DOCUMENT RESUME

ED 034 560 24 LI 001 811

AUTHOR Grimes, George
TITLE Information Services; A Survey of the History and Present Status of the Field. MOREL Regional Information System for Educators.
INSTITUTION Michigan-Ohio Regional Education Lab., Inc., Detroit.
SPONS AGENCY Office of Education (DHEW), Washington, D.C. Bureau of Research.
BUREAU NO BR-6-1465
PUB DATE Jul 69
CONTRACT OEC-3-7-061465-3071
NOTE 35p.; Related documents are LI 001 810 and LI 001 812

EDRS PRICE EDRS Price MF-$0.25 HC-$1.85
DESCRIPTORS Automation, Educational Research, *History, Information Centers, Information Networks, Information Retrieval, *Information Science, *Information Services, Information Systems, *Libraries, *Regional Laboratories

ABSTRACT

This document is one of a series describing the background, functions, and utilization of the Regional Information System (RIS) developed by the Michigan-Ohio Regional Educational Laboratory (MOREL). The continuing history of the field of librarianship and information services is reviewed in this report. The first part covers ancient times to the invention of movable type; the second extends from the advent of print to the end of the nineteenth century; and the third summarizes the period from 1900 to the present. The first two parts deal almost exclusively with library history, although the work of documentalists becomes a stronger and stronger trend from the last of the nineteenth century onwards. The emphasis in the last part is on the accelerating activities of the information services area as operationalized by those engaged in documentation, information retrieval, and the emerging discipline of information science. Appended are descriptions of the information service efforts of four regional educational laboratories: the Far West Laboratory for Educational Research and Development, the Michigan-Ohio Regional Educational Laboratory, the Central Midwestern Regional Educational Laboratory, and the Southwestern Cooperative Educational Laboratory. (Author/JB)

MOREL

REGIONAL INFORMATION SYSTEM for educators

Information Services

A Survey of the History and Present Status of the Field

by George Grimes

MICHIGAN-OHIO REGIONAL EDUCATIONAL LABORATORY

3750 Woodward Avenue Detroit, Michigan 48201

This document is one of a series describing the background, functions, and utilization of the Regional Information System (RIS) developed by the Michigan-Ohio Regional Educational Laboratory. The series includes:

Information Services — A Survey of the History and Present Status of the Field
Establishing the Information System — An Operational Handbook
A Searcher's Manual of Information Resources
Installation and Evaluation of the RIS

Published by the Michigan-Ohio Regional Educational Laboratory, a private, nonprofit corporation supported in part as a regional educational laboratory by funds from the United States Office of Education, Department of Health, Education, & Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the Office of Education, and no official endorsement by the Office of Education should be inferred.

July, 1969

Preface

For purposes of viewing, in a logical manner, the continuing history of the field of librarianship and information services, this report utilizes a somewhat artificial three-part time division. The first part covers ancient times to the invention of movable type; the second extends from the advent of print to the end of the nineteenth century; and the third summarizes the period from 1900 to the present.

The first two parts deal almost exclusively with "library" history, although the work of documentalists[1] becomes a stronger and stronger trend from the last of the nineteenth century onwards. The emphasis in the last part is on the accelerating activities of the information services area as operationalized by those engaged in documentation, information retrieval, and the emerging discipline of information science.[2]

The Michigan-Ohio Regional Educational Laboratory (MOREL) is a private, non-profit corporation established in 1966 under the provisions of the Elementary & Secondary Education Act of 1965. One of 20 such regional laboratories in the United States, MOREL is dedicated to the development of tested alternatives to current educational practice. The Laboratory's developmental efforts include the Teaching Behavior Improvement Program, the MOREL Regional Information System, and a program focusing on Combatting Racism and Its Effects.

This document was developed during the author's tenure as Coordinator of Information at MOREL.

[1]Harold Borko—in an article titled "Information Science: What is It?" *American Documentation* XIX (Jan., 1968), p. 5 — states that documentation "is concerned with acquiring, storing, retrieving, and disseminating recorded documentary information, primarily in the form of report and journal literature." An earlier and somewhat broader definition is offered by Helen L. Brownson in "Definitions of Documentation," *American Documentation* VI (Oct., 1955), p. 254, which states that documentation is "the art of facilitating the use of specialized knowledge through its presentation, reproduction, publication, dissemination, collection, storage, subject analysis, organization, and retrieval."

[2]Robert S. Taylor — in his chapter on "Professional Aspects" in the *Annual Review of Information Science and Technology* (New York: Interscience, 1967), vol. I, p. 19 — relates a basic definition of information science which emerged from the Conferences on Training Science Information Specialists at the Georgia Institute of Technology in 1961 and 1962. This definition states that information science is ". . . the science which investigates the properties and behavior of information, and the forces governing the flow of information, and the means of processing information for optimum accessibility and usability. The processes include: origination, dissemination, collection, organization, storage, retrieval, interpretation, and use of information. The field is derived from or related to mathematics, logic, linguistics, psychology, computer technology, operations research, the graphic arts, communications, library science, management, and other fields."

It is interesting to note that the American Documentation Institute has recently changed its name to the American Society for Information Sciences.

Contents

ILLUSTRATIONS

Ancient Libraries to the Advent of the Printing Press

Richard Irwin, in an article on the history of libraries, states that:

> The history of libraries begins in China, Egypt and Assyria, where collections of records on tablets of baked clay are known to have been associated with temple and royal palaces. The significance of this association is of interest, for it is evidence of the feeling that in an unlettered world knowledge has a mystical power of its own, and that books are in the end more potent than arrow or spear or gun.[3]

The major cornerstone of today's libraries in the ancient world was the library at Alexandria, Egypt, which has been characterized as "the most famous Greek library of all."[4] The Alexandrian Library was actually an adjunct to a "museum" or a "house of the muses" (that is to say, a house of the arts and sciences) established under Ptolemy about the year 297 B.C.

The Museum library was stocked with copies of all known books (papyrus rolls) in the city of Alexandria, and ships arriving in the harbor of Alexandria were forced to "lend" any books which they carried. Agents were also sent to other lands to buy or borrow books to be copied. One important feature of the Alexandrian Library was the number of outstanding figures who served it as librarians or who were connected with it as scholars. One of these, Callimachus, is said to have compiled a catalog of the library. Callimachus divided his work into eight major subject categories: Oratory, History, Laws, Philosophy, Medicine, Lyric Poetry, Tragedy, and Miscellany.

The Alexandrian Library flourished for several hundred years and was a great influence in the cultural development of the Hellenic world. In 273 A.D. much of the library was burned during the conquering of Egypt by the Roman Emperor Aurelian. Later attacks by the Roman Emperor Theodosuis I (391 A.D.) and the Moslem conqueror Omar (645 A.D.) completed the destruction of the collections.

Aside from its primary value as a center of scholarship, a continuing value of the Alexandrian Library has been its status as an ideal to be replicated and, if possible, surpassed. There is a story that Eumenes II, King of Pergamum, tried to entice a librarian, Aristophanes of Byzantum, to come from Egypt to Pergamum, and another story that Egypt cut off the supply of papyrus being sent to Pergamum to prevent its library from growing as large as that in Alexandria.[5] Thus, the Alexandrian Library was seen as a beacon in organization, content, and scholarship for others to emulate.

From the middle of the second century B.C., Roman generals began to bring home Greek libraries along with other booty. The first to do this was Aemilius Paulus, with Sulla and Lucullus following his example in the next century. Caesar was eager to found a state library, but the first public library in Rome — the Atrium Libertatis — was established after his death. At the opening of the fourth century A.D. there were 28 public libraries in Rome. The most important of these was the Biblitheca Ulpia located near the Column of Trajan. Like the others it was divided into Greek and Latin divisions and also served as an archive for important state documents. Heading these libraries at first were distinguished scholars with the rank of procurator. A distinction later developed between the administrative officials proper and the scholarly directors.[6]

The cities and provinces of Italy endeavored to follow the example of Rome. Although there is no accurate estimate of the number of public libraries across the empire, the impression is that the majority of the larger provincial cities had libraries.

An outstanding feature of library development in Rome was the development of private villa libraries. The letters of Cicero and Pliny the Younger attest to this. During the Empire period, villa libraries became a fashionable means of displaying one's wealth.

The most direct continuation of the pure Greek heritage of the Alexandrian Library was found in Constantinople where the Imperial, Patriarchical, and University libraries continued the tradition for over one thousand years. Little new was produced, but editing,

[3]Thomas Landau, ed. *Encyclopedia of Librarianship*, 3rd ed. rev. New York: Hafner, 1966. p. 253.

[4]Elmer D. Johnson. *A History of Libraries in the Western World*. New York: Scarecrow, 1965. p. 51.

[5]*ibid.* p. 57.

[6]Alfred Hessel, *A History of Libraries*, trans. by Reuben Peiss. Washington, D. C.: Scarecrow, 1960. p. 6.

annotating, and re-editing of standard texts was carried on, thus guarding them for the future.[7]

From an early date libraries became associated with the work of the church. Origen's library at Caesarea was well known, as were the patriarchical libraries of Alexandria and Constantinople. A papal library was formed in Rome in the fourth century by Damasus.

The age of the monastic library began with Cassidorus and Saint Benedict whose monasteries of Vivarium and Monte Cassino were founded in the sixth century. In both of these libraries the tasks of reading — and, as a necessary corollary, that of copying — were joined, and the great tradition of the monastic scriptorium was launched. The monastic libraries continued the Roman practice of separating books according to whether they were Greek or Latin and subdividing within these two language categories by major subjects and sometimes by size and source. The early monastery librarians were known as "armarius" after the name of the type of chest in which books were kept at first, an "armarium." The term "librarius" was also used because the librarian often directed the scriptorium and the book bindery as well as the library proper.[8] The catalogs of the monastic book collections were usually little more than lists of books, some of which have survived to tell us of the general content of the collections.

From the fall of Rome to the twelfth century, for the most part, education in Western Europe was in the hands of the monasteries. By the late eleventh century, however, some secular schools were emerging and reaching higher levels of instruction; and in some cases, as in Paris, advanced degrees were offered. The earliest universities of importance were those in northern Italy at Bologna and Padua. There were no libraries, as such, in these early universities. Each master had a collection of books which he might lend or rent. Each student had to buy not only his own textbooks, but any other books which he might wish to read, unless he could borrow or rent from a master or book seller. As the universities grew in numbers of students, the demand for books made it necessary to establish libraries. The outstanding college library of this time was the one at the Sorbonne in Paris which contained over a thousand volumes in 1322. By 1400 a circulating library with duplicate copies had been established at the Sorbonne. By 1480 this library was housed in a separate building with a large reading room.[9]

The organization of the university library was similar to the larger of the monastery libraries, except that the main divisions of books were according to subjects taught in the colleges. Within these subjects there were apparently no sub-classes, and books were arranged by size according to accession. Interestingly enough, there was an attempt at a "union" catalog in fourteenth century England where an unknown monk compiled a *Registrum Librorum Angliae,* which was an attempt to list all of the known copies of the works of some 90 authors, together with the libraries in which they could be found. This work contained not only authors, titles, and locations, but a short biographial account of each author as well.

There were also a number of important private libraries at various times in the Middle Ages. Notable among them were those of the Italian authors Petrarch and Boccaccio and several members of the Medici family. Federigo, Duke of Urbino, founded the famous Urbino Library of Greek and Latin Classics in the fifteenth century, largely with gifts from his own private collection. Many private collectors donated their libraries to universities or other libraries. Another prime example of this tendency was Robert de Sorbonne who, in 1250, gave his collection to the college that took his name. In England, Duke Humphrey of Gloucester gave his library to Oxford University in the fifteenth century.

The libraries of the ancient world through the Middle Ages dealt with a relatively rare commodity. Even an ordinary book in the Middle Ages would be worth in excess of two hundred dollars at present prices. Fairly wealthy people might acquire only a few books in a lifetime, and wills have been preserved that mention ten or twenty books as a valuable bequest. A tenth century sale of a single book of sermons brought a price of 200 sheep and three barrels of grain, while a whole Bible was traded for a house and lot.[10] This entire picture changed radically with the advent of movable type printing in the second half of the fifteenth century. This event, together with the intellectual movements of the Renaissance and Reformation, did much to change the entire thrust and function of the library.

[7]Landau. *op cit.* p. 254.

[8]Elmer D. Johnson. *Communication.* New York: Scarecrow, 1960. p. 36.

[9]*ibid.* p. 42.

[10]*ibid.* p. 46.

Libraries from the Advent of Printing to the Close of the 19th Century

In the years between 1440 and 1460, a number of experiments were being carried on with block printing and movable type. A block printed book, *St. Christopher,* dated about 1423, is thought to be the earliest example of this technique. Johann Gutenberg began the experiments which lead to movable type printing in 1440. At that time, other people were also engaged in discovering some method of producing an "artificial script." Avignon, Bruges, and Bologna are mentioned as places where such experiments were carried out.[11] The perfection of the printing press, coupled with the attacks on the order maintained by the Catholic Church, roughly coincide in time and were mutually reinforcing toward the broadcasting of ideas through print.

The Reformation thrived on the printed word and the advocates of internal church reform and later separation, like Martin Luther, were prolific writers but, more importantly, they wrote to be read in the natural languages of the people rather than in Greek and Latin. Luther's translation of the New Testament and other works into German fostered vernacular education which met with considerable success and reinforced the nationalistic mood of the times. The basic four R's (reading, writing, arithmetic, and religion), along with music and some history and physical education, became the principal curriculum of the common vernacular schools in Lutheran lands.[12] A broadened educational base increased the demands for more books which the printing press could deliver as needed, which inspired more authors to write, which produced more ideas and educated people, etc., etc. This continuous spiral of book creation and production had obvious and fundamental implications for libraries.

In this period many medieval libraries ceased to exist and a large number of new libraries had their origin. Printed books became plentiful enough to be loaned for use outside the library and hence the public, circulating library became a possibility. The typical library became an oblong room with books around the walls and with tables for readers in the center. The library was open at stipulated times, and a librarian was on duty at those times.

To a great degree the source of library development became closely allied with national development from this time onward. In Italy, for instance, several outstanding libraries were supported by wealthy merchants and nobles with the most important library being the Vatican Library at Rome. Many treasures from monastery libraries found their way into this collection as gifts.

The libraries in France reflected that country's status as a unified nation. King Francis I (1494-1547) strengthened the Bibliotheque du Roi, as it was then called, by ordering that one copy of each book printed in France be deposited there. After being housed in several locations, the royal library became the Bibliotheque Nationale following the French Revolution. Military conquests under Napoleon I brought additional volumes so that by 1815 the collection held over a half million volumes. By 1900 the Bibliotheque Nationale was probably the world's outstanding library.

In England both book arts and libraries were severely retarded in the 1530's following the Act of Dissolution, separating the Church of England from the Roman Catholic Church. Much of the property of the church was transferred to the king and many monastery libraries were broken up and their contents destroyed or sold. During the Elizabethan Period there was a revival in the English literary world and university libraries were strengthened. The outstanding example of this was the Oxford University Library which was built through the activities of Sir Thomas Bodley. In 1570, Sir Humphrey Gilbert, a favorite of Queen Elizabeth, drew up a plan for a Royal Academy and Library. The then Royal Librarian, Roger Ascham, advanced a similar plan. It was not until 1753, however, that a private collection (Sloane) was united with two private libraries (Cottonian and Harleran Libraries) to form the beginnings of the British Museum which was finally opened to the public in 1759.

The development of the modern English public library actually had its beginning in 1850 with the passing of the Public Libraries Act which allowed cities of 10,000 or more population to levy taxes to support library service. In 1870 a school law was passed which made communities responsible for maintenance of free public schools, thus greatly increasing the number of

[11]S. H. Steinberg. *Five Hundred Years of Printing.* Baltimore: Penguin Books, 1955. p. 18.

[12]R. Freeman Butts. *A Cultural History of Western Education.* New York: McGraw-Hill, 1955. p. 225.

readers and, consequently, the demand for public library service.[13]

The history of libraries in the United States shows a number of very interesting patterns. Harvard and Yale universities were actually founded, in part, by a gift collection of books. Parish libraries were promoted and the first successful attempt at making books available for general public use came through the establishment of subscription libraries in the eighteenth century. Benjamin Franklin is usually given credit for beginning the first one in Philadelphia in 1731. Rental and circulating libraries were associated with printshops and bookstores and many books were sold directly, of course. After the Revolutionary War, there were usually literary society libraries to be found on most college campuses, many of which were more complete than those of the colleges with which they were associated. Scientific society libraries also developed in the large cities along with social libraries. One popular type of social library was that designed for workers and apprentices. At least one type of library was publicly supported and controlled before 1850, and that was the school district library. This type of book collection apparently originated in New York State and spread throughout New England and the Middle West.

In the year 1800, an appropriation was made for books to be included in a Congressional Library. This Library has become one of the most important libraries in the world, the Library of Congress. Today, the Library of Congress is a pervading influence in all aspects of library activity and has become the focal point of our national library system, which also includes the National Libraries of Agriculture, Medicine, and the Interior.

By the year 1900, the basis for the modern library was well set through the work of such persons as Ainsworth R. Spofford of the Library of Congress, John Shaw Billings of the Surgeon-General's Office and later the New York Public Library, Charles C. Jewette of the Smithsonian Institute, and the ubiquitous Melvile Dewey.[14]

[13]Johnson. *Communication. loc. cit.* p. 92.

[14]*Encyclopedia Americana.* New York: Americana Corporation, 1960. Volume XVIII, p. 392.

Modern Library and Information Service

Up to this point we have taken an overview of the history and organization of libraries from ancient times through the advent of the modern library in the last half of the nineteenth century. Our scope, to this point, has been quite broad to the end of providing a general understanding. We shall now turn to the more specific area of documentation and specialized information services.

In their introductory remarks to Bradford's book, *Documentation,* Jesse H. Shera and Margaret E. Egan point out:

> Documentation as a discipline distinct from librarianship, may be said to have begun on the continent of Europe at the close of the Nineteenth Century . . . Paul Otlet and Henri La Fontaine laid the foundation of an international movement for world documentation at their historic meeting at Otlet's home in the de Florence, Brussels, in 1892. From this meeting of these two men came a series of important events that shaped the progress of documentation for more than a generation. It was they who planned the Office International de Bibliographie which, after a series of changes in name, eventually became the Federation International de Documentation. It was they who conceived a universal international bibliography to which was to be attached an international reference library of subject bibliographies. And it was they who, in 1895, called the first international conference on bibliography.[15]

Otlet's *Traite de Documentation* (published in 1934) still stands as a monument in the field of documentation.

So that we may better understand the nature of documentation, let us look at some definitions before discussing what has occurred from the start of the century up to the present. At the beginning of this account, a basic definition of documentation was offered which stated that, "documentation is concerned with acquiring, storing, retrieving, and disseminating recorded documentary information, primarily in the form of report literature and journal literature."[16] One of the main reasons for the emphasis on report and journal literature is the fact that most traditional classification schemes (Dewey and Library of Congress) assume that the basic content unit is the book. A breakdown thus occurs when these systems are faced with multiple content oriented periodicals and multifaceted report literature. To give more specificity to this general definition of documentation, it is necessary to make a visual comparison of functional components of librarianship and documentation as offered by Foster E. Mohrhardt of the National Agricultural Library. Mohrhardt identifies the following facts relevant to documentation:

1. Documentation is a twentieth century discipline.
2. It has borrowed from numerous disciplines and has sprawled across many subject areas.
3. Confusion has resulted from a lack of information concerning (a) what the documentalist does, (b) how he carries out his work, (c) what subject fields are basic to his trade, and (d) how his work relates to other fields. Confusion is compounded by the recognition that he often does what other groups do, but in a different way.

Mohrhardt's concepts of the relative relationship of documentation, librarianship, data centers, and information centers are shown in Figure 1.[17]

The three persons who were among the pioneer librarian/documentalists in the United States — Ralph Shaw, Jesse Shera, and Mortimer Taube — are all reported to agree that documentation differs from librarianship in two particular aspects. It performs library-type functions in greater intensity with evaluation that requires specialized subject matter knowledge. Shera adds that it is the intensive bibliographic work which he feels distinguishes the activities of documentalists. Taube stresses the impact of technical report literature as a driving force for documentation. Shaw accepts all of these elements and adds that documentation is concerned with a complete cycle of information activities expanding and rounding out the segments selected by librarianship.

Booth and Wadsworth, after an investigation of the relationship of documentation to research librarianship

[15]Jesse H. Shera and Margaret E. Egan. "A Review of the Present State of Librarianship and Documentation." In S. G. Bradford. *Documentation,* 2nd. ed. London: Crosby Lockwood, 1953, p. 19.

[16]Borko. *op. cit.* p. 5.

[17]*ibid.* p. 744.

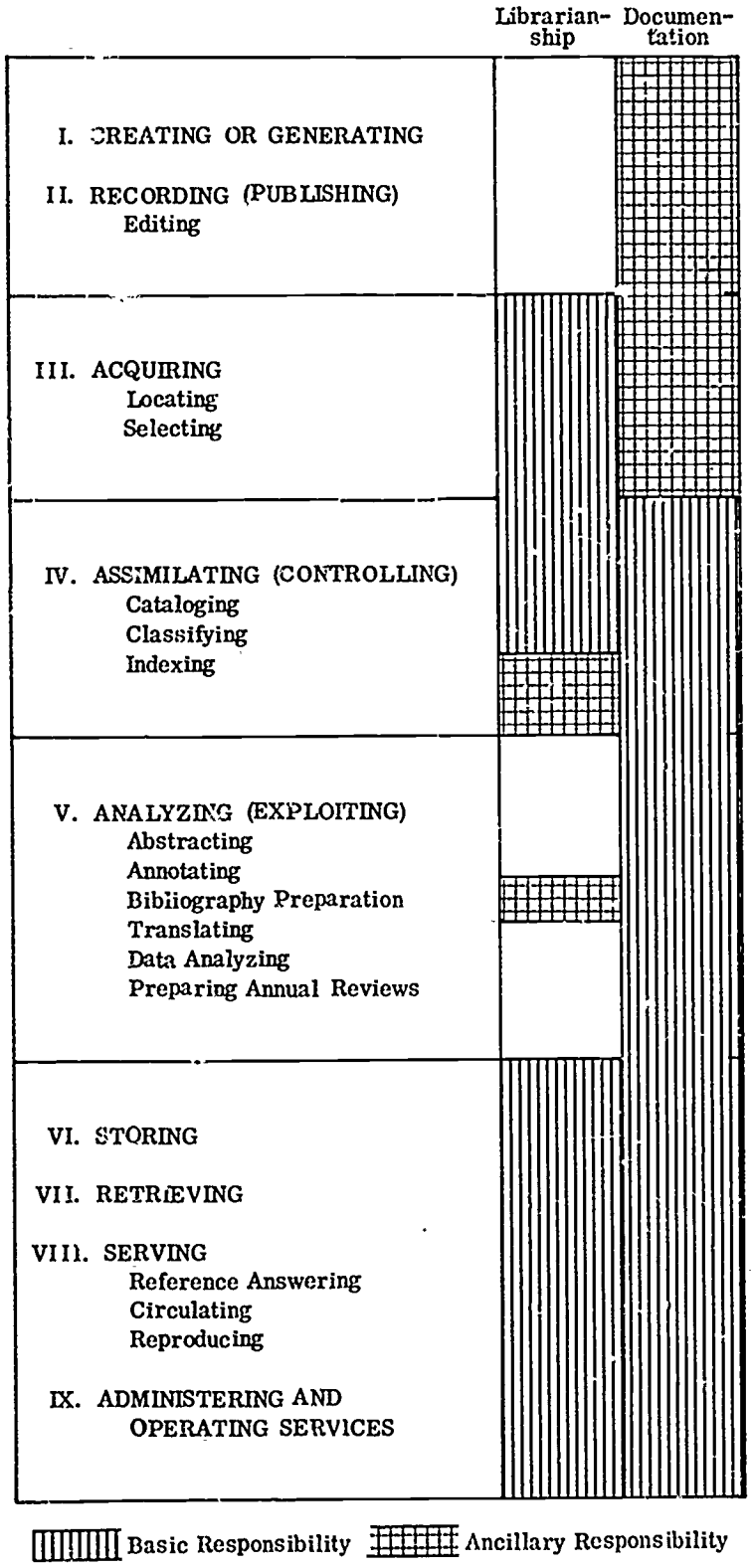
which involved various statistical and logical analysis concluded that:

> Documentation is to be regarded as no more than a scientific attitude towards the materials, the processes, and the services of research librarianship. It is an attitude which can be shared by public librarians, academic librarians, and representatives from other fields . . . [documentation] is, then, an attitude rather than a separate field . . . [and the] dichotomy of documentalists *and* research librarians cannot continue if both groups are to realize society's needs and expectations of the field.[19]

Table 1

LIBRARIANSHIP AND DOCUMENTATION

A Functional Comparison



Let us now pursue the history and development of the attitude of documentation to the present.[20]

Two trends in the modern use of documents as graphic records of information have tended to create situations in which exact information must be found. The first and most important is the reporting of new scientific knowledge in the form of research monographs on minute and precise topics, and the second trend, which is of increasing importance, is the reliance placed upon exact information by business, industry, and government agencies. We find that science, industry, and government have, therefore, become the leaders in documentation, special library, and information center activity. More will be said of the manifestations of this activity in the next section on status and trends.

In July, 1908, the Special Libraries Association (SLA) was formed by John Cotton Dana at the Bretton Woods, New Hampshire, meeting of the American Library Association (ALA).[21] A year later Dana tried to have SLA incorporated as a division of ALA with no success. Since that time, the Special Libraries Association has been an independent organization and has continually grown in activity and importance.

In Britain, a parallel circumstance is found. The Hoddesdon Conference of 1924 led to the formulation of the Association of Special Libraries and Information Bureaus (ASLIB). The organization also exists separately from the British Library Association and is very large and vigorous.

After 1910, the number of industrial firms forming special research libraries increased greatly. Many of these libraries began as corporate files and archives, but they soon included specialized reference materials, technical journals, and general scientific works. Banking and industrial companies were among the earliest to develop special libraries, but their use was not widespread until the 1940's.

In 1927, the British Society for International Bibliography was founded by Professor A. F. C. Pollard and others. The Society became the British National Committee of the International Federation of Documentation. This was the same year as the United States Library of Congress was organized in its present

[18]Foster E. Mohrhardt. "Documentation: A Synthetic Science." *Wilson Library Bulletin* XXXVIII. May, 1964. p. 747.

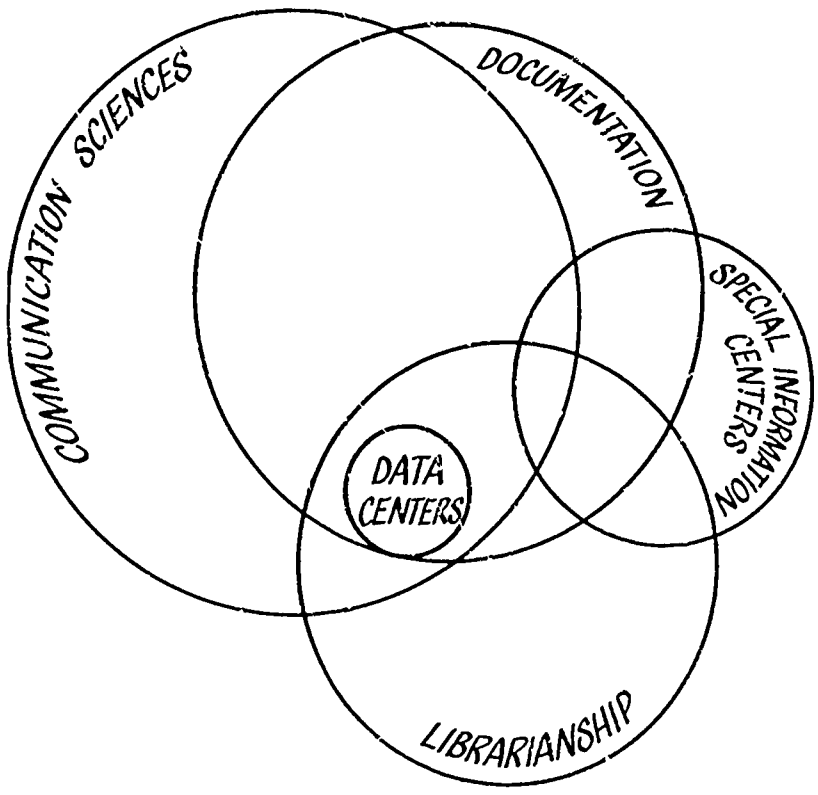
[19]Robert Edmond Booth and Harrison Morton Wadsworth. *A Stochastic Theory of Documentation Systems.* Unpublished *Ph. D.* dissertation. Western Reserve University, 1960. p. 236.

[20]Much of the material in this section is derived from a chronology developed by Booth and Wadsworth *(ibid.)*, the commentary of Shera and Egan in Bradford's *Documentation (op. cit.)*, and Bradford, Chapter VIII, "Fifty Years of Documentation."

[21]Chalmers Hadley. *John Cotton Dana: A Sketch.* Chicago: American Library Association, 1943. p. 88.

Figure 1

THE RELATIONSHIPS OF DOCUMENTATION, LIBRARIANSHIP, DATA CENTERS, AND INFORMATION CENTERS



form. Union catalogs and other cooperative ventures have become an effective force in the provision of information services and the Library of Congress has created the most comprehensive catalog in our country.[22]

The Association of Research Libraries was founded in the United States in 1931, and in the following year a documentation center was established at the library of the Berlin Technischa Hochschule. Paul Otlet's *Traite de Documentation* was published in 1934; and, by 1935, the Special Libraries *Directory* listed 1,154 libraries.

In 1937, the American Documentation Institute emerged from the work of the Science Service, dating from 1926, and the Bibliofilm Service of Watson Davis, which originated in 1935. The original emphasis of the American Documentation Institute was on microphotography. This emphasis has been subsumed for the most part under the umbrella of information services and the emerging field of information science today.

[22]Robert B. Downs. *Union Catalogs in the United States*. Chicago: American Library Association, 1942. p. xvii.

[23]Information on the development of the information center since World War II was obtained, in part, from a draft copy of an introductory chapter intended for inclusion in a handbook for information center personnel being developed under government contract by Systems Development Corporation for the U. S. Office of Education.

[24]*ibid*. p. 10.

[25]Battelle Memorial Institute. *Battelle-Columbus* (brochure). Columbus, Ohio: The Institute, n. d.

With the advent of World War II, a great acceleration and change overtook the whole area of documentation. In order to process the tons of German and Japanese documents captured during and after the war, the U.S. Air Force established the Air Documents Research Center in London, England. In 1945, this facility was moved to Wright Field, Dayton, Ohio, where it became the Air Documents Division of the Intelligence Department of the Air Material Command. The Division was reorganized in 1947 as the Central Air Documents Office (CADO), and its activities were broadened to include the processing of domestically produced technical documents. Concurrently in 1948, the Bureau of Ordnance and the Office of Naval Research established a contract operation with the Library of Congress with these two Navy components. On May 14, 1951, both organizations were merged into the Armed Services Technical Information Agency, the present Defense Documentation Center. Similar services are being performed today by the Clearinghouse for Federal Scientific and Technical Information of the National Bureau of Standards and the Scientific and Technical Information Facility of the National Aeronautics and Space Administration.

Shortly after World War II, a slightly different type of center arose — the Analytical Data Center. This type of center dealt with precise analytical data. The first one was created at the Battelle Memorial Institute, Columbus, Ohio. This particular center dealt with data pertinent to titanium and its alloys; e.g., melting point, physical and mechanical characteristics, and so forth. To date, there are approximately 90 of these federally supported centers.[23]

In the private sector, there has been a definite movement toward the use of mechanized documentation and information retrieval techniques on the part of professional organizations and societies. Prior to 1955, computing equipment was used primarily for numeric data compilation as contrasted with information presented in an alphabetic format. A breakthrough took place when the American Society for Metals Documentation Service was developed at Western Reserve University, Cleveland, Ohio.[24] Mechanized techniques have since been implemented by several professional groups offering information services, the most notable and comprehensive example being the American Chemical Society's *Chemical Abstracts*. Not all information centers have turned to computers, however, the notable exception here being Battelle Memorial Institute which maintains numerous information centers under private and public contract, all of which use manual techniques. An interesting fact is that Battelle has an information center on information centers, the Information Research Center, which uses manual techniques.[25]

The government of the United States is probably the largest operator of information services and centers in the world today. The most active divisions are the National Aeronautics and Space Administration, the Atomic Energy Commission, the Department of Defense, the National Science Foundation, the Department of Health, Education, and Welfare, the Depart-

Table 2

AGENCIES AND ORGANIZATIONS VISITED BY SYSTEM DEVELOPMENT CORPORATION

GROUP*	FUNCTIONS/CHARACTERISTICS	FEDERAL	NON-FEDERAL
LIBRARIES	ACQUIRE, CATALOG, AND ANNOUNCE ACQUISITIONS WITH A VIEW TOWARD STORING, CIRCULATING, AND PROVIDING SELECTED REFERENCE SERVICES.	FEDERAL AVIATION AGENCY DEPARTMENT OF INTERIOR LIBRARY OF CONGRESS NATIONAL AGRICULTURAL LIBRARY NATIONAL LIBRARY OF MEDICINE PUBLIC HEALTH SERVICE SMITHSONIAN INSTITUTION	JOHN CRERAR LIBRARY HARVARD UNIVERSITY LIBRARY MASSACHUSETTS INSTITUTE OF TECHNOLOGY LIBRARY UNIVERSITY OF CALIFORNIA AT LOS ANGELES LIBRARY UNIVERSITY OF MARYLAND LIBRARY
INFORMATION ANALYSIS CENTERS	ACQUIRE, CATALOG, AND INDEX WITH A VIEW TOWARD REVIEWING, ANALYZING, EVALUATING, SYNTHESIZING, INTEGRATING, AND OTHERWISE REPORTING ON THE CONTENT OR SUBSTANCE OF DOCUMENTS. PARTICULAR EMPHASIS ON USE OF SUBJECT AREA SPECIALISTS FOUND HERE.	FOOD AND DRUG ADMINISTRATION NATIONAL REFERRAL CENTER FOR SCIENCE AND TECHNOLOGY SCIENCE INFORMATION EXCHANGE COAST AND GEODETIC SURVEY	BATTELLE MEMORIAL INSTITUTE
PUBLICATION, ANNOUNCEMENT AND DISTRIBUTION	ACQUIRE, ABSTRACT, INDEX, COPY, PUBLISH, ANNOUNCE, AND DISSEMINATE DOCUMENTS FOR THE PURPOSES OF PROVIDING DOCUMENTS OR SECONDARY REPRESENTATIONS USUALLY TO A WIDE POPULATION OF USERS.	ATOMIC ENERGY COMMISSION CLEARINGHOUSE FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION DEFENSE DOCUMENTATION CENTER GOVERNMENT PRINTING OFFICE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PATENT OFFICE	AMERICAN CHEMICAL SOCIETY AMERICAN INSTITUTE OF PHYSICS AMERICAN PETROLEUM INSTITUTE AMERICAN SOCIETY FOR METALS ASSOCIATION FOR COMPUTING MACHINERY BIOLOGICAL SCIENCES INFORMATION SERVICE CHEMICAL ABSTRACTS SERVICE ENGINEERING INDEX, INC. MCGRAW-HILL PUBLISHING COMPANY SOCIETY OF AUTOMOTIVE ENGINEERS CAMBRIDGE COMMUNICATIONS CORPORATION
DOCUMENT GENERATORS/USERS	PRIMARILY ORIGINATE OR USE DOCUMENTS (ALTHOUGH ALL ORGANIZATIONS DO THIS TO SOME DEGREE). TEND TO BE MISSION-ORIENTED AND WOULD ENCOMPASS MOST INDUSTRIAL ORGANIZATIONS (NOT VISITED).	CENTRAL INTELLIGENCE AGENCY DEPARTMENT OF HEALTH, EDUCATION AND WELFARE NATIONAL SECURITY AGENCY	
ADMINISTRATION, POLICY, AND SUPPORT	ADMINISTER, MAKE POLICY, PROVIDE SUPPORT, OR OTHERWISE INFLUENCE DOCUMENT AND INFORMATION OPERATIONS BUT ARE NOT IN THE OPERATIONAL LOOP WITH RESPECT TO PROCESSING OR MANIPULATION OF DOCUMENTS AND INFORMATION (EXCEPT FOR THEIR OWN USE).	NATIONAL BUREAU OF STANDARDS NATIONAL INSTITUTES OF HEALTH NATIONAL SCIENCE FOUNDATION OFFICE OF EDUCATION	AMERICAN LIBRARY ASSOCIATION ASSOCIATION OF RESEARCH LIBRARIES COUNCIL ON LIBRARY RESOURCES ENGINEERS JOINT COUNCIL NATIONAL FEDERATION OF SCIENCE ABSTRACTING AND INDEXING SERVICES SPECIAL LIBRARIES ASSOCIATION

* FUNCTIONAL GROUPINGS ARE IN TERMS OF EMPHASIS OR PRIME ROLE OF ORGANIZATION IN S&T DOCUMENT AND INFORMATION HANDLING ACTIVITIES.

ment of Commerce, and Congress, through the Library of Congress. The following chart (Table 2), developed as a part of the background study done by Systems Development Corporation (SDC) for the Committee on Scientific and Technical Information (COSATI) of the Federal Council for Science and Technology, summarizes the various agencies and organizations in the information services business in and out of government.[26] One addition that should be made to the chart is the Educational Resources Information Center (ERIC) of the U.S. Office of Education, Department of Health, Education, and Welfare, which was not in operation at the time the chart was created.

The intent, up to this point, has been to draw a very general history of the field of information services. We have traced, in broad terms, the nature and organization of libraries and information centers from ancient times to the modern era. Moreover, an attempt has been made to define and to focus upon the area of documentation and the development of specialized information services. We have not looked in any detail at the current status of the field. This aspect will be covered in the next section by a careful isolation and inspection of some significant trends which are prevalent to day. Finally, an in-depth analysis of specific information centers and facilities presently available shall be made.

[26]System Development Corporation. *Recommendations for National Document Handling Systems in Science and Technology,* Appendix A, "A Background Study," Vol. II. Santa Monica, California: The Corporation, 1965. p. 63.

Present Status and Trends

The previous historical overview had as its intent the provision of a context for viewing the present and projecting the future of the field of information services. From this overview, some trends can be easily discerned such as the emphasis upon precise treatment of information through specialized centers, the involvement of professional organizations in the provision of information services, the movement from documentation to information science, and the increasing utilization of mechanization in some aspects of information services while still other areas reject it, at least for the present. In order to further delimit the particular areas that shall be analyzed more closely, other sources shall be examined which seek to determine and define trends. After these and other trends have been identified, key trends will be examined in more detail.

The most authoritative and comprehensive treatment of what is current and promising in information services is found in the *Annual Review of Information Science and Technology*.[27] Two volumes of this continuing series have appeared to date. The first volume, published in 1966, covered the literature appearing in the calendar year 1965, as well as some earlier materials. Volume II appeared in 1967, and covered the calendar year 1966. *The Present Status and Future Prospects of Reference/Information Services*[28] was also examined, as were several other relevant articles and documents. Interviews were an additional source of input.

In his chapter on "National Information Issues and Trends," John Sherrod discusses the role of the Committee on Scientific and Technical Information (COSATI) and lists the basic assumptions which resulted from the attempts of COSATI to develop a realistic conceptual framework for a plan to improve the overall national complex of scientific and technical information activities — government and non-government — in the United States. The most important of the basic assumptions were:

1. The Federal Government has the responsibility to ensure that there exists within the United States at least one accessible copy of each significant publication of the worldwide scientific and technical literature.
2. The Federal Government has the responsibility to see that the significant worldwide scientific and technical literature be acquired, announced, processed, and made accessible to qualified individuals and organizations in the United States.
3. There will be important portions of the national information system independent of the Federal Government.
4. Any systems proposed must be evolutionary in character, in the sense that they will start with the present activities, such as libraries and information exchanges, and evolve to forms which will be consistent with an overall plan.[29]

A number of alternative concepts for a nationwide scientific and technical information system were also listed, all of which involved some type of national network or coordination.

In the chapter on trends and issues in the *1967 Annual Review,* Donald P. Hammer devotes most of the chapter to information networks along with comments on the problems of the information explosion and copyright revision.[30]

Verner W. Clapp, President of the Council on Library Resources, in his keynote address to the Conference on the Present Status and Future Prospects of Reference/Information Services at Columbia University in March, 1966, stated that:

> . . . World War II . . . called the attention of scientists once more, and that of many engineers for the first time, to the need for improving access to the literature of an information on their subjects . . . from these origins have come developments typically in either of two forms. One is the establishment of a center or series of centers to facilitate access to the reports and other documents . . . the other is the establishment of a center for extracting, assembling, and servicing information (as contrasted with documents).[31]

[27]Carlos S. Cuadra, ed. *Annual Review of Information Science and Technology*. New York: Interscience, annual.

[28]Winfield B. Linderman. *The Present and Future Prospects of Reference/Information Service.* Chicago: American Library Association, 1967.

[29]Cuadra. *Annual Review,* I. *op. cit.* p. 342.

[30]Cuadra. *Annual Review,* II. *op. cit.* p. 385.

[31]Linderman. *op. cit.* p. 6.

and furthermore,

> . . . the responsibilities of government with respect to the provision of scientific, technical and other information for use in business, industry, research, education, and medicine have become common subjects of discussion and investigation at the topmost levels of government . . . Out of these discussions and investigations, there emerged from time to time plans for national information service. Although these plans at first may show insufficient comprehension of the mechanisms which they discuss or in other ways fall short of their targets, yet it may be expected that sooner or later the tendencies and pressures which they represent will gradually force the development of reference services which are much more 'complete' . . . [32]

Dr. Clapp goes on to discuss the effect upon the local library of a national reference system and points out that the commitment of manpower it requires should be offset by the advantages of mechanization to the library. He cites, as examples, the nationally coordinated, but also decentralized service facilities of the National Aeronautics and Space Administration (NASA) and the National Library of Medicine through its MEDLARS (Medical Literature Analysis and Retrieval System) program.

What does the major professional group concerned with information services see as the trend of the future? The answer to this question can best be seen in the topic for the fall conference of the American Society for Information Science held on October, 1968, at Columbus, Ohio. In the October, 1967, issue of *American Documentation,* a call was given for papers on a theme of the 1968 conference — information transfer.[33] A model of information transfer was presented and papers on the topic were solicited. This longer range approach to a significant topic, allowing time for idea generation, incubation, and revision, is most heartening.

In addition to our historical overview, we have surveyed the prime sources of information on trends in the area of information services. Based upon this investigation, the following topics seem to be those which are on the cutting edge today.

- Information Networks
- Information Transfer
- Specialized Information Centers and Services
- Mechanization
- The Movement to an Information Science from Documentation

It is evident and should be noted that most of the substantive work in the advancement of the state of information services has been done in the area of science and technology. On this point, D. J. Foskett has observed that:

> Most of the significant advances in techniques of information retrieval have been made in the natural sciences. This was inevitable because it was there, particularly in applied science and technology, that the right conditions existed. First, there was the mere growth in the quantities of data available, which led to increased specialization. Combined with the need for bigger and more costly equipment this meant that research became like production itself, a social matter, with projects requiring teams rather than individual craftsmen or scientists. Second, there was the need to apply the results of research as quickly as possible; the great contribution made by industry to scientific research was to supply the motive power arising from the drive for increased production.
>
> Until recently, these conditions have not existed in the humanities or the social sciences. Individual workers have relied on their own resources, and governments have been less preoccupied with social than with technical problems.[34]

This situation is now changing, not only for the humanities and the social sciences in general, but for education in particular. The nature and direction of changes taking place are not unlike those in science and technology, however, but are quite parallel and draw heavily upon the greater experience of the sciences.

Information Networks

Well over half of the chapter on "National Information Issues and Trends" in the *Annual Review of Information Science and Technology,* Volume II, is devoted to the topic of national information networks. This section starts with the words:

> Perhaps the development in the information sciences that will do the most to solve the problems that beset scientific information users is the national information network. It will have, through its many supporting components, greater resources and faster access than any of our libraries and information centers could hope to have today . . . interacting groups of information generating agencies, information centers, libraries and switching agencies, all with coordinated activities,

[32]Linderman. *op cit.* p. 8.

[33]John W. Murdock and David M. Liston, Jr. "A General Model of Information Transfer: Theme Paper." *American Documentation* XVIII (October, 1967). p. 707.

[34]D. J. Foskett. "Information Retrieval in the Social Sciences." *Wilson Library Bulletin* XXXVIII (May, 1964). p. 755.

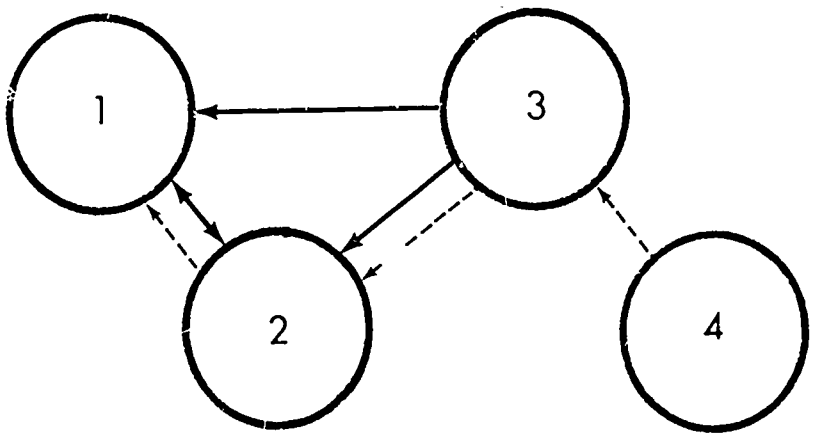
should be eventually capable of supplying all kinds of data to all comers.[35]

An information network is, therefore, an interconnected and interrelated system of information producers, storage and retrieval facilities and users. Such networks are concerned with the expeditious distribution of documents and data to those who use them.

Jordan Baruch of EDUCOM sees three types of communication networks: the need-resources or natural network, the physical network, and the organizational network. The natural network depicts the distribution of needs and resources among a set of nodes. It illustrates a set of interconnections that could produce the information transfer desired. For example, if four universities chose to lend each other computer programs (solid lines) and books (dashed lines) the natural network might look like this:

Figure 2

THE STRUCTURE OF A NATURAL COMMUNICATION NETWORK



Center 1 needs books that 3 and 4 have, and programs available at 2 and 3. It has, as a resource, books needed by 4 and programs needed by 3. Such a network is simply a pictorial expression of various desires and resources. It does not express any connections, paths, or the actual flow of such resources. The arrows between the nodes are merely visual representations of the desired flow direction.

The physical network is a structure or combination of parts capable of conveying a subset of the resources connecting points 1, 2, and 3 in Figure 2. For the exchange of programs, a truck making the trip to transfer books would be part of the physical network. The actual configuration of any network is dictated largely by history, cost, time of response required, material or medium to be carried, and other similar design considerations.

The organizational network is basically concerned with the flow of network meta-information (billing, cost accounting, ordering, instructions, performance data, and data concerning the shape of the network itself). Such a network might have a fifth node added to Figure 2 (if a separate entity existed to manage the physical network), or it might have lines running from 1, 2, and 3 to 4, if 4 was the system administrative agent.[36]

In order to provide further definition of the information network concept, a brief look will be taken at four proposed or emerging networks which represent differing areas of intellectual endeavors: EDUCOM (higher education), COSATI (science and technology), CONLIS (a total knowledge network), and ERIC (elementary, secondary and higher education). Interestingly, the third mentioned proposal (CONLIS) would incorporate or coordinate all of the other networks and their component parts.

EDUCOM

EDUCOM is the short name for the Interuniversity Communication Council, a non-profit organization supported by foundation monies to "facilitate the extra-organizational communication of the university."[37] Its goal is to bring about collaboration among institutions of higher education in their efforts to utilize the communications media. While all information-processing activities are of concern to the organization, the primary goals are to disseminate reports on the state of information-handling techniques and to set up task force groups to study areas of critical development. The original five-year, $75,000 grant from the Kellogg Foundation grew from a belief that only through cooperation can the academic community make a major contribution to new concepts and systems or derive maximum benefits.[38]

In the summer of 1966, representatives of universities, government, industry, and private foundations gathered for four weeks at the University of Colorado in Boulder. Out of this meeting came the overall design for a higher educational information services network which projected the use and development of sophisticated technology for the transmission of information. The present tools being used by EDUCOM are:

> . . . symposia, visits and meeting to define needs; educational programs to introduce new technology, and extensive publication program to ensure optimal growth of network utilization; and the staff participation in EDUCOM panels concerned with application . . . EDUCOM's work is facilitative in nature (and a) major role in the natural network will be to uncover any shortcomings, gaps and cost mismatches between existing physical or organizational networks and the natural network.[39]

[35]Cuadra. *op cit.*, Volume II. p. 391.

[36]Jordan Baruch. "Thoughts on Taking Office." *EDUCOM* III (March, 1968). p. 3.

[37]*ibid.* p. 1.

[38]George W. Brown, James G. Miller and Thomas A. Keenan. *EDUNET, Report of the Summer Study on Information Networks*. New York: John Wiley, 1967. p. 6.

[39]Baruch. *op cit.* p. 3.

COSATI

The Committee on Scientific and Technical Information (COSATI) is a part of the Federal Council on Science and Technology which is an advisory group to the President. COSATI has the task of designing a national information transfer system or network of systems which would serve the needs of practicing scientists and engineers and their managers in such a way as to promote the more effective and efficient execution of the national research and development effort.[40]

In order to determine the optimum approach to a national system, COSATI contracted with the System Development Corporation (SDC) to do a thorough study of information needs, the current system, relevant legislation and executive orders, available equipment and software, trends of the future, and recommendations for action. The final report, *Recommendations for National Document Handling Systems in Science and Technology,* appeared in September of 1965 in two volumes. Volume I contained the major recommendations of the study and Volume II, supporting materials. The major recommendations were:

1. The establishment of a capping agency within the executive branch to have overall directive and review authority relative to Scientific and Technical information and documentation.

2. Implementation of the Responsible Agent Concept which involves the establishment of responsibility for the Federal departments or agencies to assume the performance of the necessary operations.

The alternate systems suggested include:

1. A Federal operating agency which would be both responsible for and operate a national information service.

2. A private corporation (possibly government chartered) which would provide the services of the Federal operating agency.

3. A national library administration in the Executive branch which would be an amalgamation of the major libraries now existing in the government.

4. Strengthen the existing system, mainly the Office of Science and Technology.[41]

A major implication of the SDC report is that there is a need for several national libraries handling documents in each of several different subject fields, with operating responsibility for each library residing with a federal agency having primary mission in that field. From the beginning, it is intended to bring these libraries together into a coordinated system under review of the Office of Science and Technology. This does not necessarily mean that the federal government will operate the document handling systems, but only that it will be responsible for ensuring an effective system.[42]

CONLIS

In March, 1966, an invitation was extended by Robert Vosper, president of the American Library Association, to nine national library groups to send representatives to a meeting in Chicago to consider the COSATI report on recommendations for a national document handling system in science and technology. The consensus of the meeting was that the recommendations of COSATI were "basically inadequate to the real needs of the situation by virtue of their limitation to science and technology . . . [and furthermore] . . . Not only did they fail to consider the urgent needs for improved access to information in the social sciences and humanities . . . but, in the opinion of those present, this failure vitiated even some of the proposals made by COSATI."[43] Many of the shortcomings as viewed by the participants were attributed to the limited charge given COSATI.

As a result of the Chicago meeting, an Ad Hoc Joint Committee on National Library/Information Systems (CONLIS) was formed. The recommendations of this committee were presented at the Midwinter Conference of the American Library Association in January, 1968. The report proposed as a basic hypothesis that the national interest requires assured and ready access by all citizens to unrestricted information as, "information as a commodity is essential to our development as individuals, to optimization of our activities, to the strength of our nation, and to the progress and survival of mankind."[44] It was pointed out that equal access should be given to all fields of knowledge, that there is a large quantity of information in relation to local resources, and that the federal government is the logical body to carry responsibility for a nationwide information system. The problems of intellectual and physical access are discussed and a recommendation is made that:

> There be established within the federal government a single agency with the responsibility to assure that there is ready access to all significant published information by all elements of the economy and with the continuing budget support that will enable it to fulfill this responsibility.[45]

It is strongly emphasized that this recommendation is not for a monolithic federal agency, but for the use of many channels, from local libraries to serve the local community to national service libraries and bibliographic facilities. The Atomic Energy Commission and National Science Foundation are cited as possible models, with placement within a department such as

[40]John R. Ray. *Information Processing Systems and Networks: A Working Paper.* (A mimeographed paper presented at the National Conference of Regional Laboratory Directors, New Orleans, La., January 14-16, 1967.)

[41]Systems Development Corporation. *op. cit.* p. 52.

[42]Cuadra. *op. cit.*, Volume I. p. 343.

[43]"A National Library Agency . . . a Proposal." *ALA Bulletin* LXII (March, 1968).

[44]*ibid.* p. 256.

[45]*ibid.* p. 262.

the Department of Health, Education and Welfare being seen as logical.

The CONLIS proposal is, therefore, for a national coordinating agency which would perform services where none existed and wield those services presently existing into a total system. Again the concept of a system of many parts is proposed.

ERIC

The Educational Resources Information Center (ERIC) is a "nation-wide information service [which] has been established to help put the results of new educational research into the hands of those who need it — teachers, administrators, researchers — and to do so on an up-to-date basis at nominal cost to the user."[46] ERIC has shifted in its emphasis to some extent from "research" to "resources." In fact, the R in the ERIC acronym originally stood for research.

ERIC is a part of the Division of Research Training and Dissemination of the U. S. Office of Education, and covers preschool, elementary, secondary, and higher education through the junior college.

The ERIC system consists of a headquarters office (Central ERIC) which is responsible for overall development and coordination, 18 decentralized subject area clearinghouses, and several specialized services. The chief specialized services are the ERIC Document Reproduction Service (EDRS) and the publication *Research in Education*. The Document Reproduction Service makes the documents indexed in *Research in Education* available on microfiche or hard copy. The inclusions in *Research in Education* are obtained for the various clearinghouses which exercise quality control over input. All projects financed by the federal government which pertain to education are also listed in *Research in Education*. The main content of the ERIC system is report literature.

ERIC, in essence, is a national decentralized system for the gathering, selection, and dissemination of report literature in the field of education.

Information Transfer

As indicated earlier, the theme of the 1968 convention of the American Society for Information Sciences was information transfer.[47] The theme paper for this convention set forth a general model of information transfer which serves as an excellent vehicle to use in examination of this area. In the introduction to this paper Murdock and Liston made the following points:

> Inherent in at least one set of definitions of the words "knowledge" and "information" is the concept that an item of knowledge becomes an item of information when it is "set in motion" — when it enters the active process of being communicated or transferred from one or more persons, groups, or organizations (sender) to one or more other persons, groups, or organizations (receiver). Many people will argue that knowledge as defined here has no intrinsic value — that only when it is successfully transferred is its value to be realized. Others go further, arguing that the value of information cannot be realized until it is actively applied in decision making. Either of these viewpoints must necessarily concede that *value* is dependent upon *transfer*. Thus, *information transfer* is an important and appropriate theme . . .[48]

Murdock and Liston state that their model of information transfer is based on the classic sender-channel-receiver concept, but uses a variety of alternate channels.[49] Their model is shown in Figure 3.

Several terms used in the Murdock-Liston model require further investigation and shed additional light on the nature of information transfer.

1. The *direct channel* is face-to-face discussion in which communication is:

   a. Very direct

   b. Very dynamic, permitting the utilization of words, phrases, sentences, etc. (language); gesticulations; inflections of the voice; interruptability, allowing the receiver to interrupt the sender requesting clarification of or elaboration on the message being spoken; and feedback, allowing the receiver to become the sender with reverse flow of information transfer.

   c. Very rapid with virtually no delay time.

The primary disadvantages of this channel are related to:

   a. Faulty memory

   b. Little chance for study of what is transferred.

   c. Frequent acceptability of vague generalizations which would not be permitted in a recorded message.[50]

Progressing from the point of face-to-face discussion along the communication continuum toward situations involving less directness, less dynamic transfer, and more time delay, one can visualize situations such as phone conversations, television broadcasting, and radio broadcasting. Murdock and Liston see all of these types of transfer as signified by the direct channel from the originator to user depicted in their model because of their immediacy.

2. The primary *recorded media channel* is created when the originator comes to feel that what he has to say should be recorded as a part of the body of literature of his discipline. Other examples of primary re-

[46]Lee C. Burchinal. *ERIC . . . and the Need to Know.* (An explanatory brochure describing the ERIC program, no publisher or date indicated, unpaged.)

[47]*Supra,* p. 10.

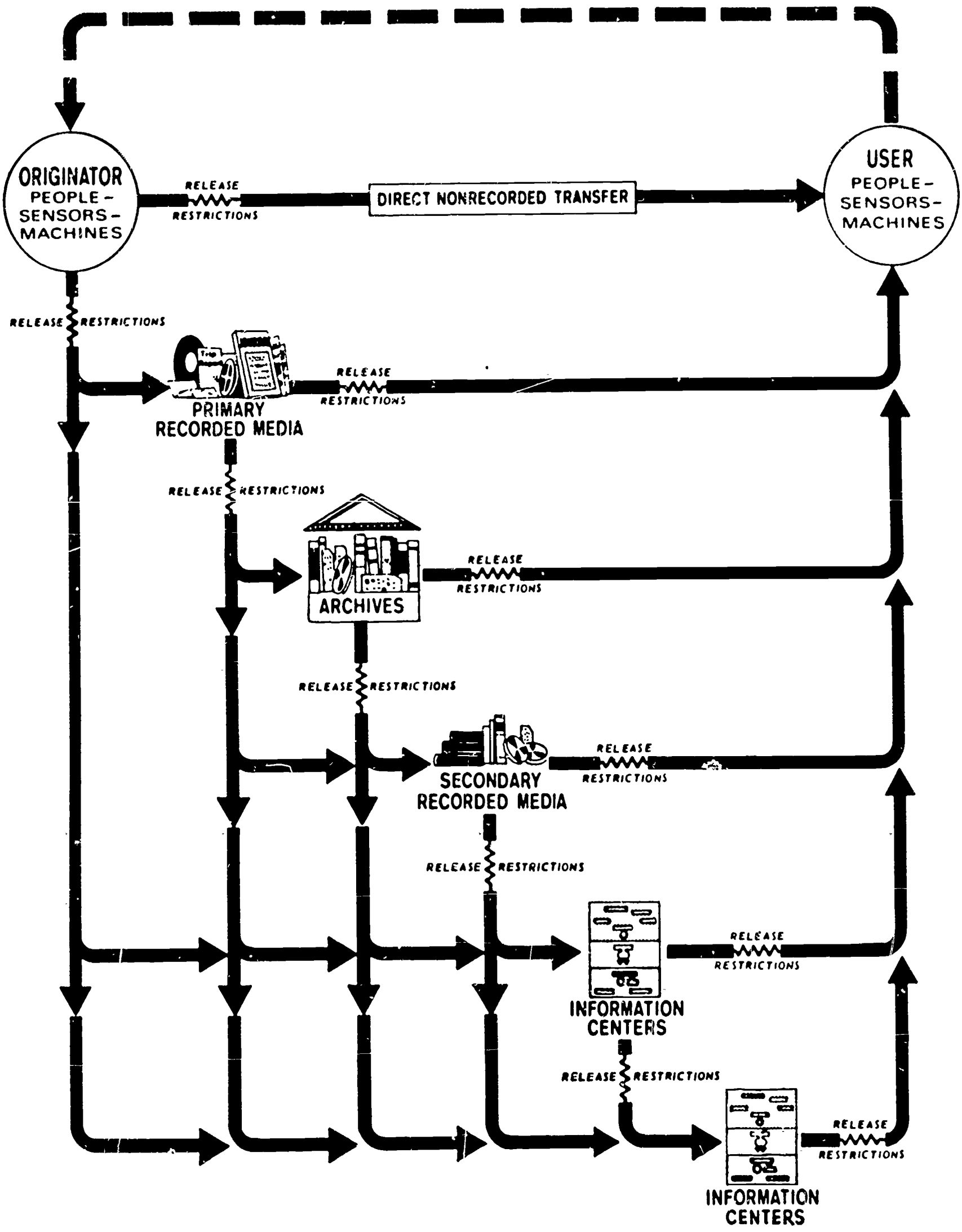
[48]Murdock and Liston. *op. cit.* p. 198. See also the discussion of the nature of information.

[49]See also the work of Berlo, Lasswell, Osgood, Schramm, Ross, and Westley-MacLean among others in communications theory for other elaborations on this model.

[50]Murdock and Liston. *op. cit.* p. 198.

Figure 3

A GENERAL MODEL OF INFORMATION TRANSFER[51]



[51] *ibid.*

corded media are letters, newspapers, conference notes, technical reports, handbooks, monographs, texts, patents and recorded tapes. Little has been done, up to the last five years, to package primary media for retrospective searching other than providing periodic indexes.

3. The *archival channel* has developed to store information for subsequent delayed usage when the user becomes aware of the need for it. Document depots, libraries, special libraries, and corporate files are all forms, at least in part, of archival storage.

4. The *secondary recorded media channel* feeds from both the primary recorded media and archival channels and becomes archival itself when collected into libraries and other holdings. The purpose of secondary recorded media is to assist people to search, more easily, the ever increasing volume of current and stored informational items. Abstracting journals, accessional bulletins, indexes, and bibliographies are faced with handling increasing volumes of literature and with pressure to reduce the time period for funneling information from other channels into the secondary media channel.

5. The *information center channels* represent an attempt to provide a service to essentially a known group of users on demand. The information analysis center, in particular, "attempts to utilize all information transfer channels to provide technical answers to technical questions posed by users."[52] The concept of the analysis center, therefore, has been primarily applied to technical disciplines and mission oriented projects. It should be noted that one information center can refer to another in the model.

6. *Release restrictions* impede the free transfer of information from originator to user. These restrictions could be compared to the resistances or impedances in electrical circuits. The total resistance to flow probably varies according to whether the resistance in the channel is applied in series or in parallel or in combinations of both.

Release restrictions exist even at the face-to-face (direct channel) level of communications in such forms as language difficulties, personal reluctances to devulge facts, and personal incapabilities of expression. Restrictions become more notable as contact between the sender and receiver grow progressively less direct.

Although the existence of this release restriction impedance is generally acknowledged, not a great deal is known about it, including the answers to such questions as

a. What is the magnitude of the impedance? What percentage of valuable information is not available to certain people because of security classifications, for example?

b. How critical is the impedance? To what extent does it really impair progress and understanding?

c. What possibilities are there for reducing or compensating for the impedance?

d. How justifiable are these impedances in view of the value of information -- or do they exist *because* of information.

A set of tentative levels or restrictions are:

a. Unclassified/Public Domain
b. Unclassified/Copyrighted
c. Proprietary
d. Security Classified
e. Natural Language Discrepancy
f. Personal limitations in written or verbal expression
g. Expense (cost)[53]

An interesting discussion of the implications of restrictions in the area of information classification, for reasons of profit or national security, was given in an article appearing in April, 1967, which utilized an earlier version of the Murdock-Liston model.[54]

7. The *symbol for information centers* in the Murdock-Liston model was first described by G. S. Simpson at the 1961 annual meeting of the American Documentation Institute. The three parallel segments of the symbol represent the primary functions of the analysis center as described by Simpson. The top segment represents the acquisition function; the middle segment, the storage and retrieval function; and the bottom segment, the primary function of analysis.

We have been looking at a rather general model of the process of information transfer, in order to give more specificity to the concept. We shall now turn to a particular experiment in information transfer, Project INTREX.

Project INTREX

As Jesse H. Shera said in his article, "Librarian's Pugwash, or INTREX on the Cape":

> INTREX, for the enlightenment of the uninitiated, is an acronym for *information transfer experiments* and, parenthetically, one might note that in most *advantgarde* engineering circles information is no longer communicated or even retrieved, it is transferred. But, whatever one may think of the semantic derivations of INTREX, the term stands for a projected multi-million-dollar, four-year research program at the Massachusetts Institute of Technology to be directed toward the development of new methods for technical and scientific information handling.[55]

Dean Shera also observes that the project seems to be strongly influenced by the work of Vannevar Bush and J. C. R. Licklider.

In August, 1965, a planning conference was held for project INTREX at Woods Hole, Massachusetts.

[52]Murdock and Liston. *op. cit.* p. 200.

[53]Murdock and Liston. *op. cit.* p. 201.

[54]Gustavus S. Simpson, Jr., and John W. Murdock. "$ and Secrets." *American Documentation* (April, 1967). p. 110.

[55]Jesse H. Shera. *Documentation and the Organization of Knowledge*. Hamden, Connecticut: Archon Books, 1966. p. 115.

The conference was co sponsored by the Independence Foundation and the Massachusetts Institute of Technology. The task of the conference was to formulate a coordinated program of information transfer experiments to be performed by Project INTREX. The object of these experiments was to provide a design for evolution of a large university library into a new information transfer system that could become operational in the decade beginning in 1970. The report volume stressed that it is the belief of the conferees that the information transfer system of the next decade will result from a confluence of three main streams of progress:

1. The modernization of current library procedures through the application of data processing, textual storage, and reproduction.
2. The growth, largely under Federal sponsorship, of a national network of libraries and other informamation.
3. The extension of the rapidly developing technology of on-line, inter-active computer communities into the domain of the library and other information centers.[56]

In order to accomplish the purpose of INTREX, the conference recommended four sets of experiments as a core program:

1. *Augmented catalog experiments* — the augmentation of the library catalog in the areas of content, depth and connectivity to be undertaken through the use of a computer which will control the flow of information.
2. *Text access experiments* — the development of means of delivering and displaying documents once they are identified. A number of technologies will be explored for storage, delivery and display.
3. *Network integration experiments* — exploration of a range of ideas to promote the integration of university libraries into a national (and ultimately, international) network of information centers.
4. *Fact retrieval experiments* — experiments with rapid access to very large files, retrieval and assembly of facts, and automatic systems to answer questions.

Development of a computerized "handbook" and data banks and techniques of querying them had a high priority.[57]

An interesting part of the INTREX conference report is the "Information Transfer System at M.I.T. in 1975," which even includes a budget for that year (15 million dollars).

In terms of progress, the November 15, 1967, *Project INTREX Newsletter,* reports that:

> . . . The current effort in the augmented catalog experiments are proceeding in three areas: (1) input data, (2) the computer program, (3) the equipment. The Catalog Input Group . . . has selected for initial cataloging a list of current documents . . . (and) . . . has also selected the data to be included in the experimental catalog.
>
> The Computer Programming Group . . . is developing programs in three phases . . . testing and evaluating various techniques of storage and retrieval . . . (and) . . . for use in conducting more advanced experiments with the interest sector of the M.I.T. community.
>
> The Console Group has specified the components of a remote console and is in the process of ordering the parts for a laboratory prototype..
>
> The Text Access Group is currently evaluating various components of the system . . . (and) . . . yet to be undertaken are the network integration experiments and the fact retrieval experiments.[58]

Thus, at least one high level experiment is ongoing in the area of information transfer with an eye to development of a total system for the future.

In light of the proceeding, a basic definition of information transfer might be: the movement of information from one person, sensor, or machine to another person, sensor, or machine through varied and appropriate channels.

Specialized Information Centers

It was noted in the earlier historical account of the development of documentation that specialized information centers and services grew from two main forces, the need to report new scientific knowledge in the form of research monographs on minute and precise topics and the reliance placed upon exact information by business, industry, and government agencies.[59] Furthermore, these two trends were intensified from World War II onward; and this period is marked by the rise of the specialized information and analytical center. It was further pointed out that several professional organizations have been and are engaged in specialized information services.[60] With this background in mind, our task in this section shall be more to provide definition for the nature of the specialized information center than to explore further the reasons for their existence.

Kent[61] provides a very systematic analysis of the nature and functions of specialized centers dealing with

[56]Carl F. J. Overhage and R. Joyce Harman, eds. *INTREX: Report of a Planning Conference on Information Transfer Experiments.* Cambridge, Massachusetts: The M.I.T. Press, 1965. p. xv.

[57]*ibid.* p. xviii.

[58]Massachusetts Institute of Technology. *Project INTREX Newsletter* (November 15, 1967). p. 2.

[59]*supra.* p. 6.

[60]*supra.* p. 7.

[61]Allen Kent, *Specialized Information Centers.* Washington, D.C.: Spartan, 1965.

them in terms of their functional organizations. His categories are: acquisition, analysis, terminology control, recording the results of the analysis on a searchable medium, storage, question statement and analysis, conducting the search, and delivery of the results (first 5 input, last 3 output). He also treats overall organization, costs and evaluation, and future developments. Case histories are provided under all topics.

In his introduction, the author quotes from a report issued by the Panel on Science Development appointed under Dr. Jerome B. Wiesner, Special Assistant to the late President Kennedy, dealing with the recommendation that, "More and Better Specialized Information Centers Are Needed."

> A specialized information center makes it its business to know everything that is being published in a special field . . . it collates and reviews the data, and provides its subscribers with regularly issued compilations, critical reviews, specialized bibliographies, and other such tools . . .[62]
>
> We believe that the specialized information center, backed by large central depositories, might well become a dominant means for transfer of technical information.
>
> Specialized information centers, to be fully effective, must operate in closest possible contact with working scientists and engineers in the field. The activities of the most successful centers are an intrinsic part of science and technology. The centers not only disseminate and retrieve information; they create new information . . .
>
> Since the technical information center . . . must be part of science and technology, it is natural that it be located where relevant science is flourishing. The Panel, therefore, urges that new information centers be established at public and private technical institutions, not as adjuncts of general libraries, or of publishing ventures, or of central depositories.[63]

In order to place the information center in its proper place in relation to the user's needs, Kent discusses "the reader's dilemma." The reader cannot possibly read, recall or process in advance of needs all of the published materials that are of potential usefulness to him. He has, therefore, relied upon librarians, journal editors, and the editors of abstracting and indexing journals to gain organized information. In recent times so many secondary publications (indexes and abstracting services) have been produced that the reader's dilemma is reoccurring at a second level; and so another level of delegation has been created to provide the reader with relevant current and/or retrospective materials. It is at this second level of delegation that the information center appears. As shown in the general model of information transfer, this second level of delegation may be double-level itself, in that information centers may refer to other information centers for materials in their area of specialization.[64]

There are several ways in which an information center may specialize. Among the possibilities are:

1. By subject field, either by general subject (e.g., chemistry), or by more limited scope within the field (e.g., organic chemistry).

2. By type of source material, e.g. patents, company reports, government reports.

3. By number of people served, e.g., individual scientists, research group, company, general public.

4. By geographic origin or location of (a) source material, or (b) clientele..

5. By type of service provided, e.g., current awareness searches, retrospective searches.[65]

In regard to the services performed by different types of specialized information centers, the following chart (Table 3) gives some indication of emphasis. It should be noted that most specialized information centers and services are quite capable of providing more than one type of service. For example, an information analysis center can provide the information service of bibliographic preparation and an abstracting service can perform information analysis.

A brief look shall be taken at three specific types of center: the analysis center, the referral center and the one-stop service center.

The Information Analysis Center

One of the most highly developed of the information analysis centers is the Defense Metals Information Center of the Battelle Memorial Institute. Mr. Ralph L. Darby, Chief of the Information Operations Division of Battelle, offered an analysis of the information analysis center in a paper presented at the Workshop on Report Literature and Sources of Information sponsored by the New Jersey Chapter of the Special Libraries Association on April 5, 1967. Mr. Darby depicted the analysis center's organization through a diagram (Figure 4).[66]

The differentiating factor between an analysis center and a library or regular information center is shown by the bottom portion of the figure. Here, instead of bibliographies, abstracts, and indexes, the main products of the analysis center are technical answers to inquiries, data computations, monographs, and state-of-the-art reports.

In the case of the Defense Metals Information Center, its mission is to collect, process and disseminate scientific and technical information on structural metals and closely related aerospace materials. The center has

[62] *ibid.* p. 8.

[63] *ibid.* p. 9.

[64] *supra.* p. 14.

[65] Kent. *op. cit.* p. 21.

[66] Ralph L. Darby. "Information Analysis Centers as a Source of Information and Data." *Special Libraries* LIX (February, 1968). p. 93.

Table 3

RELATIVE EMPHASIS OF INFORMATION SERVICE ACTIVITIES[67]

Type of Information Services*	Functional Groups			
	Document Depot	Abstracting/ Indexing Service	Special Library	Information Analysis Center
Passive acquisition	M	r	r	r
Active acquisition	r	M	M	M
Total storage	M	o	o	o
Selective storage	r	M	M	M
Reference searchings	M	m	M	M
Retrieval	M	m	M	M
Hard-copy dissemination	M	m	M	m
Microcopy dissemination	M	m	M	m
Preparation of abstracts	m	M	r	r
Dissemination of abstracts	M	M	m	r
Preparation of indexes	m	M	m	r
Accession lists	m	m	m	r
Preparation of bibliographies	M	m	M	m
Answer technical questions	r	m	m	M
Preparation and dissemination of analytical studies	o	r	m	M
Referral service	m	m	r	r

*M = major activity m = minor activity r = rare activity o = no activity

a manager, approximately 145 engineers (each a specialist) who participate part time to answer inquiries or prepare special reports, and eight full-time information specialists who operate the system and assist the inquirer and discuss the details of the question. This arrangement (1) lets the inquirer know that his problem is receiving attention, and (2) delimits and further defines the need. The center answers questions, publishes reviews or recent developments, and issues technical memoranda and state-of-the-art and evaluative reports on particular subject areas.

The National Referral Center for Science and Technology

If we look at the information transfer network in terms of an electrical analogy, information centers would act as "switching centers" which utilize the "circuitry" of the information channels to answer varying requests. Furthermore, the most critical task in standard reference procedure is to "define" or "negotiate" the originally asked reference question. Therefore, another type of information center is one which does not produce answers itself, but which acts as a matching and switching point for directing requestors to the places where their answers can be found whether in the literature or through other centers. The National Referral Center for Science and Technology is one such facility.

An explanatory brochure about the center states that:

> The National Referral Center for Science and Technology may be described most simply as the 'information desk' of the scientific and technical community. Operating in the Library of Congress with the support of the National Science Foundation, the Center is designed to provide a single place to which anyone with an interest in science and technology may turn for advice on where and how to obtain information on specific topics.[68]

The concept of information resources which the Center has adopted is an extremely broad one. It extends to any organization, institution, group, or individual with specialized knowledge in a particular field and the willingness to share this knowledge with others. Through a continuing survey, the Center is building up a central inventory of detailed data resources in terms of their areas of interest and the services which they provide.

Another activity of the Center is the publication of directories of information resources in the areas of the physical, biological sciences and engineering; social sciences; water; and the federal government.

[67]Cuadra, *op. cit.*, I. p. 305.

[68]*National Referral Center for Science and Technology.* Washington, D.C.: Library of Congress, n.d. (brochure)

The One-Stop Information Center

Moving from the area of science and technology to education, Lee Burchinal, Director, Division of Information Technology and Dissemination, Bureau of Research, U. S. Office of Education, has on numerous occasions advocated the creation of one-stop information service centers. One of the first references to this concept was included in an article on "ERIC and the Dissemination of Research Findings" which appeared in April, 1967. After a discussion of the rationale for the creation of the ERIC system, Burchinal makes the point that, "Information stored in the systems must be available in a form which can be understood and used. Here is where the local information service centers could provide valuable services."[69] He also specifies some of the functions of such local centers. He suggests that they:

> 1. Become and remain familiar with all important organized sources of knowledge that could be usefully applied to development of educational programs in any field.
>
> 2. Know the operational requirements of systems . . . (so that) . . . Specialists in one-stop centers could not only indicate what kinds of information might be forthcoming from a given system or combination of them, but also how long it will take to obtain an answer, the form it will come in, and if there is a charge, the cost.
>
> 3. Act as an important intermediary between the user who can only phrase his question in his own concepts or terms and the more formal language of storage and retrieval of the system.
>
> 4. Become a "listening post" and source of information about user information needs.[70]

Burchinal goes on to say that the local center would have multiple copies of *Research in Education* and other ERIC publications; abstracting journals from other federal and private systems; a full collection of newsletter and reoccurring bibliographies; and special bibliographies tailored to the local user requirements. It would also respond to queries for information that could be assembled from available indexes or information files, prepare digests and interpretative summaries of new findings and develop selective dissemination programs through which carefully selected packages of information, probably abstracts of documents, would inform users of what is current in their specific areas of interest.

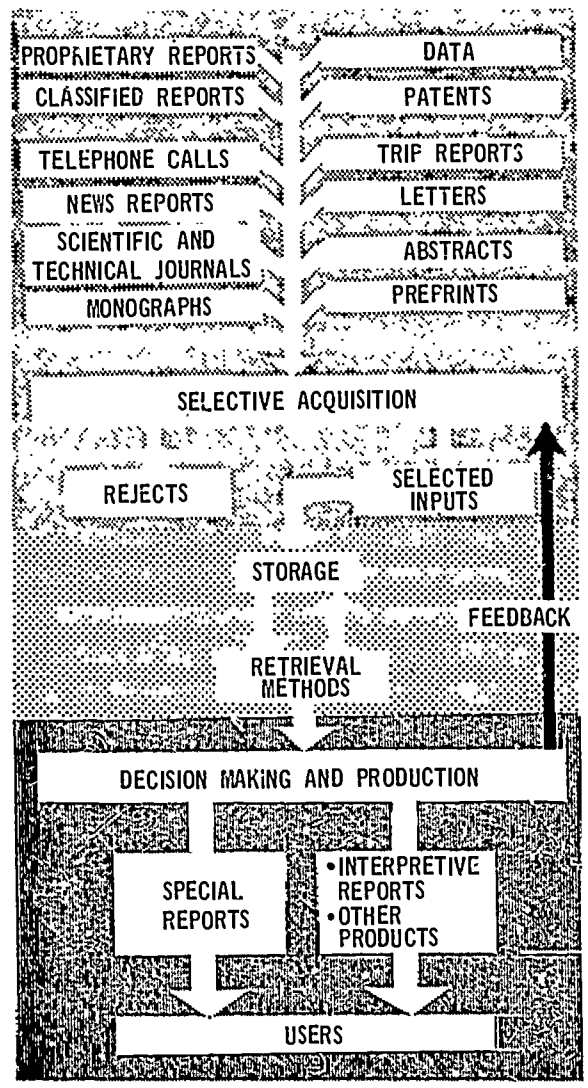
Four settings are specified as natural for the one-stop center: regional laboratories, state and local departments of education, or Title III (ESEA) regional centers.

Further restatement and elaboration on the one-stop center, theme by Burchinal appeared in the *Educational Researcher*[71] and in a paper presented at the 1968 American Education Research Association (AERA) Convention. The AERA paper stressed the emergence of a multi-level set of resources available to education which has appeared during the last few years and indicates five lines of development which are needed if we seriously intend to promote widespread installation of promising programs:

> 1. Further development of a multi-level communication network based upon specialized information processing and transferring organizations that are bound together by functional linkages.
>
> 2. Articulation of mutually dependent roles of "inhouse" information processors and "field-oriented" change agents within the context of the concept of a national educational communication network.
>
> 3. Development of research programs that can provide guidance for integrating information systems theory with theoretical formula-

Figure 4

THE ORGANIZATION OF AN INFORMATION ANALYSIS CENTER



[69]Lee G. Burchinal. "ERIC and the Dissemination of Research Findings." *Theory Into Practice* (April, 1967). p. 83.

[70]*ibid.* p. 82.

[71]Lee G. Burchinal. "Needed: One-Stop Information Service Centers." *Educational Researcher* (Supplement, 1967). pp. 8-9.

tions of disciplines relevant to understanding the change process.

4. Development of the necessary training programs, training aids and operational manuals to provide the skills needed by individuals now in change-facilitating roles . . .

5. Development of a community of interest for sustained work toward articulation of research, training and operational programs related to change.[72]

It can be readily seen that Burchinal views the one-stop information center as an important element not only in the operation of an educational information system, but also in the entire change process as well.

Mechanization

When we think of mechanization in terms of libraries and information centers, one almost automatically assumes that they are about to discuss computers. Burton W. Adkinson and Charles M. Stearns of the Office of Science Information Service of the National Science foundation have identified three phases of the application of computers to library operations. The first phase is to automate information files simply to replace mutual library tasks of a conventional sort with like machine operations. Great strides have already been made in this area, and each of the three national libraries (agriculture, medical, and congressional) have completed extensive studies of automation possibilities and have automated various operations to varying degrees. Phase two is the one in which we are today. It involves the question of which documents in the file contain information on a specific subject.

In the first phase, we have automated our inventory control over packages of information (books, periodicals, monographs, etc.); in the second phase we are trying to automate the process of selecting those packages which contain answers to particular questions. The best known technique in this area is coordinate indexing. The greatest problem here is the "natural language" problem, or how a computer can make meaningful searches using the language of the human requestor.

In the third phase, conventional operations may disappear almost completely, and storage and search will be for information itself almost completely without regard for the item or document that contains it. This ultimate system will have the capability of threading through files of great depth and variety and be able to attack these files from a variety of angles to obtain the desired information. We have not really entered this phase as yet. Some experiments are being made toward it; Project MAC at the Massachusetts Institute of Technology is an example. Project MAC involves shared time use of a heterogenous pool of information from remote consoles.[73]

J. C. R. Licklider in his book, *Libraries of the Future,* lists some of the information processing schemata which will play a role in shaping future knowledge retrieval systems:

1. Random-access memory
2. Content-addressable memory
3. Parallel processing
4. Cathode-ray-ocilloscope displays and light pens
5. Procedures, subroutines, and related components of computer programs
6. Hierarchical and recursive program structures
7. List structure
8. Procedure-oriented and problem-oriented languages
9. Xerographic output units
10. Time sharing computer systems with remote user stations.[74]

In terms of our overview, we shall not attempt to deal with this range of factors, but shall look briefly at three presently available, but as yet not completely implemented, information mechanization procedures: Selective Dissemination of Information, facsimile transmission, and on-line remote inquiry.

Selective Dissemination of Information

Selective Dissemination of Information (SDI) was first developed by H. P. Luhn of the IBM Advanced Systems Group in the late fifties. SDI is a "current awareness" procedure which provides selected materials from current literature to individuals based upon their interests. The key to the system is the creation of "profiles" which characterize the content of an article or document and the user. Each profile is made up from characteristic terms or "keywords" selected on the one hand from the language of the document, and on the other hand from the specialized vocabulary of the user. Profiles are compared, the keywords serving as a common denominator, allowing documents to be sent to those people whose list of keywords sufficiently match the list of document keywords.

So that the users will not have to be burdened with the full text of the documents which are in their general area of interest, but which they do not want to read fully, only abstracts are sent to the users initially. A feedback procedure is built into the system so that users may inform the SDI service that (1) the information was of interest, and served to keep the user sufficiently informed, (2) the information was of interest, and the user would like the complete text, or (3) the information was of no interest. This feedback allows the recipient's profile to be modified.

[72]Lee G. Burchinal. *Articulation of Resources for Research Utilization.* (A paper presented at the 1968 convention of the American Educational Research Association, Chicago, Illinois, February 9, 1968.)

[73]Burton W. Adkinson and Charles M. Stearns. "Libraries and Machines — A Review." *American Documentation* (July, 1967). p. 122.

[74]J. C. R. Licklider. *Libraries of the Future.* Cambridge, Massachusetts: The M.I.T. Press, 1965. p. 9.

Because of the vast number of documents and recipient keywords which have to be matched in an SDI system, mechanization is necessary, "Since mechanization is essential it follows that machinable records . . . must be used. A typical set of machinable records describing a document consists of IBM cards for author, title, source, keyword and abstract."[75] The profile for a given recipient is a list of his interests which are determined initially by having each potential recipient submit a list of topics pertinent to his area of activity which are checked against a keyword dictionary. "The document profiles and the recipient profiles are read into a computer and compared. In those cases where enough keywords match, the machine notes the name and address of the recipient and the identification code of the document selected for him, whereupon an information card and an address-response card are sent to him."[76] The SDI procedure is really the reverse of the normal library procedure in that the information seeks the user rather than the user seeking the information.

An example of an operating SDI system is the installation at the Bonniville Power Administration. An explanation of this program states that:

> A team of specialists follow the literature carefully, abstract, and index according to keywords found in a thesaurus (a kind of dictionary) created at the Bureau of Reclamation. Each participating engineer has a profile — a verbal description of his interests — using words taken from the thesaurus. When the two are matched in a computer an abstract card is sent to the subscriber.[77]

This system is very much like the original IBM model except for two major functions which have been added: retrospective searching when needed and the weighting of keywords so that abstracts are sent out only when a combination of keywords weights a significant "hit" level, thus eliminating those documents of low relevance.

An example of the application of the SDI approach to higher education can be found in the system operated at Wayne State University for a number of universities across the United States.[78]

[75]International Business Machines Corp. *Selective Dissemination of Information*. White Plains, New York: IBM, 1962. p. 5.

[76]*ibid*. p. 7.

[77]Eric I. Bronberg, George A. Dubinski, Norman D. Peterson. "Bonneville Power Administration Selective Dissemination of Information Program." *Special Libraries* LXIII (October, 1967). p. 589.

[78]Lois Lindow. *Selective Dissemination of Information: Its Basic History and Its Application at Wayne State University*. (Unpublished master's essay, Detroit, Michigan: Wayne State University, 1967).

[79]Sharon Scatz. "Facsimile Transmission in Libraries: A State of the Art Survey." *Library Resources and Technical Service* XII (Winter, 1968). p. 6.

[80]*ibid*.

Facsimile Transmission

"Facsimile transmission is the rapid transmission of printed pages from one point to another point using electronic devices."[79] All facsimile transmission methods require converting the original picture into an electrical impulse which is then transmitted over telephone lines, private lines, microwave or a combination of these communication means. When the transmitted signal arrives at the receiving unit, the electrical impulses are used to recreate a duplicate of the original document either on a screen or in the form of hard copy. The major users of this technique are presently newspapers, wire services, and commercial organizations who can afford the relatively high cost. Some basic considerations which should be taken into account in regard to information center use are:

1. Facsimile equipment is available that can accept any type of information which exists on paper and will do so without any intermediate transcribing or processing.

2. Facsimile systems will operate over any available communications medium including telephone lines, overseas cable, radio, microwave, and COMSAT satellite.

3. There is no technical limitation to the distance over which facsimile can be transmitted.

4. Most facsimile systems are designed to accept and transmit standard 8½ by 11-inch pages . . . Facsimile recorders are available that are 36 inches in width.

5. Most facsimile recorders utilize special electrosensitive or pressure sensitive paper not unlike special papers used in copying machines.

6. For copy of average nature, such as a printed page, the time to transmit a page over telephone lines varies between three and six minutes. Production equipment is available that will cut transmission by as much as 20 times, but this requires substantially more expensive communication facilities.

7. Facsimile can transmit from colored originals, but the received copy will be in all of one color. Tone shades may be received on many systems.

8. Facsimile scanners are available that operate with microfilm clips or slides. They can be used to transmit microfilm records and reproduce them in enlarged form at remote locations.

9. Information in facsimile form can be stored on magnetic tape where it can be manipulated by computers. Computer-generated information can be processed by an available "scan converter" and transmitted over telephone lines in facsimile form.

10. Facsimile signals can be digitized and encrypted for secure communications over telephone lines.

11. Facsimile network switching systems may be as automated and flexible as those for other types of communications networks.[80]

In a facsimile network extending over any reasonable distance the cost of communications rather than equipment may become the major factor.

There have been several experiments conducted in information centers using facsimile equipment. The Xerox Corporation markets two types of facsimile equipment, the Magnafax Telecopier, a low cost system, and Long Distance Xerox (LDX), a much more costly device which works in much the same manner as a regular Xerox 914 photocopier. The first device was given a 30-day test at the University of Nevada. Results show that use of the Magnafax Telecopier was feasible and convenient for routine interlibrary use. A test of the LDX equipment at the University of California's Institute of Library Research showed that such unprecedented interlibrary service could be made possible with this equipment and that, "entirely new concepts of cooperative sharing and distribution of library resources"[81] could be obtained; however, "the cost of an LDX system precludes its use in libraries at current interlibrary photoduplication service levels."[82]

The previously mentioned Project INTREX has done some work with a single frame microfilm facsimile system which has been partially evaluated. In its present configuration, the system consists of three units — a flying-spot scanner, a receiver, and a video transmission channel.

The Division of Development of the New York State Library is conducting a pilot program in facsimile transmission known as FACTS (FACsimile Transmission System). The project encompasses 14 stations, six of which can both receive and send, and eight of which can only receive. The facsimile equipment of two manufacturers is being tested and a technical evaluation of the study should be available soon.

As can be seen, the area of facsimile transmission has great promise, but the costs are presently too high for widespread usage. Hopefully, further developments will rectify this problem.

On-Line Remote Inquiry

The advantages of the capacity to perform on-line, remote inquiry of computer files seems rather obvious when contrasted with typical off-line procedures ranging from the book index to "batching" of computer quiries. An article in the *SDC Magazine,* discussing on-line access to computers, states that:

> Of all of the potential advantages of storing information from and about documents in machine-readable form, one that will have particularly striking impact on information gathering customs of the future is the potential of someday placing the contents of the greatest libraries in the world at the fingertips of people in their own offices and homes . . .
>
> On-line techniques enhance computer utilization by enabling people to control their own programs directly at the time the computer is processing them . . . With on-line usage, the user sits at a terminal device of some kind, usually a teletype machine or a cathode ray tube scope, and tells the computer directly — by typed commands — what to do with the data stored in its memory.[83]

In the case of a document retrieval system, as presently developed, the user can formulate his search request at the input device, specify documents with a given list of characteristics (index terms, dates, subject areas, etc.) and receive a list of all documents in the collection that match the given description. Not only does such a system save the searcher time, but it should give him more information than he would get from a catalog, thereby enabling him to make his search far more specific. Systems using microimage techniques could display or print out the entire text of a document (see the previous section on facsimile transmission).

A specific example of on-line, remote inquiry is the nationwide system recently installed for access to selected data of general interest by the U. S. Office of Education.[84] Authorized users of this system merely dial the area code and telephone number of the computer and transmit their inquiry phrased in a structured, abbreviated English language format. If he wishes, the user can call for the answer to his inquiry to be printed out on his own remote teletype and the answer to his question will be forthcoming between two and thirty minutes later. The user can also request that his answer be printed out on a high speed printer connected to the central computer and mailed to him, usually within 12 hours. The intent of this new remote inquiry system is to allow project managers within the Office of Education to exchange information among themselves. These managers will also be able to access directly the great volume of information which is collected by the National Center for Educational Statistics as well as to respond to requests from the educational community for special reports. The U. S. Office of Education system has provision for assuring the privacy of sensitive data and has great flexibility in the construction of inquiries. Statements of relationship (equal to, not equal to, less than, etc.) can be made in almost unlimited combinations using natural language addressing.

Remote inquiry systems are becoming more prevelant and will become more so as larger computers with time-sharing capacity become readily available. The ultimate implication of remote inquiry is that of having all of the world's literature available at any given location, whether it be office or home.

[81] *ibid.* p. 8.

[82] *ibid.* p. 9.

[83] "Document Storage and Retrieval." *SDC Magazine* (Fall, 1967). p. 9.

[84] Jack W. Smith and William C. Dickson. "An On-Line Nationwide Remote Inquiry System for Dissemination of Educational Data." *AEDS Journal* I (September, 1967). pp. 5-14.

At the beginning of this report some attention was given to the movement from documentation to an information science.[85] Further on in the chapter a more detailed accounting of the nature of documentation was given as this field developed from the late nineteenth century onwards.[86] The intent here shall be to further define the emerging discipline of information science as it evolves from documentation and other areas of concern.

Tefko Saracevic, of the Center for Documentation and Communication Research at Case Western Reserve University stated in a paper delivered at the 1968 Special Libraries Association Convention that:

> Since the historical conferences at the Georgia Institute of Technology in 1962-63, the attempt to define information science has become a sport, if not a preoccupation. By 1968 the term has gained common acceptance and respectability despite the lack of agreement as to its definition . . . It is unfortunate that information science has become equaled in so many instances with information technology, a technological pursuit based upon the application of the computer and mechanical manipulation of graphic records such as indexes cannot be regarded as a science. This reinforces a conviction that information science cannot be equated with information retrieval.[87]

Saracevic proceeded to discuss the qualities which a science should possess. Those which he indicated were:

1. A commonality of interest in a given set of phenomenon.
2. An existing number of persons working in the area possessing accepted qualifications, commitment, and interest.
3. Available tools and methodologies.
4. Existence of a theoretical base.
5. Provision of a formal education for other persons interested in the area.
6. Emergence of formal and informal communication channels among persons working in the area.
7. Existence of a professional association or society and publications in scholarly journals.[88]

Saracevic's conclusion is that information science meets most or all of the above qualifications. He then turns to the question of what information science is and continues:

> General agreement exists that information science is concerned with communication phenomenon; its behavior, properties, transfer of information involving communication, the processes involving communication and the tools involved in employing and facilitating the communicative process.[89]

Under a question title, "What Is Information Science?," in an explanatory brochure produced by the American Society for Information Science (ASIS), this definition is offered:

> Information Science as a discipline seeks to create and structure a body of scientific, technological, and systems knowledge related to the information transfer chain . . . As a discipline, Information Science investigates the properties and behavior of information, the focus that governs the transfer process, and the technology required to process information for optimum accessibility and use. Its interests include information representations in both natural and artificial systems: the use of codes for efficient message transmission, storage and recall: and the study of information processing devices and techniques such as computers and their programming systems.
>
> It is an interdisciplinary field derived from and related to mathematics, logic, linguistics, psychology, computer technology, operations research, librarianship, the graphic arts, communications, management, and similar fields.
>
> Information Science has both a pure science component, which inquires into the subject without regard to application, and an applied science, which develops services and products.[90]

What are the practical dimensions of information science? A look at the sections headings for the year-

[85]*supra.* p. iii.

[86]*supra.* p. 5.

[87]Tefko Saracevic. "The Impact of Information Sciences on the Practice of Librarianship." Paper given at the 1968 Special Libraries Association Conference, Los Angeles, California, June 3, 1968.

[88]*ibid.*

[89]*ibid.*

[90]*American Society for Information Science.* Washington, D.C.: The Society, n. d. (brochure)

book resulting from the 1964 conference of the American Documentation Institute, *Parameters of Information Science,* provides an interesting outline:

Information in Decision Procedures
Educational and Professional Aspects of Information Science
Information and Data Centers and Services
Human Factors and Communications Environments
Document Storage and Display and Online Machine Mediation in Time Sharing
Analysis, Indexing and Correlation of Information
Symbolization and Transforming of Information.[91]

In short, the field of information science is concerned with the properties and flow of information; What information is, how it is gathered, processed, and stored; how it is expressed and communicated, and how it is used, by both individual and man-machine systems.[92]

National and Regional Information Services

To fill out the picture drawn to this point of the history, present status; and trends of the area of information services, a look should be taken at a selected group of centers and services presently available. Networks and specialized centers of a general nature shall be dealt with, with little or no attention being paid to individual publications unless they are a product of a more comprehensive facility.

The main sources of information for this listing were the National Referral Center for Science and Technology's *Directory of Information Resources in the United States* series, particularly the volumes on *The Federal Government* and *Social Sciences,* as well as a publication produced under contract to the U. S. Office of Education which was utilized in a seminar on information sources in education at the 1968 American Educational Research Association convention.[93] Other major sources of input came from the various articles and publications gathered and used for the previous section of this paper.

A few general characteristics of the following centers and services should be noted. A rough division has been made between "educational" and "non-educational" facilities. This refers to the primary audience of the center and not to the relevance of the center's information to education. If a center or service sees itself, as being primarily interested in education it is so categorized. If other areas of interest are primary, it is placed in the general "non-education" category.

A differentiation has also been made between "networks" and "specialized services." Networks consist of more than one unit and specialized centers, by and large, operate from one physical or functional location.

Data centers are included within both the educational and non-educational categories. Data centers are distinguished from other information centers in that they are facilities organized primarily for acquiring, processing, storing, retrieving and disseminating data, as opposed to information as defined for the purposes of this paper.

Presently operating information centers and services include:

Educational — Networks

Educational Resources Information Center (ERIC)
EDUCOM (Interuniversity Communications Council)
Midwestern States Educational Information Project (MSEIP)

Educational — Specialized Services

Center for the Study of Liberal Education for Adults
Educational Products Information Exchange (EPIE)
Institute for International Education
National Information Center for Educational Media (NICEM)
Project INTREX
Project TALENT Data Bank
School Research Information Service (SRIS)

Non-Educational — Networks

National Aeronautics and Space Administration, Technology Utilization Division
Neurological Information Network, National Institute for Neurological Diseases and Blindness

Non-Educational — Specialized Services

Alexander Graham Bell Association for the Deaf
Clearinghouse for Federal Scientific and Technical Information
Clearinghouse for Sociological Literature
Data Repository, Survey Research Laboratory
DATRIX (Direct Access to Reference Information; A Xerox Service)
Defense Documentation Center
Information Research Center
International Data Library and Reference Service
Management Information Service
National Aeronautics and Space Administration, Scientific and Technical Information Division
National Clearinghouse for Mental Health Information
National Library of Medicine
National Referral Center for Science and Technology
Research Program in Child Development
Safety Research Information Service
Science Information Exchange
Scientific Information Centers Branch, National Institute for Child Health and Human Development

[91]American Documentation Institute. *Proceedings of the American Documentation Institute, Volume 1. Parameters of Information Sciences, Annual Meeting, Philadelphia, Pennsylvania, October 5-8, 1964.* Philadelphia: The Institute, 1964. pp. iv-vi.

[92]Louise Schultz. *Careers in Information Science.* Santa Monica, California: Systems Development Corporation, 1963.

[93]American Institutes for Research. *Seminar on Information and the Behavioral Sciences.* (A handbook passed out at the 1968 American Educational Research Association Convention, Chicago, Illinois, February 7, 1968; produced with the support of the Division of Information Technology and Dissemination, Bureau of Research, U. S. Office of Education.)

The Future

It is possible only to conjecture about the future, but G. S. Simpson, Jr., has engaged in some interesting projections of past history and present trends. Simpson sees the world of information services as a vastly different one in the year 2000 *A.D.*

By the year 1975, in Simpson's projection, an organization has been established under the auspices of the United Nations which has as its task the coordination and integration of the various extant information systems. A master plan is implemented which dictates that every piece of scientific information and data produced be exposed to a print reader which retransmits to other scientists only that information approved by the Regional Information Center. Information not approved is automatically destroyed. Regions are based upon the predominant grammar type used (i.e., all Russian-speaking people are Region One). A World Scientific Information Center (WSIC) composed of comparator-translator, master storage, and master selective dissemination divisions, coordinates the entire system. The sequence of events followed at the World's Scientific Information Center is:

> Any group of ten or more scientists agree on a proposed research program. Using U.N. standardized communication language and equations, they prepare a succinct statement of the purposes and objectives of their program. After internal human editing, the local print reader absorbs the content of the proposal. The print reader automatically relays the message to the World's Scientific Information Center via the Regional Information Center which conducts an initial and limited (single language) comparison. At World's Center, the master comparator matches the contents of the new proposal with other proposals from any language. If a proposal is unique . . . it is subjected to a second test. The second test . . . involves a statistical matching of the objectives of the proposal against the information already integrated in the master storage division of the Center. . . .
>
> When a project has been accepted by the Center, implemented, and completed by the scientists, the report describing the activity is exposed to the print reader. Like before, the print reader relays the report to the World Scientific Information Center via the regional center. At WSIC it is translated, stored, and selectively disseminated polylingually . . . .
>
> Under this totally automated scientific information system, there is no duplication of research . . . [and] . . . no scientist can make a technological advance without its being known to all his contemporaries within three minutes.[94]

Simpson indicates that a number of socio-economic changes resulted from the above system. Advertising is outlawed in 1990; congresses and symposia are eliminated by 1993; the printing, publishing, and paper industries are reduced in size; and the world postal system reduces its staff.

Simpson's projection will most certainly not be the actual situation in the year 2000, but it represents an informed opinion as to what today's trends could bring tomorrow.

[94]G. S. Simpson, Jr. *The Scientific Information System of the Year 2000 A.D.* (Mimeographed paper obtained from the Battelle Memorial Institute, Columbus, Ohio.)

Summary

The keystone of library history is the Alexandrian Library of ancient Egypt. This institution attracted a number of outstanding figures as librarians, one of which is said to have compiled a catalog of the library. One of the continuing values of the Alexandrian Library was its status as an ideal to be replicated.

Roman libraries emulated the Greek and, in fact, received much of their impetus from the Greek library collections brought back from various military campaigns. Roman libraries were divided into Greek and Latin divisions and also served as archives for important state documents. The cities of Italy and the provinces endeavored to follow the example of Rome.

The age of the monastic library began in the sixth century. The tasks of reading, and its corollary of copying, were joined in the monastic library and the great tradition of the scriptorium was founded. Monastic libraries followed the Greek practice of dividing the collection into Greek and Latin sections.

The organization of the university library, which flowered during the fifteenth and sixteenth centuries, was similar to the larger monastic libraries except that the main division of books was according to the subjects taught.

The advent of the printing press, coupled with the intellectual ferment of the Reformation, provided a formula for broadcasting ideas. The spread of vernacular education and the creation of literature in the natural languages of the people further intensified the creation and use of print.

Generally, the development of libraries to the end of the nineteenth century was closely tied to national development. In the United States, private and semi-private libraries provided literary access until about 1850 when the public library system as we now know it began to form. By the end of the century the basic pattern which we enjoy today had been devised and was well on its way to implementation.

The foundations of the area of documentation were laid by Otlet and La Fontaine in a meeting at Otlet's home in 1892. Documentation, in its essence, is the application of scientific method to library procedures. It stresses the analyzing of information in addition to acquiring, assimilating, storing and retrieving information as practiced in the traditional library situation.

With the coming of World War II a great acceleration and change overtook documentation. The reporting of new scientific knowledge in the form of research monographs and the reliance placed on exact information gave rise to the analytical and other information centers.

The main trends operative in the current state of the field of information services are:

1. Information Networks
2. Information Transfer
3. Specialized Information Centers
4. Mechanization
5. The Movement to Information Science from Documentation

Each of the above trends is interrelated toward the goal of creating an ideal system which would have the capacity of providing any significant document to any person desiring it at the place and in the form most convenient to them. Another level of service is the provision of "secondary channel" services which distill and repackage information for more economical use. A number of separate projects and centers are working at various aspects and on differing levels of this task toward creation of an effective ordering of the many specialized services into a meaningful whole.

A specific need has been expressed, in the area of education, for the creation of a one-stop center where the various existing information resources can be coordinated in relation to specific reference needs.

Appendix

The Information Service Efforts of Specific Regional Educational Laboratories

In reviewing the *Bureau of Research Taxonomy* codification of all "activities" and "projects" of the twenty regional laboratories only two specific indications were found of information service programs as defined for the purposes of this study.[95] There are a number of programs for handling information in the data processing sense, but only two in the information/knowledge area.

One of the identified programs, that of the Far West Laboratory for Educational Research and Development (FWLER), is a "project" under the general "activity" of Communications. The second effort is at the larger "activity" level and is being carried on by the Michigan-Ohio Regional Laboratory (MOREL).

The Central Midwestern Regional Educational Laboratory (CEMREL) has two "projects" which are somewhat related to the information/knowledge area; one to classify, index, and evaluate educational materials and the second to maintain a continuous regional directory of innovative practices. A look shall also be taken at a laboratory dissemination program which has some definite implications for information services.

We shall examine the two major programs in some depth, and take a much briefer look at the remaining two.

Far West Laboratory for Educational Research and Development

In the introduction to its *Information System Task Force Report,* the Far West Laboratory states that they have

> . . . undertaken two major research and development programs and a small number of auxiliary projects. The primary R and D program (is) concerned with developing and implementing more effective inservice training for teachers . . .
>
> The secondary R and D program of the Laboratory seeks to improve dissemination and productive use of research and development information by school personnel who make decisions affecting school organization and operation. The objectives of this program are (1) to develop motivation among school personnel to learn about new developments in education; (2) to provide efficient systems through which school personnel can have ready access to relevant information; and (3) to develop organizational arrangements within school systems and support personnel training programs so that school personnel will be able to use research and development information effectively.[96]

To reach the objectives stated above the laboratory has proceeded with a coordinated and systematic research, development, and implementation effort through the following components:

1. *Development of Attitudes and Realistic Expectations.* This focuses on the use of mass media to inform teachers and other school personnel about significant innovations and research based developments in education.

2. *Design of and Experimentation with Systems Through Which School Personnel Can Have Access to Relevant Information in Usable Forms.* Two related activities are being undertaken in this component. One is the collection of data on information needs and system requirements. (The report being referred to here is a product of this activity.) The other involves the development, field testing, and implementation of model information systems.

3. *Development of Organizational Arrangements Within Schools To Utilize Information Effectively.* This component includes three activities: study of educational decision making and change process as they relate to information requirements; identification and analysis of specific organizational arrangements and training programs that will facilitate effective use by school personnel of research and development information; and pilot tests of selected organizational arrangements and training programs in school systems.[97]

Five activities specifically related to information systems have been initiated by the Far West laboratory. They are:

1. A Communication and Utilization Study for Educational Research and Development (completed through a contract with the Lockheed Missiles and Space Company).

2. A Formulating Educational Problems Project (done under contract with the American Institutes for Research).

[95]Bureau of Research, Office of Education, U.S. Department of Health, Education & Welfare. *Taxonomy.* Washington, D.C.: The Bureau, 1968.

[96]Far West Laboratory for Educational Research Development. *Information Systems Task Force Report.* Berkeley, California: The Laboratory, March, 1968.

[97]*ibid.* p. 1.

3. A review of the literature and field study on the manner in which research derived information is used by various levels of school personnel (conducted under a contract with the Stanford Research Institute).

4. Studies and reviews by laboratory staff.

5. A detailed study and analysis of educational information systems requirements by a specially selected Task Force. (The report being discussed here is the product of this Task Force.)

The Far West Laboratory Information Systems Task Force met in four working sessions during the months of July and August, 1967. The topics covered, by sessions, were:

1. Output — the requirements of local school personnel.

2. Input — the content, organization, and location of information.

3. System — existing and planned information services and information technology developments.

4. Roles — national, regional, state, and county roles and their potential relationship to educational research and development services.

The *Task Force Report,* as it stands in draft form, deals with problem definition, description of existing conditions, model system requirements, practical system concepts (including system constraints and a functional description), and the assignment of roles and functions.

The two major conclusions of the report are:

1. Organization and operation of a single system which would incorporate all sources of information and use one indexing system is not feasible in view of the present state of taxonomy of educational information and existing organizational interests.

2. Two major functions are not being serviced properly at this time: production of user-oriented information materials (evaluative reports, interpretive summaries, and handbooks), and input/output to provide a dialog for translating user needs into formalized system language on input and vice-versa on output.

The national network should consist of several large and many smaller systems with their own collection and indexing processes. In addition, a subcentral processor is needed to accomplish the input-output functions described in the previous section, e.g., the interpretation of questions, the use of various systems to collect and organize reports, the evaluation and presentation of data in a form compatible with user needs, etc.[98]

It is stated that the most reasonable approach to these processor functions . . .

> . . . would be to assign them to an information specialist within the school system . . . [and furthermore] . . . the laboratory could delve into solving their problem . . . [by having] . . . several possible roles:
>
> 1. Training and support of information specialists in each school district in the region.
>
> 2. Preparation, production, and distribution of interpretive summaries on subject areas of local interest in a format compatible with user requirements.
>
> 3. Preparation of an annual review of educational R and D.[99]

It should be re-emphasized that the Far West Laboratory does not intend to set itself up as an information services center, but as a developer and supporter of information service systems to be operated by others.[100]

Michigan-Ohio Regional Educational Laboratory

In its statement of program and budget done according to the Planning Programming Budget System (PPBS), the Michigan-Ohio Regional Educational Laboratory identified the second of its three major program goals as "To Provide Information Services. . . ."[101] This program emphasis of the Michigan-Ohio laboratory stems from the results of an in-depth survey of their service area taken in the summer of 1966.[102] In Volume IX of its *1967 Annual Report,* the Laboratory states that:

> The MOREL Information Center and Resource Bank are intended as a one-stop spot where educational and educationally related agencies in the region can tap informational resources which are relevant to their specific needs. The structure of the center is that of a "switching" or "transfer" network in that

[98]*ibid.* p. 46.

[99]*ibid.*

[100]This conclusion is substantiated by a personal conversation with Dr. Paul Hood, Project Director. He stated that the Far West Laboratory has no intention of establishing an information system, but saw its role as fostering such systems in others.

[101]Michigan-Ohio Regional Educational Laboratory, *MOREL Program and Budget, December 1, 1967 - November 30, 1968 (PPB System).* Detroit, Michigan: The Laboratory, September, 1967.

[102]An analysis of this survey which involved over one thousand structured interviews of regional lay and educational leaders was reported in *The Second Annual Report of the Michigan-Ohio Regional Educational Laboratory* (Detroit, Michigan: The Laboratory, October, 1966).

it does not possess extensive stores of actual information, but is composed of the searching tools necessary to identify and locate such information upon request.

1. To act as an information linkage network, bringing together persons or agencies having specific informational needs with sources possessing the desired information. These sources may be regional or extra-regional.

2. To maintain a one-stop spot where all significant informational searching tools are available (indexes, directories, catalogs of printed cards, MOREL Resource Bank, etc.).

3. To provide "current awareness" services in terms of national, international, and regional educational activity. Such a dissemination system is both quick and selective in output and immediately responsive to activity in the field of education and related disciplines.

4. To provide specific reference service for all MOREL projects, program and support activity.

5. To act as a transmitter of information generated by MOREL and other regional agencies to related national information networks such as the Educational Resource Information Center (ERIC) of the U. S. Office of Education, other regional laboratories and research and development centers.

6. To identify, foster and support cooperative information services, with the region and to urge participation in national networks.

7. To be aware of the operational requirements of other information sources and systems in terms of what type and extent of service they offer.

8. To assist in the identification of regional needs through the identification of voids in the informational fabric of education in the region.

In short, the MOREL Information Center operates much like the information switchboard in a large reference library where an inquiry (need) comes in from a person or agency, the need is further defined if necessary, an identification is made as to where the particular informational need can be satisfied, and the person is switched to the appropriate department.[103]

[103]Michigan-Ohio Regional Educational Laboratory. *MOREL Annual Report, Volume IX: Information Center and Resource Bank*. Detroit, Michigan: The Laboratory, September, 1967.

This *Annual Report* volume goes on to deal with the content of the system (documents, data, talent and resources), the progress of the Information Center, and a proposed budget for the Resource Bank together with its coding scheme and data gathering forms.

The information system of the Michigan-Ohio laboratory is one which sees the regional laboratory's role in information services as being that of developing an information system to give direct service to its constituents within a local to national hierarchy.

It should be noted here that the author of this study has had major conceptual and operational responsibility for the MOREL Information Center and Resource Bank from the inception of the laboratory. This situation has provided the author with a unique opportunity to test many of the ideas dealt with in the paper. This circumstance has also given major impetus to the development of a model which can be used to evaluate and point directions for present and future information services activities of the regional laboratories, including MOREL.

Central Midwestern Regional Educational Laboratory

One of the avenues taken in gathering information for this study was to contact the Science Information Exchange at the Smithsonian Institution. The Science Information Exchange catalogs research in progress. The only response, among twenty received from the Exchange in answer to a query about national information systems and centers, that related to the regional laboratories concerned the Central Midwestern Regional Educational Laboratory. The Notice of Research Project said in part:

> . . . for its program on systems design and application, CEMREL has begun an examination of the information requirements of educational decision makers and planners in an effort to determine ways in which existing educational information can be made more accessible and useful.

In an information booklet about CEMREL, under the heading of Information Services, four sub-areas are listed:

> 1. Educational Planning. Work is directed to discover ways for (a) gathering, storing, and using educational information, (b) continuous identification of crucial problems facing public and private education in the region, and (c) various agencies to work together to solve educational problems.
>
> 2. Computer Utility for Education. This program is designed to develop and test a wide variety of computer uses in education in the areas of (a) administration, (b) teaching, and (c) guidance.

3. School Data Systems Design. This program is developing a system to help schools convert from manual data handling systems to more rapid, efficient computer methods.

4. Classification, Indexing, and Evaluation of Educational Materials. This program will (a) survey existing systems for organization of educational materials, (b) develop new systems where appropriate, (c) join with other libraries, materials, and information centers in the development of media and information systems for smaller schools and school districts, (d) design systems to take advantage of automatic input storage, and retrieval hardware and software, and (e) develop techniques for encouraging the effective use of a wide variety of informational and instructional materials at the classroom level.[104]

The CEMREL program is somewhat limited in terms of the area and scope of this paper, but there are some definitely relevant aspects. Under the sub-area Educational Planning, the discovery of ways to gather, store, and use educational information would seemingly be germane, although the author was unable to find evidence of specific efforts in this direction and this project was not listed in the *Bureau of Research Taxonomy*. The classification, indexing, and evaluation of educational materials was listed in the *Taxonomy,* but these techniques would most certainly have transferability at the internal, technical level and not at the overall systems design plane. In the CEMREL situation information systems, as they are defined in this paper, are restricted to "smaller schools and school districts" which again speaks to an area much narrower than that intended for this paper.

It would seem that CEMREL's efforts have tangential relevance and are an area of activity to be aware of rather than being central to the concerns we are dealing with here.

Southwestern Cooperative Educational Laboratory

In a plan for the gathering and dissemination of information proposed in 1966, the Southwestern Cooperative Educational Laboratory (SWCEL) included several ideas quite relevant to the topic of this paper. The program of the Southwestern laboratory does not actually include all of these items at present, but their natures are quite germane to the concerns of this study. The purposes of this proposed plan were:

1. To allow the laboratory to receive the kind and quantity of information needed.

2. To make educators and others aware of and to encourage the use of information or innovative practices in the classroom.

Some interesting aspects of the plan are:

1. A comprehensive survey of innovative practices (Regional Resource Inventory).

2. A "People Bank" of consultants.

3. Reciprocal arrangements with other regional laboratories to exchange research findings.

4. A complete "union catalog" of research on specific areas (in the case of SWCEL cultural factors in learning).

5. Identification of those classroom teachers who are receptive to new ideas and are willing to innovate.[105]

The Southwestern Laboratory plan gives attention to some of the areas included in the Michigan-Ohio laboratory program, particularly in terms of human resources and innovative centers and practices. It does not strive to provide broadbased information services, however.

Summary

Title IV of the Elementary and Secondary Education Act of 1965, which provided funding for the twenty Regional Educational Laboratories, incorporated and expanded the Cooperative Research Act of 1954. As part of this expansion, additional Research and Development Centers were established for basic research, and the regional laboratories were created to move the products of theory and research into practice. The Educational Resources Information Center (ERIC) was also started in May, 1964, to disseminate research and research related information. Thus, these three sets of agencies, stemming from the same office, are mutually supportive and complementary.

The first twelve of the twenty regional laboratories went into operation in June, 1966 after an intensive development period of 75 days. An additional eight laboratories, which enjoyed a somewhat longer developmental period, were operative, or nearly so, by the early part of 1967. A reinforcing and supporting network of laboratories is now coming into being as well as a stabilizing and maturing set of programs and funding base.

In terms of geographic placement all sections of the United States, except Hawaii, are served by a laboratory. The laboratory service areas range in size from one city (New York City) to a laboratory dealing with sections of eight states. The organizational structure of the laboratories is that of a non-profit corporation. Laboratory governments have come to be broadly based in

[104]Central Midwestern Regional Educational Laboratory, *Central Midwestern Regional Educational Laboratory, Inc., for Educational . . . Research, Innovation, Diffusion, Implementation.* St. Ann, Missouri: The Laboratory, n.d.

[105]Southwestern Cooperative Educational Laboratory. *A Proposed Information System for SWCEL.* Albuquerque, New Mexico The Laboratory, a mimeographed draft copy dated September, 1966.

their regions, including persons from educational and non-educational pursuits.

The programs of the laboratories range widely over the high priority needs of education today and are oriented toward the development of viable alternatives for use in the classroom. The role of the laboratories in educational development is becoming more and more clearly defined. The entire area of educational development itself is gaining more power and favor as its intent is to produce usable results derived from basic theory and research.

Four regional laboratories have initiated or developed programs oriented toward the provision of information services. The Far West Laboratory for Educational Research and Development has built a strong theoretical base for information handling and sees its role as promoting and assisting with the creation of information systems in its region. The Michigan-Ohio Regional Educational Laboratory, based on the results of a needs survey, has established a referral service for printed, human, and institutional resources. The Central Midwestern Regional Educational Laboratory and the Southwestern Cooperative Educational Laboratory have both designed and established information components into their general programs, although they do not elevate these efforts to "activity" or "program" status.

In general, the regional educational laboratories have become a potentially vital force in American education in a period of a little over two years.