189; factors inhibiting, 45-46, 189, Soviet policies, 59
Innovations, recipient population record, 118-119, 121; time lag in application, 43-45
International Aerospace Abstracts, 25, 52
Inventions, and R & D, 33-34
Journal des Scavans, 50
Keyword indexes, 23, 51
Labor force, geographic distribution, 230-231
Library and information centers, 141-143, 151-157, 172-173
List of Small Business Concerns Interested in Performing Research and Development, 27, 162, 164
Manufacturing industries, percentage shares in total output, 197, R & D and rate of return, 199; R & D as proportion of net output and sales, 198; service recipients, 82-84, 92-94, 236-237, 247-255, 276-277
Military recipients, 261-262
Monthly Catalog of United States Government Publications, 25
NSA (see Nuclear Science Abstracts)
National Defense Education Act, 190
Non-Federal U. S. recipients, by attention-line distribution, 257; by COSATI subject field, 219-227, 257; by geographic region, 240-241; by service, 226-227, 234-235; by state, 228, 232-235; by type of institution, 223-225, 232-233
Nonprofit institutions (see Educational/nonprofit institutions)
Nonrecipient organizations, 167-172; Federal agency contracting, 170; information needs outside field of specialization, 171; internally-sponsored R & D, 170; library and information centers, 172; R & D for private industry, 170; R & D outside field of specialization, 171; scientists and engineers employed, 169; staff time devoted to R & D, 171; subject field specialization, 169
Nonrecipient population, 162-182
Nonrecipient Questionnaire, 27, 107, 165, 276-277, 295-301; respondent acquaintance with services, 173; adequacy of information services, 173; broad institutional groupings, 166; fields scanned for needed information, 179; frequency of reasons for using published materials, 176; interest in obtaining services, 174; preferences for subject scope coverage, 175; primary activity, 167; receipt of selected abstracting and indexing services, 180; types of information needs, 178; use made of published materials, 177; use made of services, 174
Nuclear Science Abstracts (NSA),

21, 52; diffusion pattern, 76-106, 226-227, 234-239; 242-246, 259-273 (see also specific headings)
Official distribution 77-80
Patent applications, 119-121, 124
Personal author indexes, 134, 139-140
Physics Abstracts, 52, 1[illegible], 180
Poland, 54-56
Potential recipients, 183-184
Prehled technicke a hospodarske literatury, 57, 208
Private recipients, 83-84
Productivity and R & D, 32-33
Psychological Abstracts, 52
Publishing record, 118-124
Purposeful dissemination, inhibiting factors, 189; need for, 188-189
R & D (see Research and development)
Recipient organizations, 120-157; definition, 105; Federally-sponsored R & D, 122-123; internally-sponsored R & D, 122; library and information center functions, 141, 147-157; publishing and innovation record, 118-124; scientists and engineers employed, 121
Recipient population, 79-80, 107-160; approaches to services, 134, 137-138; citation file maintenance, 116, 118; document acquisition, 144; educational background, 116, 119; information needs, 116, 118, 130, 134; most recent use made of abstracting and indexing services, 130, 133; professional library services, 143; publishing and innovation record, 118-119; R & D conducted outside field of specialization, 118; reasons for use of abstracting and indexing services, 130-132; subject specialties, 116-117; uses made of services, 124-125
Recipient Questionnaire, 27, 107-112, 281-294; respondent distribution, by state, 274-275; employment, 112; frequency of need of information types, 138; frequency of use of indexes to services, 140; frequency of use of services, 138-139; individual recipient characteristics, 112; interest in obtaining information about services, 146; library or information center accessibility, 143; preferences for subject scope coverage, 141-142; primary activity, 112, 114; retention of services, 144-145; subject specialization, 115-116; time devoted to scanning of services, 126; types of information or data sought, 135; usefulness of service indexes, 139
Recipient types, 185-186
Referativnyi Zhurnal, 60-68, 141, 207-218; abstract coverage, 52, 61-62; evaluation of, 67; foreign distribution, 66-67, growth of, 60-62; internal distribution and use, 63-66; publication time lag, 68; series and subseries, 141, 207-218
Regional distribution, 240-241
Report number indexes, 134, 139-140
Research and development, and Federal budget, 43; and Gross National Product, 35-37, 39-40, 42-43; as percentage of net output, manufacturing industries, 198; as percentage of output and sales, manufacturing industries, 198; contracts by state, 229-230; corporate projections, 204-206; definition, 34; effect on inventions, 33-34; effect on Federal government, 113, 115, 122-123; Federal support, performance for the 37-41, 200; performance outside field of specialization, 118; fund allocations, by industry, 256; private support, 41, 122; public vs. private support, 41; rate of return, manufacturing industries, 199; recipient organization performance, 113, 115, 118, 122-123; return on investment, 34; sources for funds, 42, 202-203

Research Centers Directory, 162, 164
Research results, concentration of, 21-22
Roster of U. S. Government Research and Development Contracts in Aerospace and Defense, 27, 162-163
Routing policy, 151
SIC distribution, 92-94, 247-255
STAR (see Scientific and Technical Aerospace Reports)
Sampling technique, 108, 165
Scientific and Technical Aerospace Reports (STAR), 21, 52; diffusion pattern, 76-106, 226-227, 234-239, 258-263, 266-273 (see also specific headings)
Scientists and engineers, geographic distribution, 230-231; in nonrecipient organizations, 169; in recipient organizations, 121
Scientific and technical information, Federal funding, 77
Site distribution, 94-96
Soviet bloc, 54-75
State and local government recipients, 83-84
State Technical Services Act, 22, 29, 192
Subject indexes, 134, 139-140
Subject scope preferences, 141-142
Subscribers, 78-80, 83-84, 98-99, 258-259
TAB (see Technical Abstract Bulletin)
Technical Abstract Bulletin (TAB), 21, 52; diffusion pattern, 76-106, 226-239, 242-246, 259-265 (see also specific headings)
Technical progress, effect on productivity, 32-33
Technical reports, 20; as communication media, 44; DDC acquisition, 191; descriptive cataloging, 149, 153; library holdings, 154-155; primary distribution, 53-54; subject analysis, 152
USGRDR (see U. S. Government Research & Development Reports)
USSR, 37, 59-75
U. S. Government Printing Office Depository Libraries (see GPO Depository Libraries)
U. S. Government Research & Development Reports (USGRDR), 21, 52; diffusion pattern, 76-106, 226-227, 234-239, 242-246, 259-273 (see also specific headings)
Universities (see Colleges and universities)