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THE INFORMATION RESOURCES AND SERVICES OF THE UNITED STATES:  
AN INTRODUCTION FOR DEVELOPING COUNTRIES

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## . ABOUT THIS BOOK

This publication is intended to introduce the scientific and technical information resources of the United States, as well as the services and organizations that will assist information seekers in developing countries in accessing, interpreting, and using this information.

Information resources are the carriers of information. They occur in two forms: as recorded information stored in analog form (ink print, film) or digital form (on electronic media); and as technical expertise possessed by humans. Information services are professional organizations and individuals who mediate access to information resources and assist their clients in applying appropriate information in the solution of problems. Information services are the primary mechanism that can link information seekers outside the United States with U.S. information resources, and that can facilitate the use of information contained in these resources.

The first part of this volume discusses the nature of the U.S. information resources and services. It provides an introduction to the listings of these resources and services in the appendix to the narrative part. There are three discrete lists, as follows: Tables 1 and 2 list, by broad subject categories, the major computer-based information resources of the United States: bibliographic and numeric (factual) data bases. The tables indicate, for each data base, the organization that produces it and one or more organizations through which the data base is available to the public. Table 3 is an alphabetic list of selected information service organizations (including those from Tables 1 and 2), indicating the nature of their client services, and their current addresses.

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## INTRODUCTION

This short guide to the information resources and services of the United States has been prepared with the aim of assisting individuals in developing countries in obtaining easier access to scientific and technical information and expertise of the United States.

Knowledge and socioeconomic development are inseparably intertwined. The industrialized nations, the United States among them, attest to the importance of knowledge in the development of their own economic and social systems; in these nations, application of scientific and technical knowledge is perhaps the key factor responsible for their present level of industrialization, their rate of productivity, and their standard of living. For the developing nations of the world, which are embarking on carefully planned programs of national socioeconomic development, efficient access to already existing knowledge resources is a matter of major importance. As noted by the Preparatory Committee for the United Nations Conference on Science and Technology for Development, attempting to generate the scientific and technological knowledge anew, without making full use of the knowledge already available worldwide and particularly in developed countries, would not only be a task of extreme difficulty but also a wasteful and unreasonable one.

The traditional ways of transferring scientific and technical information between countries are twofold: through direct transfer of recorded information and expertise, and indirectly via commerce in goods and products that emanate from knowledge-producing research and development. This volume is concerned with the first of these.

Despite the apparent simplicity of the proposition to share information internationally, for many nations the access to information resources in other countries has been less than easy. Improving the efficiency of the transfer of existing knowledge therefore calls for an understanding of the reasons for what appear to be the obstacles to such transfer; this applies to both the developed and the developing countries. The developed countries should attempt to understand the nature of information needs of the developing countries; the latter, in their turn, should become better acquainted with the characteristics of the knowledge resources in industrialized countries.

This chapter is intended to impart an impression of the principal characteristics of the information resources of the United States.

### The Social Importance of Information

Information is truly the lifeblood of American society. The U.S. is entering an era characterized by sociologists as the "information age," the outcome of this age being the "information society." The era and the outcome have been described in terms of the "knowledge sector" of the national economy,<sup>1</sup> the "postindustrial society,"<sup>2,3</sup> and the "information economy."<sup>4</sup> In the United States information activities -- the production, processing, and use of information -- engage over 45 percent of the work force, and account for more than half of all labor income. Not all of these activities have to do with scientific and technical information, of course. Those that do, however, exhibit the primary characteristic of the information society: an uncommonly high degree of dependence on information in all walks of life. Using a quantitative measure known as the "index of information orientation" of a society, the United States scores nearly 2.5 times higher than the next postindustrial societies of Japan, West Germany, France, and England.<sup>5</sup> The strong public demand for information has given rise to a labyrinth of domestic information channels through which this nation's people access and obtain the information necessary for the performance of their functions.

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<sup>1</sup>Machlup, F. The Production and Distribution of Information in the United States. Princeton, N.J., Princeton University, 1962.

<sup>2</sup>Drucker, P. The Age of Discontinuity. New York, Harper and Row, 1969.

<sup>3</sup>Bell, D. The Coming of the Post-Industrial Society. New York, Basic Books, 1973.

<sup>4</sup>Porat, M.U. The Information Economy. Washington, D.C., U.S. Department of Commerce, 1977. (9 vols.)

<sup>5</sup>Tanaka, Y. "Proliferating Technology and the Structure of Information Space." In: Edelstein, A.S., ed., Information Societies: Comparing the Japanese and American Experience. Seattle, Washington, University of Washington, 1978. p. 196.

The dependence on information that pervades present-day American society, particularly its constituencies of decision makers and problem solvers, has in turn led to an intensive growth of a new sector of the economy -- the information industry, a complex of information systems and services that cater to this highly information conscious clientele. These then are the characteristics of the information society of the United States: a high rate of information production and consumption by nearly half of the labor force, multiple channels and networks of information flows, and a panoply of information services.

### The Economic Importance of Information

Among the effects emerging from the evolution of the post-industrial society is an improved understanding of the interactions between information and the national economy. In contrast to the preindustrial and industrial eras, in which the costs of knowledge generation and of information services tended to be subsumed as parts of activities of either scholarship or industrial development, information resources and services in post-industrial society have an economic importance of their own. In this new environment, information is viewed as a significant resource of the national economy, one whose value is discrete, highly positive, and increasing. There are at least three reasons that have caused this perception of information as a national economic resource to crystallize.

The first is the increasing significance of knowledge in post-industrial society. In many ways, knowledge is the fuel that drives the development of postindustrial society. The generation of knowledge is growing in terms of both volume and social investment; current estimates place the total average cost of generating a single scientific or technical publication in the \$30,000-\$50,000 range. The management of this resource also requires an increasing investment in its organization and servicing: the U.S. invests more than \$10 billion annually in the generation, processing, dissemination, and use of information. (Approximately 50% of the costs cover the authoring and use of information; the other half is spent on information services: publishing (16%), processing and control (24%), and the creation of numeric data bases (8%). Information services for U.S. science and technology are

thus provided at the rate of \$2400 per year per scientist/engineer.<sup>6</sup>) The magnitude of these investments cannot but impact the economic value of information as a national resource.

The second reason for the economic importance of information is its effect on the viability of national economic sectors other than the information sector. Information contributes very significantly to assuring that the agricultural, industrial and service sectors of the national economies of all free-market countries remain competitive in both domestic and international markets. Information relevant to the vitality of these sectors therefore has a temporal value higher than knowledge generated for purposes of scholarship alone.

The third reason relates to the viability of national information industries. The information industry is essential to the economic health of the information sector (and, increasingly, of the non-information sectors as well), and it is crucial that this industry -- which covers both the information technology and information services -- be able to function and prosper in the competitive environment of a free market economic system.

#### Availability of U.S. Information

What effect does this perception of information as a national economic resource have on the availability and cost of U.S. information resources? To answer this question we must first consider the manner in which the United States supports the generation of new knowledge. In the economic system of the United States, production of information is supported from two distinct sources that are termed "public" and "private." Public support comes predominantly from governmental organizations that derive their financial resources from taxes; private support emanates from industrial and other privately owned organizations. Much of basic science information -- the result of research by university, governmental and other non-profit laboratories -- is generated through public support; in contrast, a significant part of "technological" knowledge -- the result of applied research, development, market testing and evaluation, and of the experience of doing all these -- is funded by the private sector.

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<sup>6</sup>King, D.W. et al. Statistical Indicators of Scientific and Technical Communication (1960-1980). Rockville, Md., King Research, Inc., 1977. Vol. V.

The source of funding the generation of information determines, in a large measure, the "ownership" of information in the United States. Accordingly, almost all information generated with the support of public funds is publicly owned; that is, it exists in the "public domain" and is unrestricted in this availability.

The amount of information available in the public domain in the United States is not exceeded by any other country. It includes all recorded information that results from publicly-funded efforts, whether carried out by public or private institutions; the only exception to this rule is information vital to the security of the United States. It also includes much of the expertise possessed by humans, many of whom are anxious to share it through consultancy and other ways.

Information in the public domain includes not only the primary, open literature; from the viewpoint of developing countries, the public availability in the U.S. of technical report literature -- which many countries, including the socialist ones, completely withhold from international circulation -- is particularly significant. To the United States, the designation "in the public domain" carries a global meaning; as a result, the U.S. information resources are available to one and all, without regard to nationality, geographical location, and political or economic philosophy. It is accurate to point out that as regards the availability of public information in the United States, US nationals hold no advantage or priority over nationals of any other country -- even though such information may (and often does) create competition for U.S. organizations and firms.

Although much of the information generated with private support is also published in the open literature and hence relegated to the public domain, some of such knowledge is withheld from the general public. It is important to understand the reasons for this practice. Privately supported research and development in the United States has, as one general objective, an improvement of the competitive position of the industry or firm. The results of such research thereore may be of considerable value to their possessor (individual as well as organizational). Information that has such an above-par value is called "proprietary." Proprietary information may exist in recorded form or as "experiential" knowledge -- the stock-in-trade possessed by human experts. Although figures are lacking to estimate the

ratio of U.S. information resources that is proprietary, the prevailing impression of its unavailability is incorrect; the possessor of proprietary information is often prepared to share it provided he is compensated in some way for its value.

The right to hold information proprietary is a necessary component of all economic systems, free market as well as planned, and a condition of their viability.

### Information Services

The volume and complexity of scientific and technical information and expertise jointly held in the U.S. private and public domains are such that gaining access to them invariably requires the assistance of "information services," a discrete segment of the information industry. These services should be viewed as the principal link between developing countries and the information resources located in the public and private sectors of the United States.

Information service organizations are of two basic types: those that mediate access to recorded information resources and provide its delivery, usually in the form of documents; and those that offer a wider range of services to information seekers, including assistance in applying information in the solution of problems. The range of these services is considerable, and the organizations offering them may again be public (i.e., government-related and non-profit) or privately owned and operated. The United States government makes an effort to organize broad categories of mission-oriented information resources that are in the public domain, and to provide access to them. The private sector of the information industry, including professional and scholarly associations, supplements this effort through organization of discipline-oriented information resources, and by provision of specialized services demanded by the various constituencies of information users.

A selected list of major U.S. information services constitutes Table 4,

## The Costs of Information and Information Services

The cost factor is important to anyone seeking to use scientific and technical information. A convenient way of discussing U.S. information costs is to distinguish between the cost of information and that of information services.

In the United States, public information (that is, the content of the information resources that are relegated into the public domain) is treated de facto as a commodity of zero economic value; it is thus "free" in both meanings of the word -- as regards availability, and as regards cost. The United States does not attempt to recover its public investment in the generation of new knowledge by placing a price on this commodity, either to its own citizens or those of other nations.

Nevertheless, it is a fact that information seekers in the United States do pay for obtaining scientific and technical information. This apparent inconsistency is clarified when one understands that these charges are associated with the costs of information services -- the functions that are performed to collect, organize, index, catalog, keep an inventory of, announce, search, reproduce, and otherwise manipulate the information resources of the United States. These functions are performed by organizations that constitute the information industry of the United States. Whether these organizations are in the public or the private sector, most operate on a full cost recovery basis; that is, the expenditures that they incur in the performance of these functions are allocated on as equitable a basis as can be devised to the clients who use their services -- again, with no fundamental distinction being made between foreign and American clients.

Typical information service costs thus may have any one of three basic components: a prorated element of the cost of services shared by all clients; the cost of personnel necessary to perform the specific service requested; and the cost of materials. The prorated, shared cost element can vary considerably with the nature of the service organization, the magnitude of the "background" activities the organization must maintain to provide effective customer services, and with the number of clients over whom such costs are distributed. Personnel costs, on the other hand, vary with the nature of requests for information services: the more complicated an information request, the more likely it is to require the involvement and

technical skills of information professionals. Requests for analytical information services that include retrieval and evaluation of information, and possibly consulting assistance in solving the customer's problem, may demand many hours of service by skilled professionals. In contrast, straightforward requests for searching information files or delivering information will require largely material costs for computer time, communications, duplication, correspondence and the like; the price often has built into it the cost of the personnel involved. Personnel and material costs are usually quoted in terms of units -- e.g., cost of man-hour of effort, cost of the computer time used, mail charges, etc.

In contrast to information in the public domain, proprietary information may carry a price tag that reflects the private investment that generated this information, and/or its value to the owner. Included in the category of proprietary information are some products of the information industry itself, for example an analytical state-of-the-art study prepared by a private firm for a clientele that may include only a few customers; the price of such a report is then expected to reimburse the effort that generated the publication. In general, the cost of proprietary information (i.e., the content of documents and data banks, or the sharing of human expertise) may take into account the investment in its production, the value of its being held in sole or restricted possession, as well as its value to the prospective purchaser. While some proprietary information is not intended to be brought to public attention, much of it is available without charge or at a nominal cost once the information seeker learns of its existence. This is particularly true about the knowledge possessed by expert professionals in both the public and private sectors -- knowledge which is frequently shared for the asking.

## INFORMATION RESOURCES IN THE UNITED STATES

Scientific and technical information resources in the United States may be conveniently divided into two categories.

The first category is information recorded and preserved on some medium (paper, film, magnetic tape, electronic disc) and accessible, publicly via suitable locating mechanisms, in appropriate repositories such as libraries or from publishers and information "vendors." Recorded information is often classified further by form (e.g., books, periodicals, technical reports, patents, dissertations), by media of storage (analog or digital), and by type of content (natural language, numeric, graphic, audio). Still other breakdowns are into "primary sources" of information (original contributions), secondary sources (indexes to and abstracts of primary contributions), and tertiary sources (guides to primary and secondary sources). Secondary sources, which constitute the main tools for locating primary contributions, exist in printed and/or computerized form; the computerized indices and abstracts are usually referred to as "bibliographic data bases." In contrast, fact-oriented data bases are computerized collections of largely numeric data (technical, economic, scientific, demographic, etc.).

The second category of information resource is knowledgeable human experts. The information they possess has different characteristics than recorded information: it is empirical, often the result of experience rather than systematic research, and situation- or environment-specific. As a resource, this "experiential" information is highly dispersed; because of the unsystematic character of its organization, it is often referred to as the "informal" information resource, accessible mainly through personal contacts, consultants, invisible colleges of experts, meetings, and the like.

The following two sections address the organization of and access to these two types of U.S. information resources.

### Recorded Information and Its Organization

The United States processes about 80 percent of the world's primary scientific and technical literature. A nontrivial portion of these worldwide resources is information generated in the United States. To illustrate

the U.S. contribution to scientific and technical information, the following estimates are given of U.S. information production for the year 1979: 9,200 scientific and technical periodicals (including 4,700 scholarly journals) carrying an estimated 325,000 articles, produced by the community of 2.3 million U.S. scientists and engineers; about 17,000 books; in excess of 90,000 publicly available technical reports; over 2,500 conference proceedings in science and technology; some 80,000 patents issued and nearly 120,000 filed; and approximately 16,800 published doctoral dissertations.<sup>7</sup>

The processing (i.e., collecting, abstracting and/or indexing) functions are the fundamental steps required to generate access to the scientific and technical literature; they result in the creation of electronic indexes to the literature that can be searched from remote terminals, thus affording more powerful ways of finding needed scientific and technical information.

During one year, the major U.S. indexing and abstracting services (comprised of 10 government organizations and 25 non-government organizations) process about 2.5 million bibliographic items (the figure increases annually by nearly six percent). These organizations produce printed indexes to the literature in their area of expertise, as well as machine readable data bases of the same information. In 1977, over 50 million bibliographic references to scientific and technical literature and 5 million monographs, contained in nearly 300 bibliographic data bases, were accessible in the U.S. for online computer searching.<sup>8</sup>

Another recorded information resource, particularly useful to development-oriented activities, are compilations of data, usually assembled from the original literature and produced as computerized data bases. These fact-oriented "electronic handbooks" are compiled by a wide range of organizations, including trade, industrial, professional, and scientific organizations, information centers of government agencies, information analysis centers, and independent research and development organizations. While many numeric data bases are of use in scientific research, decision makers in developing countries should find of much interest the wide and growing roster of numeric

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<sup>7</sup>King, D.W., op. cit.

<sup>8</sup>Williams, M.E. "Data Base and Online Statistics -- 1977." Bulletin of the American Society for Information Science, 4(2):21-23(1977).

files serving agriculture, business, economics, energy, engineering, environment, forestry, medicine and health care, meteorology, metals, petroleum, shipping, and wood products.

Tables 1 and 2 are selective directories of, respectively, bibliographic and factual data bases available for online searching in the United States. The tables show the name of each data base, its producer, the nature of content, and the "vendor" or service who makes the data base available to the public. The means of obtaining access to the information contained in these data bases is discussed in the final chapter of this volume that deals with U.S. information service organizations.

### Experiential Information and Its Organization

The scientific, technical and professional knowledge, expertise, and experience of the citizenry of the United States constitutes the second major category of information resources. It is estimated that of the approximately 220 million people in the United States, some 2.3 million are scientists and engineers (engineers represent two-thirds of this figure). Nearly 50 percent of the scientists and engineers are employed in industry and businesses; about 15 percent each in universities and in government. Some 300,000 students graduate each year to enter the ranks of scientists and engineers.<sup>9</sup>

The complexity and dynamic nature of the U.S. resource of expertise are such that its nationwide organization presents considerable difficulties, conceptual and practical. Conceptually, we can identify the major clusters of organizations that harbor this human talent; these include governmental organizations, professional societies and trade associations, academic institutions, and industrial and commerce organizations. How does one gain access to the storehouse of human expertise in the United States?

The U.S. information industry alleviates the task somewhat by producing and maintaining current a broad variety of printed directories<sup>10</sup> to these

<sup>9</sup>National Science Board. Science Indicators 1976. Washington, D.C., National Science Foundation.

<sup>10</sup>Examples of such directories are: Consultants and Consulting Organizations Directory; Encyclopedia of Associations; Encyclopedia of Governmental Advisory Organizations; Medical and Health Information Directory; National Faculty Directory; National Research Centers Directory, and Training and Development Organizations Directory -- all published by Gale Research Co., Book Tower, Detroit, MI 48226.

and other categories of organizations. By using the subject indexes of the directories one can locate organizations and/or individuals likely to possess the information desired.

In the United States as elsewhere, members of the problem solving professions give strong preference to informal, person-to-person communication, often over the formal channels of scientific communication such as journals. In doing so, they cluster into so-called invisible colleges, the very purpose of which is the sharing of experience and, in some cases, products (such as software among computer users). Organizations and institutions in developing countries are likely to profit from joining these informal, specialized "networks" of groups and individuals with whom they share common interests. Problem solving networks in the United States are common not only in science, but particularly in industrial circles, where informal exchange of experience has a high value. Many such informal channels and networks function at the international level, and membership in them is of course open. The cost of participation is usually nominal.

In situations in which there appears to be no efficient way of directly locating an expert organization or group in the United States, a good strategy is to engage an information service organization. As shall be shown in the next section, these organizations specialize in locating and gaining access to information resources, whether the latter are recorded knowledge or human experience.

The management of experiential information as a national resource is a very recent concept in all countries, including the United States. At this time, the U.S. is testing experimental, automated information systems which contain descriptions of human expertise. Although these "expert systems" offer a promise of optimizing the organization of this vital information resource, relatively difficult problems remain to be solved -- for example, the efficient capture and representation of technical experience and expertise of humans for computer storage. So far, effective tapping of U.S. expertise resources remains a function of the information service industry.

## U.S. INFORMATION SERVICE ORGANIZATIONS

The segment of the U.S. information industry which provides the interface between information seekers and the vast complex of national information resources are the information service organizations.

The growth of versatile information services in the United States is a relatively recent phenomenon, in part engendered by the demand for data and information in a society that is in the process of transition to a postindustrial economy. Consequently, the structure of this industry is somewhat amorphous. A convenient way of presenting information services is to consider them from the viewpoint of an information seeker attempting to decide what type of service is needed.

In such a situation it is fruitful to distinguish between information requests that require 1) a straightforward search for information, 2) the delivery of such information in the form in which it is found; and 3) additional processing of the information found, such as its interpretation, evaluation, and synthesis. Information services responding to these three information request types are discussed below.

### Data Base Search Services

Because of the volume of the U.S. information resources, identification and location of information relevant to one's interests and problems is a nontrivial problem. In order to provide such access, it is necessary to first collect and index or abstract the literature, and then place the indexes at the convenient disposal of information seekers. These two functions are not usually combined in the United States: the organizations responsible for indexing and/or abstracting the primary literature and for the generation of bibliographic and fact-oriented data bases typically do not offer the service of searching these compilations. Rather, they sell or lease their products to other organizations: printed indexes to numerous libraries and other subscribers, and machine-readable data bases that contain these indexes to a small number of organizations that offer mechanized information retrieval services to the general public.

Information services are provided in two modes: "online" (in which the information seeker or his agent -- called an intermediary -- interacts

directly with the data base from a remote computer terminal), and "batch" (in which the data base is searched automatically by the computer against a fixed query, and the output is subsequently forwarded to the client). Batch services, marketed by the major online bibliographic search services and some of the data base producers, search against only the new material regularly added to bibliographic data bases; as a result, these so-called current awareness services are less expensive and highly popular. They are low-cost means of providing information to developing countries in subjects germane to their needs and interests.

Online searching of bibliographic data bases in the United States grows at a rate of 40% per year; it is estimated that some 2 million searches were made in 1977. There are five major providers of online bibliographic search services in the United States: Lockheed Information Systems, SDC Search Service, Bibliographic Retrieval Service (BRS), the National Library of Medicine, and the New York Times Information Bank. Jointly these services can retrieve bibliographic information from more than 100 bibliographic data bases.

Table 2 identifies, for each bibliographic and numeric data base listed, organizations that provide searching services on that data base.

The services mentioned provide access to journal, report, or special literatures. The best sources for locating information on the availability of monographic (book) literature are the United States Library of Congress Union List and List of Supplemental Locations, and the computer files of OCLC, Inc. The latter is the largest service in the world to provide online cataloging for over 1650 libraries in the United States. As a byproduct of this activity, the files of OCLC contain information on the location of all books cataloged.

Institutions and organizations in developing countries can, in principle, avail themselves of the online search facilities that service U.S. bibliographic and numeric data bases; because of the high cost of telecommunications, however, international online searches are very expensive. A more realistic approach is to make arrangements with one or more of the online vendors for batch searching services. Another alternative is to make arrangements with one of the U.S. information service organizations (such as listed in Table 5) for conducting online searches from the United States, and having the output mailed directly to the institution or firm in the developing country.

## Document Delivery Services

For the information seeker in the United States, copies of the documents identified via printed indexes or computerized search services are provided from many of the more than 11,600 university, special and medical libraries. Many libraries offer document delivery services on an international basis, accepting requests by mail, telephone, TWX or telex. The John Crerar Library (35 W. 33rd St., Chicago, IL 30616) and the Price Gilbert Memorial Library (Georgia Institute of Technology, Atlanta, GA 30332) are examples of institutions that handle document reproduction requests on an international basis; a complete list of such libraries is given in the Directory of Library Reprographic Services (Microform Reviews, Inc., 1973). In most cases, special arrangements are preferred, including setting up a deposit account with the organization from which documents are ordered.

Information seekers who do not have access to well-stocked libraries may contract with a U.S. information service organization (discussed next) for the use of online document ordering services available in the United States. By means of a remote computer terminal this organization can place an online order for document delivery, to be executed by one of the following services:

<u>Organization</u>	<u>Ownership</u>	<u>Documents Supplied</u>
Congressional Information Service	Private	U.S. government documents
The Institute for Scientific Information	Private	5200 scientific & technical journals
National Technical Information Service	Public	Government sponsored research reports
The Society for Automotive Engineers	Private	SAE published papers
The ERIC Document Reproduction Service	Public	Documents on research in education
The University Microfilm International	Private	Dissertations; education journals
FIND/SVP	Private	Management documents
Lockheed Information Systems	Private	Scientific and technical publications

Government documents (defined as information produced by a government entity which is available to the public upon request but is not usually considered of such broad public interests as to warrant general publication or distribution) are available from the Documents Sales Service, the book-selling arm of the Government Printing Office. The DSS distributes annually over 148,000,000 publications, operates 26 book stores and maintains one of the largest mail order services in the world.

In addition to the Document Sales Service, government information is also available from more than 300 clearinghouses in the Federal government. Among the major clearinghouses established by law are the National Technical Information Services (NTIS) of the Commerce Department, the Educational Resources Education Center (ERIC) of the Office of Education, and the National Criminal Justice Reference Center (NCJRC) of the Justice Department. Most clearinghouses focus upon specific topics; many collect and distribute, against payment, both government and private sector publications. The clearinghouses operate on a full-cost recovery basis, and are not financially subsidized by the government.

#### Specialized Information Services

Not all problems are simple enough to be solved through the provision of a bibliographic reference, an article, or a single piece of data. Many problems are ill-defined or complex and require analysis by experts to define the question as well as provide a useful answer to it. Some may require the development of training programs or individual courses because they involve a continuing activity rather than a discrete problem. At a more general level there may exist a requirement for the design and development of an entire information system for one or more organizations, an industry or an entire economic sector. At the national level, many countries are developing or strengthening nationwide infrastructures of information organizations and services, an important and complex undertaking. This expansive range of information intensive activities is the *raison d'etre* for the existence of more than 2,000 specialized U.S. information services.<sup>11</sup>

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<sup>11</sup>Kruzas, A.T. and Sullivan, L.V., eds. Encyclopedia of Information Systems and Services. Detroit, Michigan, Gale Research Co., 1978.

The following are some of the characteristics of this information industry sector. The services may be located in the public (government-supported) or private (non-profit or for-profit) sector. In size they range from one-person consulting operations to organizations with large staffs and distributed offices. The technical competence of the professional staff typically covers two areas: information processes and systems, and discipline or mission-oriented subject expertise (such as a field of science or engineering, management, economics, etc.). The services they provide focus on analytical and synthetic data and information processing, tailored to the idiosyncratic needs and requirements of specific clients. Basic to these functions is a thorough knowledge of the national and international information resources, and the ability to access and search these resources.

The following list illustrates the range of services provided by these organizations: abstracting and abstract publishing; aerial photography; audiovisual information processing; bookselling; cataloging; clearinghouse functions; computer output microfilm; conference and meeting organization; corporate planning; current awareness; design and management of data bases; data base searching; directory preparation; document acquisition and delivery; education; technological forecasting; indexing and index publishing; design and evaluation of information systems; library automation; marketing research; microform equipment, system design, and publishing; newsletter and newspaper publishing; publishing; software development; surveys; technology transfer; timesharing; and typesetting.

Information services in the United States are provided by governmental, educational, professional, research and commercial institutions. They have become so numerous that referral services have come into existence to keep track of them and to allow users to find the information services appropriate to their problems. At the apex of such referral centers is the National Referral Center in the Science and Technology Division of the Library of Congress (Washington, DC 20540). This Center assists those with questions in scientific or technical fields by referring them to organizations that can answer these questions. It provides a single place to which anyone may turn for advice on where to obtain information on specific topics in the physical, biological, social and engineering sciences, and the many technical areas relating thereto. The National Referral Center maintains a subject

index data base that is continually updated by a professional staff and that contains descriptions of 13,000 organizations having specialized knowledge in some area of science and technology. Organizations covered include professional societies, university research bureaus and institutes, federal and state agencies and units within them, industrial laboratories, museum specimen collections, testing stations, and individual experts.

As regards information services specific to developing countries, many governmental agencies of the U.S. can offer appropriate expertise. The Agency for International Development (AID) supports the Technical Assistance Information Clearinghouse (TAICH), operated by the American Council of Voluntary Agencies for Foreign Service; TAICH serves as an information center specializing in the socioeconomic development programs abroad of U.S. voluntary agencies, missions, foundations, and other non-profit organizations. AID is the leading agency of the several hundred bureaus and offices in the U.S. government that are involved in foreign development or technical assistance activities. The staffs of these offices command considerable expertise in the subjects and areas appropriate to their mission. A Federal International Development Offices Directory (available from Agency for International Development, Washington, D.C. 20523) describes these missions and services.

Under an agreement with AID, the National Technical Information Service has an established program of scientific and technical information transfer, designed around cooperating agencies in developing countries which receive, disseminate and contribute to the information supplied by NTIS. In countries where there is no cooperating agency, a monthly publication, "Application of Modern Technologies to International Development," is mailed to potential technical information users. NTIS will also train personnel in the cooperating agencies in information analysis, production, dissemination, processing and networking.

A fruitful source of information services, particularly in ill-defined areas of need, are the information analysis centers of the United States. These organizations collect and review information in specific scientific or technical subject areas and provide analyses, state-of-the-art studies, and other specialized information services. The federal government supports the operation of 108 information analysis centers; a directory of these

centers is forthcoming from the U.S. Library of Congress. A number of these centers relevant to the needs of developing countries are included in Table 3.

Table 3 is a selected listing of public and private information service organizations in the United States. It is highly eclectic; for more comprehensive listings the reader should consult the Directory Information Service, a guide to information on the sources of information (Gale Research Co., Book Tower, Detroit, Mich. 48226)); the Information Industry Association (4720 Montgomery Lane, Bethesda, MD 20014) which is the parent organization of many information service firms in the private sector; and the directories of information produced by several publishers (R.R. Bowker Co., 1180 Avenue of the Americas, New York, N.Y. 10036; and McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, N.Y., 10020).

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The complexity of information resources and services of the United States defies their designation as a "national information system," and their complete description in a small number of pages. They are, however, among the world's richest, best managed, and most accessible resources and services. Information seekers who take the time to become acquainted with them can avail themselves of unhindered access to much of man's scientific and technical knowledge, expertise, and experience. It is our hope that this brief volume will assist our friends outside the United States in this goal.

Table 1. Major Bibliographic Data Bases Online in the United States

<u>Subject Area</u>	<u>Data Base Name</u>	<u>Subject and Scope</u>	<u>Producer</u>	<u>Vendor*</u>
Agriculture and Food	AGRICOLA	Cataloging and indexing (CAIN) data base providing worldwide coverage of agriculture; 1970+; 1,060 records	National Agricultural Library	
Agriculture and Food	Aquatic Sciences and Fisheries Abstracts	Oceanography, pollution, freshwater biology, and limnology as well as legal, political, and social topics related to sea and inland water studies; 1975+; 31,000 records	FAO & UNESCO	
Agriculture and Food	Commonwealth Agricultural Bureaux Abstracts	Comprehensive coverage of literature related to the agricultural sciences; 1973+; 690,000 records	Commonwealth Agricultural Bureaux	
Agriculture and Food	Food Science and Technology Abstracts	International coverage of food science and related technologies; 1969+; 153,000 records	International Food Information Service	
Business	INFORM	Abstracted business information covering business; finance, and related fields; August 1971+; 75,000 records	ABI	
Business	LABORDOC	Worldwide journal and monographic literature in the fields of labor relations, employment, working conditions, economic and social security, training, demography, and labor legislation; 1965+; 75,000 records	International Labor Labor Organization	
Business	Management Contents	Journal literature of business and management; September 1974+; 43,000 records	G.D. Searle	
Chemistry	Chemical Abstracts	Bibliographic data and keyword phrases for chemistry and chemical engineering; 1970+; 2,870,000	Chemical Abstracts Service (CAS)	

\*See Table 3 for full names and addresses.

Table 2. Major Fact-oriented Data Bases Online in the United States

<u>Subject Area</u>	<u>Data Base Name</u>	<u>Subject and Scope</u>	<u>Producer</u>	<u>Vendor*</u>
Agriculture	Agriculture -- major livestock groups, 15 crops		DRI	DRI
Agriculture, Meteorology	Agriculture/Weather		US. Department of Agriculture	Data Resources, Inc.
Agriculture business and economics	Chase Econometrics Agricultural Data Base		CEA	ADP
Agriculture, business and economics	Chase Econometrics		CEA	ADP
Agriculture	Current Research Information System (CRIS)		US Department	LIS
Agriculture	Fertilizer Forecast		CEA	ADP
Agriculture	Fertilizer Forecast		CEA	ADP
Agriculture	Pesticides Active Ingredients		Environmental Protection Agency	Tymshare

\*See Table 3 for full names and addresses.

Table 3. The U.S. Information Industry: Selected Specialized Service Organizations

<u>Organization</u>	<u>Major Services</u>
Aspen Systems Corporation 20010 Century Boulevard Germantown, MD 20767	Information systems development, data base design and management, user needs studies, legislative information studies
Auerbach, Inc., Consultants 6560 North Park Drive Pennsauken, NJ 08109	Computer technology, consulting, management information systems, information systems design
Becker and Hayes, Inc. 11661 San Vincente Boulevard Suite 907 Los Angeles, CA 90049	Consulting in library automation, library architecture, information policy, market research
Capital Systems Group, Inc. 6110 Executive Boulevard Rockville, MD 20852	Information systems, development in health sciences, energy, environment, consumer safety, transportation, clearinghouse operations, indexing and abstracting, data base development
Chase Econometrics, Associates, Inc. 555 City Line Avenue Bala Cynwyd, PA 19004	Economic forecasting, economic information and analysis to corporate planners
Cuadra Associates, Inc. 1523 Sixth Street, Suite 12 Santa Monica, CA 90401	Consulting in the development, operation, evaluation and marketing of online data base services
Disclosure, Incorporated 4827 Rugby Avenue Washington, DC 20014	Information on corporate intelligence compiled on publicly owned companies of the United States
Environment Information Center, Inc. 292 Madison Avenue New York, NY 10017	Clearinghouse for energy and environmental information; analytical services under contract research
FIND/SVP 500 Fifth Avenue New York, NY 10036	On demand information searching; consulting services in area of current awareness