Sharing Information Resources Through Computer-Assisted Systems and Networking

Hwa-Wei Lee*

Introduction

Although information is regarded as an inexhaustible resource, making it fully available and easily accessible in meeting the diversified needs of its users requires that it be collected, organized, and shared. There is an economical reason, too, for the sharing of information resources, not only for the information "poor" countries, but also for the information "rich." With the continued rise in both the quantity and cost of publications, the shrinking of library budgets, and the constant broadening of user demands resulting from the expanding frontiers of knowledge, it becomes quite clear that finite library budgets have made it increasingly difficult to meet the infinite demands of users.

Library cooperation in sharing resources is not a new concept. In fact, many such activities have long been in existence: shared cataloging, union catalogs or lists of library holdings, central technical processing, reciprocal borrowing and photocopying, interlibrary loan, cooperative acquisitions, exchange of duplicates, cooperative storage and delivery, etc.

---

*Dr. Lee is Professor and Associate Director of Libraries at Colorado State University. This paper was presented at the IFLA/UNESCO Pre-Session Seminar on Resource Sharing of Libraries in Developing Countries, August 30-September 3, 1977, Antwerp University, Belgium.

Many of these cooperative activities have been discussed in the preceding sessions. This paper intends to discuss one of the recent developments in resources sharing: computer-assisted information systems and networking.

Because of the introduction of computers and the rapid advancement in telecommunications technology, fast and cost-effective ways of sharing information and resources are now possible on a far greater scale than was known before. The development of computer-assisted information systems and networks is of great importance for world-wide cooperation in resources sharing involving both developed and developing countries.

The development of computer-assisted information systems and networks has three interrelated components: (1) the creation and growth of many machine-readable data bases capable of on-line, interactive searching from remote terminals: (2) the development of computerized library networks connecting libraries and computer facilities and data bases; and (3) the establishment of mission-oriented national and international information systems based on a well-conceived model developed for the International Nuclear Information System (INIS)

Each of these components will be discussed in some detail below. Particular attention will be given to their implications for developing countries. The future interconnection of information resources, data bases, library networks, and international information systems to form a world-wide information network is a distinct possibility in the 1980s.

The Creation and Growth of Machine-Readable Data Bases

Because of the continued increase in the number of bibliographical records and in the cost and time required to prepare for their publication manually, many abstracting and indexing services and publishers have turned to computers for relief. The result has been a fast growth in the number and size of

machine-readable data bases in the last 15 years. The important by-products of these data bases are their ability to provide a variety of bibliographical services such as on-line, interactive search and selective dissemination of information (SDI) service.

According to the 1976 estimate of the National Federation of Abstracting and Indexing Services, there were 2,500 indexing and abstracting services in existence world-wide; of these, about 200 were in machine-readable form, and most of these were capable of being searched from remote terminals.[1] Although most of the data bases are for bibliographical information, there are others which cover news articles, full texts of legal cases and statutes, numeric data, and graphic representations.[2]

Despite their short history, machine-readable data bases have become a major bibliographical and reference tool in the U. S., Canada, Europe, and some other parts of the world. To illustrate the phenomenal growth of machine-readable data bases in the U. S., the experience of Lockheed Information System, a large commercial on-line data base service center, is used. The table below shows that, beginning with only one data base and 200,000 records in 1965, Lockheed now has nearly 30 data bases containing a total of 8 million records. Using an index of 100 for 1970, in 1975 the search volume had grown to 15,000 and the cost had dropped to 20.

TABLE 1

THE GROWTH OF LOCKHEED'S "DIALOG"[3]

Year	Number of data bases	Size of data bases	Rate of increase in searches	Rate of decrease in cost
1965	1	200,000	—	—
1970	—	—	100	100
1973	11	2,100,000	2,000	40
1975	30	8,000,000	15,000	20

The impact of the phenomenal growth of machine-readable data bases has resulted in the following: (1) more on-line

terminals established at an increasing number of locations to facilitate remote access: (2) more effective communication techniques: (3) improved standardization and cooperation among data base producers; (4) expanded bibliographical services; (5) increased demand for document delivery service, interlibrary loan, and photocopying service; and (6) greater needs for resources sharing and networking among information systems.

Before leaving the discussion of data bases, mention must be made of a particularly important one, the Machine-Readable Cataloging (MARC) created by the Library of Congress. The MARC format, designed to represent bibliographical data in machine-readable form, has since been adopted as the national and international standard. The MARC data base has been used widely in the U. S. as a cataloging and bibliographical tool, as a source for interlibrary loan, acquisitions, and circulation, and for as many as a score of other applications. An increasing number of countries, including a few of the developing ones, are now producing their national bibliographies in MARC format. Many countries are also exchanging MARC tapes.

Because of the high costs involved in creating and maintaining machine-readable data bases, it is considered impracticable for most developing countries (and even some small, developed ones) to undertake such projects, except for producing their national bibliographies and periodical indexes in machine-readable forms. They should, instead, make use of the large data bases in developed countries, either off-line or through on-line terminals.

In recent years, UNESCO and some developed countries have conducted a number of experiments or pilot projects to test the usefulness of providing SDI service to researchers in selected developing countries. The results are generally favorable.[4] However, because of the high telecommunication costs and use charges, the volume of searches to be made by developing countries may remain low unless there is a special reduced rate for users from the developing countries.

The Development of Computerized Library Networks

Another important phenomenon of recent times which facilitates the sharing of resources is the development of computerized library networks, through which machine-readable data bases become a viable information resource accessible to a large number of users, both near and far.

According to the recent report by Susan K. Martin, there are twenty-five large library networks in the U. S., all relying on computers for resource sharing. If one adds the many other non-computerized library networks, there is hardly any library which does not belong to a library network. Some, in fact, belong to several networks for different purposes. Because of the proliferation of library networks, a Council of Computerized Library Networks was founded in 1973 to discuss the need for communication among networks.[5]

Of the twenty-five computerized library networks, the most successful and best known is the Ohio College Library Center (OCLC). As the name implies, OCLC was first incorporated (in 1965) as a network for academic libraries in Ohio. It became on-line in 1971. Two years later, its membership was enlarged to include out-of-state libraries. Today it has over eight hundred libraries and fifteen hundred on-line terminals, representing almost every type and size of library in forty-two states.[6] The main operation of OCLC at present is the on-line shared cataloging and processing system. Other operations currently under development by OCLC are a serials check-in subsystem, an interlibrary loan subsystem, a circulation subsystem, and an acquisitions subsystem. In cooperation with the Council on Library Resources and the Library of Congress, 200,000 serial records will soon be made available through OCLC by the Conversion of Serials Project (CONSER).

While OCLC has scored an initial success in the U. S., the

development of computerized library networks in other countries, particularly the developed ones, has also made good progress. Besides the many local and national library and information networks already in existence in many countries, a number of multinational information networks have been established. Two well-known ones are ARPANET and ESRO/SDS. The former is a computer-communication system developed cooperatively by more than two dozen research and development organizations under the sponsorship of the U. S. Advanced Research Projects Agency. At present, it embraces sixty-five digital computers in forty-five locations in the U. S., and extends to Norway and London.[7] The latter, the Space Documentation Service of the European Space Agency, is a star-shaped network with its central computer facility at Frascati, Italy, connected by private leased lines to terminals located throughout most of western Europe, including Spain and Scandinavia. The network is currently operating at a level of 25,000 searches per year of some twelve data bases containing around 5 million bibliographical records.[8]

Another large network, EURONET, created by the nine western countries of the European Economic Community, is in the active planning stage and should become operational in 1978. This network is being planned according to a very broad concept, concerned not merely with the provision of a modern communication network, but also with a true sharing and coordination of information resources among the member countries.[9] When established, it will have switching nodes in Frankfurt, London, Paris, and Rome, and concentrators in Amsterdam, Brussels, Copenhagen, and Dublin.

For developing countries (and some small but developed ones), although local and national library and information networks have been developed largely without computers and sophisticated telecommunication systems, there is an increasing possibility that they may be connected to international networks through a designated national node in each of their countries. A recent example of this is Morocco, which has been connected to ESRO/SDS by a leased-line terminal.[10]

The so-called "network parasitology" concept employed successfully by Finland is another good example applicable to developing countries. Since 1971, the Helsinki University of Technology Library has been able to provide SDI and retrospective searches by using the computers and data bases located at the Royal Institute of Technology Library, the Biomedical Documentation Centre in Stockholm, and the Technological University of Denmark in Copenhagen. Each of the 120 SDI clients who pays about $100 for the annual subscription will receive approximately 100 SDI printouts during the year. By using telephone connections through the Tymnet link in Brussels to Palo Alto, California, the Helsinki Library can also perform on-line retrospective searches for its clients at an average cost of $30-40 per search.[11]

Other instances of networking in developing countries that are worth mentioning are the Telex networks established in several Latin American countries. The best known one is the Argentine Telex Network for Scientific and Technical Information, which was initiated in 1971 under the U. S. -Argentina Science Cooperation Program. The Telex network connects the principal libraries and documentation centers in Argentina. In addition, the network center in Buenos Aires is linked to a number of cooperating libraries in the U. S. and some other countries, with the purpose of improving access to and delivery of technical information resources within Argentina as well as from the U. S., and, eventually, from other countries in Latin America and Europe.[12]

The Establishment of International Information Systems

While the development of both the machine-readable data bases and the computerized networks is in progress, there is another important development being undertaken by several international and intergovernmental organizations to establish mission-oriented information systems on a global basis. The

first of these is the International Nuclear Information System (INIS) established in 1970 by the International Atomic Energy Agency as a cooperative system to handle information related to the peaceful applications of atomic energy.

During the process of planning and designing INIS, several important principles were conceived and agreed upon by its planning team. These principles, which have since been adopted as a model for several other international information systems such as the International Information System for the Agricultural Sciences and Technology (AGRIS) and the International Information System for the Development Science (DEVSIS) are: (1) decentralization of the task of identifying and recording information as it is produced, each participating nation (or region) being responsible for reporting what is produced in its own territory; (2) centralized merging of material reported by the different input centers (national focal points), the task being performed in an international agency through international financing; (3) output products tailored to the needs of advanced institutions with computer facilities, as well as printed (or microfilmed) indexes and abstracts that can be used by institutions without such facilities, and by individual scientists; (4) back-up service of photocopies or microfiches to ensure availability of texts; (5) products available at low cost and all charges payable in local currencies; (6) international management, based on consultation with all participants; (7) engagement of government to ensure official support and the availability and infusion of relevant government publications and reports; and (8) utilization of an internationally accepted standard bibliographical format to permit future interconnection among various international information systems.[13]

The model stipulated above has many important features, some of which are of special benefit to developing countries. First, it makes each participating country responsible for reporting the relevant publications in its territory, thereby preventing duplication of effort and ensuring full coverage. Second, since each participating country is to bear the cost of initial reporting, countries with a larger volume of publication will

pay more, while countries with a smaller volume will pay less. This apportionment of costs favors developing countries and therefore encourages them to participate. Third, the central processing of bibliographical records in an international center supported by international funding is more economical than for each country to attempt to process them locally. By means of central processing, bibliographical information from all participating countries can be quickly merged and made available worldwide. Furthermore, such processing helps to enforce accepted international standards in bibliographical format and reporting, and provides training opportunities for information workers in developing countries.

In promoting the establishment of international mission-oriented information systems and the application of methods, norms, and standards which will maximize the intercompatibility of all systems and facilitate their interconnections, UNESCO has made a significant contribution through its UNISIST programs, whose aims are to coordinate existing trends towards cooperation and to act as a catalyst for the necessary development of a world-wide information network.

Conclusion

It is clear that a new era for resource sharing has arrived. To take advantage of machine-readable data bases and the opportunity for greater resource sharing through computerized networking and international information systems, great care must be given to standardization and system compatibility. The development of information infrastructure in each country is also a necessity for effective resource sharing.

Since knowledge has no boundaries, all countries should try to make the knowledge produced in their territories bibliographically accountable either by manual system or by computer. The imbalance of geographical and language coverage of existing machine-readable data bases should be corrected to include more non-"west" publications.

While the bibliographical accessibility is bound to improve as a direct result of the development in computer-assisted systems and networks, several major impacts on library, documentation and information services in developing countries may also be expected. First is the likely increase in the demand for improved document delivery service. This has, indeed, been felt by libraries in those countries where on-line data bases are used. The second is the growing language problem to be faced by libraries and their patrons because of the expanded language coverage by many data bases. Both translation service and information on available translations will become necessary. The third is the need for training of data base searchers and users. The fourth is the problem concerning the payment in "hard" currencies or in the form of UNESCO coupons. And, finally, even though the costs for international telecommunications and the charges for data base use have declined in recent years, it is still considered very expensive for researchers in developing countries. A reduced rate or some kind of subsidy for users from non-profit organizations in developing countries is highly recommended.

References

1. Donald G. Fink, "The Impact of Technology in Library Science," *Special Libraries* 68, no. 2: 78, (February 1977).
2. Martha E. Williams, "The Impact of Machine-Readable Data Bases on Library and Information Services," *Information Processing & Management* 13, no. 2: 95-96, (1977).
3. Lee G. Burchinal, "Bringing the American Revolution On-line: Information Science and National R & D," *Bulletin of the American Society for Information Science* 2. no. 8: 27, (March 1976).
4. "UNISIST Pilot Projects for the Establishment of SDI Services," *UNISIST Newsletter* 2, no. 4: 2, (1974). "Computer-based Information Services for Science and Technology," *NAS-CONICET (Argentina) Science Cooperation Program: Report of Activities* (Washington, D. C.: National Academy of Sciences, 1976), pp. 36-43; Charles P. Bourne, "Computer-based Reference Services as an Alternative Means to Improve Resources—Poor Local Libraries in Developing Countries," *International Library Review* 9, no. 1: 43-50, (1977).

5. Martin, *Library Networks 1976-77* (White Plains, N. Y.: Knowledge Industry Publications, 1976), p. 41.
6. OCLC Newsletter, no. 106, 4 February 1977, pp. 1, 4.
7. J. C. R. Licklider, "A Network of Computer and Information Systems," *National and International Networks of Libraries, Documentation, and Information Centres*, AGARD Conference Proceedings, no. 158 (Paris: NATO Advisory Group for Aerospace Research and Development, 1975), p. 2. 1.
8. John Page, "International STI Networks: Promises and Problems," *Bulletin of the American Society for Information Science* 2, no. 4: 12, (November 1975).
9. Ibid., p. 13.
10. W. A. Martin, "Maximising the Use of an Information Service in an International Environment," *Advancement in Retrieval Technology as Related to Information Systems*, AGARD Conference Preprint, no. 207 (Paris: NATO Advisory Group for Aerospace Research and Development, 1976), p. 7. 2.
11. Elin Törnudd, "Benefits from Network 'Parasitology,'" *UNESCO Bulletin for Libraries* 30, no. 4: 206-9, (July-August 1976).
12. "The Argentine Telex Network for Scientific and Technical Information," *NAS-CONICET (Argentina) Science Cooperation Program: Report of Activities*, pp. 1-35.
13. John E. Woolston, "International Information Systems: Their Relation to Economic and Social Development," paper presented at the International Symposium on Information Systems: Connection and Compatibility, Varna, Bulgaria, 30 September-3 October 1974 (IAEASM-189/1), pp. 1-2.