SCIENTIFIC AND TECHNICAL INFORMATION: (CHAPTER X IN DRAFT) FOR A PROPOSED NATIONAL PAPER

report no.
rapport n°. 125

Ministry of State
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CHAPTER 10: SCIENTIFIC AND TECHNICAL INFORMATION

I. BACKGROUND

a) Arrangements in Canada for supplying scientific and technical information (STI) to users are complex, with origins in our geographic breadth, in our economic, political and institutional structure and background[1]. Canada is a pluralistic society with two official languages, it has federal, provincial and territorial governments, and a host of needs and corresponding institutional involvements in the supply and use of STI. There is insufficient space allowed here to do justice to the range of STI services and systems[2] found in government, in research councils, in universities and in the private sector. Included are such things as science and special libraries and related document search and delivery services, as well as data banks, referral, consulting and extension services. Accordingly, this chapter will emphasize highlights, with examples, and give pointers to other sources of information.

b) Scope of the topic

It is unprofitable to search in Canada for a generally accepted definition of STI. Instead, institutions adopt pragmatic definitions in line with their roles, capabilities and purposes[3]. When Statistics Canada, the national statistical agency, surveys federal scientific expenditures[4], it identifies scientific information simply as information and knowledge acquired as a result of scientific activities. (For this purpose "science" is understood to include not only the natural sciences (life, physical, environmental, mathematical, and engineering) but also the human, social and economic sciences.) Statistics Canada circumscribes the field in practice by defining it in terms of a list of scientific information units and services[3]. Beyond this essential core the field overlaps to some extent with activities which result in the production of transmissible scientific information: such neighboring activities include not only scientific publishing, but also research, development, data collection, analysis and consulting. Because the STI field is not precisely delineated, significant capability to supply scientific information to others is the focus of this Chapter: this provides a coherent thread in a field which has few clear boundaries.

c) Scale and importance

An indication of the magnitude of Canada's participation in the core of STI activities can be gained from inspection of federal expenditures for scientific information services, as set out by Statistics Canada in conjunction with the Ministry of State for Science and Technology. Sums earmarked for such use by federal departments and agencies in 1977/78 amount to some $100 million out of a total of $1.664 billion budgeted for scientific activities of all kinds. For the most part the identified STI expenditures are elements of larger and broader departmental programs, contributing for example to support of research, training of highly qualified manpower, to regulatory functions (e.g., in environmental quality) resource management and conservation, defense, development of public policy, and to support of business in the efficient production of goods and services. The primary responsibility for providing national STI services and related support rests with the National Research Council (NRC) of Canada[5] in natural sciences and engineering subjects, whilst bibliographic matters of national scope are the particular responsibility of the National Library of Canada[6].

d) The Canadian approach

In specialised sectors such as agriculture or resources the institutions involved purchase, develop and manage the scientific information tools required to support their work. For example, the Canada Department of Agriculture has specialized collections and capabilities in its particular fields of interest[7], so also eg. have the Canada Departments of the Environment[8], of Energy, Mines and Resources[9], Communications[10], and Statistics Canada. Similar remarks could be made about activities in provincial government departments, research councils, universities, industry and private bodies.

e) Some general themes

However, there is more to the matter than institutional responsibility to manage scientific information services which in total are geographically and organizationally scattered across Canada: there are additional interlinked themes discernable which have characterised our national approach to the development of practical mechanisms to collect and deliver STI items needed in Canada. Foremost among such themes are those of interdependency and cooperation, both domestic and external, an overall emphasis on development of practical tools and services rather than a dependence on explicit policies, and a federal support complementing and supplementing the local resources with

national capabilities. Such capabilities may be of broad national interest like those of the NRC and the National Library or lie in very specific fields e.g. the cooperative compilation of a national index to sources of geoscience data and the provision of supporting referral service by the Centre for Geoscience Data, within the Canada Department of Energy, Mines and Resources[11].

II HIGHLIGHTS AND EXAMPLES OF CANADIAN CAPABILITIES

f) Library facilities

Libraries are probably the foundation stone of our scientific information resources. This is hardly surprising because Canada produces only some 3% of the worlds output of STI e.g. in such highly-regarded publications as the Canadian Journals of Research, sponsored by the NRC. For the rest we are in large measure dependent on knowledge published beyond our borders. As a result Canadian organizations are accustomed to drawing on the world wide literature of science through library and related information technology systems and services. The former National Science Library (now merged within the Canada Institute for Scientific and Technical Information (CISTI[12]) of the National Research Council of Canada) has long been credited with having Canada's foremost collection of scientific and technical literature, with resources of more than one million volumes. Its strengths are in the natural sciences and engineering fields and it complements other federal collections of national stature such as those of the Geological Survey of the Canada Department of Energy, Mines and Resources[13] or the National Library[14] in the social sciences and the humanities.

g) Library Tools

A variety of scientific and special libraries[15] and of library schools have grown up over the years in response to institutional needs in Canada. Against this background, funding constraints and joint interests have encouraged the growth of a great degree of cooperation and interdependence in matters such as interlibrary loan services. Such tendencies have been encouraged by national agencies through development of tools and services to render cooperation easier. Thus, the National Research Council, charged with building up a national network of STI services, has through CISTI compiled and maintained a Union List of Scientific and Technical Serials in Canadian Libraries[16], thereby improving service to users and facilitating rationalisation of participating collections. Similar comments apply to the

role and contribution of the National Union Catalogue[17] maintained by the National Library of Canada and perhaps of interest to developing countries as a particular mechanism to encourage the sharing of available books through interlibrary loan procedures.

h) Data Management

It is hardly possible to discuss activities whose prime purpose is to facilitate dissemination of scientific information, without referring to related activities established for other and difference purposes. An example is the Atmospheric Environment Service (of the Canada Department of Fisheries and Environment) which collects and analyses data and disseminates information in connection with such things as weather and ice prediction activities. In this sense many Canadian organizations in government, education and industry collect, edit, analyse, and make data available. The Canadian National Committee for CODATA (Committee on Data for Science and Technology of the International Council of Scientific Unions) serves as a focus for some of these data management activities.

i) Referral services

The extreme diversity of STI sources relevant in certain fields, especially in the environmental and resource sectors, has necessitated establishment of a number of subject- oriented referral services of national stature. These specialized information centres maintain awareness of prime sources, of abstract services and like tools and facilities in a defined knowledge area; public services are provided based on this knowledge of where needed information is located. Examples include services of the Boreal Institute for Northern Studies, University of Alberta, the Water Resources Document Reference Centre (WATDOC), Dept. of Fisheries and Environment and the Canadian Geoscience Data Referral System of the Dept. of Energy, Mines and Resources.

j) Networks

There exist many individual capabilities and involvements in the scientific information field: but there is also a flourishing variety of cooperative efforts. Canada's libraries have traditionally cooperated through mechanisms such as Interlibrary Loan networks in order to provide better service and minimise unnecessary duplication of resources. For example, the Library in Ottawa of the Canada Department of Agriculture is the hub of a network of 26 branch libraries located at points across this country: University libraries in Ontario and Quebec

cooperate extensively through their own network. Other kinds of networks are based on use of other systems and services such as the bibliographic search services of CISTI, of INFORMART, QL Systems or Lockheed, in the commercial sector, or the use of computer/communications networks of the common carriers (eg. DATAROUTE, INFODAT, and DATAPAC).

k) Coordination: national system

In the face of Canada's diversity in approaches and involvements in systems, services and networks, there has been longstanding concern for an appropriate degree of overall coordination. In 1969 the NRC (under the general direction of the National Librarian) was given the task of building up a national STI system in concert with existing information organizations. CISTI, as the responsible operational arm of the NRC, has seen its task as one of being innovative in developing new methods of facilitating the dissemination of STI, of drawing specialized expertise and resources from all parts of Canada into the national system, and as one of providing national STI services to supplement and complement the local services.

III EXTERNAL LINKS

l) Given significant dependence on the knowledge generated outside Canada, particular attention has to be paid to external channels for the purchase or cooperative exchange of STI. Individual institutions pursue these matters in their fields, with some central support in areas such as the standardisation of bibliographic procedures. Thus, the National Library of Canada develops standards and tools like Canadian MARC (machine-readable cataloguing)[17] and magnetic tape distribution service, in order to build up our national bibliographic data base in a form capable of interfacing with the bibliographic systems and services of other countries.

m) Cooperative Systems

If timely retrievals are to be made in Canada in response to Canadian needs, it is necessary to have references or substantive information appropriately packaged, indexed and made accessible through information systems or other routes. In the last few years many systems, some private and some public, have been built in other countries. In a variety of fields, foreign abstracting, indexing and retrieval systems do meet many needs of the Canadian scientific community. However, Canadians have little

influence in the management, control and pricing of foreign-owned commercial systems. It is therefore with particular interest that Canada has watched the development of cooperative international information systems, of which the best example is the International Nuclear Information System (INIS).

n) The INIS system, managed by the International Atomic Energy Agency (IAEA), requires that each participating country report new information generated within its own territory. These reports are then merged into a common data base, and made available to each participating country e.g. on magnetic tape or in a printed form. Thus Canada, by doing what it needs to do in the national interest, i.e. preparing an inventory of its own nuclear information, acquires convenient access to information provided by the other participating nations. Furthermore, Canada as a participant in INIS and as a member of the IAEA, also has a voice in all decisions relating to the development and management of the system.

o) The INIS model is seen as highly encouraging for the future. It permits effective cooperation among countries at many different levels of development. Canada is now considering an invitation to participate in AGRIS (FAO's International System for the Agricultural Sciences and Technology) and has jointed ASFIS (the FAO-IOC Aquatic: Sciences and Fisheries Information System). Both these systems operate essentially on the "territorial" formula pioneered by INIS. Such a formula, with appropriate modifications, also governs national participation in the construction of the statistical data bank of the United Nations.

p) Contributions and exchanges

As a contribution to expedite international flows of scientific information, Canada has made its information handling experience available in a number of ways. Specialized fields such as oceanography, remote sensing and resource assessment have benefited from Canadian experience and expertise. For example, a number of basic data standards now used internationally in these areas were developed by Canada, which has been active in CODATA and COGEODATA (Committee on Storage, Automatic Processing and Retrieval of Geological Data, of the International Union of Geological Sciences). In addition to participation in activities of international and of intergovernmental bodies such as the UNISIST program of UNESCO, Canada has also provided direct assistance to countries requesting it. Contributions have been made through training, through technical and through financial

assistance in development of cooperative or other information delivery systems, as well through exchanges of publications and other items of information. For example, the library of the Canada Department of Agriculture has some 1700 bilateral publication exchange agreements with bodies abroad, and has been designated by The Food and Agriculture Organization of the United Nations, the United States Department of Agriculture and the Instituto Interamericano de Ciencias Agricolas de las OEA (Inter-American Institute of Agricultural Sciences, OAS) as the Canadian depository for their publicationa. At a more general level, Canada supports the goal of Universal Bibliographic Control through National Library participation in the elaboration and use of international machine and bibliographic standards[17]. In addition Canada has bilateral bibliographic exchange agreements with such Countries as Australia, France, U.K., and the U.S.A.

q) Systems development

The need to draw effectively both on world sources of STI, as well as to maintain an effective access to scientific knowledge within Canada, has led where appropriate to innovative developments in systems and services. Thus the Canada Department of the Environment for example developed and built the Canada Water data base operated by the Water Resources Document Reference Centre (WATDOC). CISTI has pioneered in development of bibliographic search and retrieval systems and services appropriate to broad national needs.

r) CAN/OLE

A prime example is the Canadian On-Line Enquiry (CAN/OLE) system[18], now widely used in Canada and well-known internationally. At present over five million citations of eight data bases can be accessed, either in French or English, through some 240 communication terminals across the country. CAN/OLE functions not only as a bibliographic search system but also a location tool and a national directory of subject expertise.

CAN/SDI

s) Another example, the Canadian Selective Dissemination of Information (CAN/SDI)[19] system developed by CISTI, has been of particular interest abroad. With the aid of CISTI expertise, the CAN/SDI system is now operational in nine organizations of seven countries. Technical and educational assistance has been provided to build up national SDI services in Argentina (Consejo Nacional de Investigaciones Cientificas y Tecnicas), India (INSDOC and the

Indian Institute of Technology) and Mexico (Consejo nacional de ciencia y technologia).

t) Technical Information Services

Another CISTI service of international interest is its Technical Information Services (TIS)[20]. This is the industrially-oriented arm of CISTI, serving small and medium manufacturing business by providing scientific and technical information to help solve their manufacturing problems, to improve productivity, to identify opportunities resulting from technological development and to promote the utilization of research results in industry. The service is offered primarily to firms which have limited or no engineering staff or other technical resources.

TECHNONET

u) Other countries have recognized the need to provide technical advisory services to their own small- and medium-size industries, and have seen the TIS as a useful model. Individuals have come to TIS for training, eg from Brazil, Mexico, Philippines, Thailand and Venezuela, and TIS has also provided consultants to help with the planning of similar services in other countries. In 1972 a number of institutions in Southeast Asia got together to plan the development of their capacities in industrial extension work, and requested both the financial support of the International Development Research Centre (IDRC)[21] and the technical advice of TIS. IDRC has committed a total of more than $3 million to this program, over a period of seven years. Eleven institutions have now joined the program, which is known as TECHNONET-Asia, and provide services to industries in nine countries: Bangladesh, Hong Kong, Indonesia, Korea, Malaysia, The Philippines, Singapore, Sri Lanka and Thailand.

IV CONCLUSION

v) The development of cooperative systems like INIS and of services like TECHNONET is welcomed both in our national interest and for their promotion of a broader international cooperation. Mechanisms are needed however to set priorities and coordinate the initiatives that are now appearing for the construction of systems on the INIS model. Many of the proposals originate in the secretariats of international organizations with particular sectoral orientations. There is danger of overlap, and there is danger of incompatibility in design. Canada has welcomed the activities of the UNISIST program of Unesco and of the International Standards Organization (ISO) in their

efforts to harmonize such developments and ensure that systems can be inter-connected. A mechanism is needed however to ensure that the initiatives of all agencies are reviewed in such a way as to enable the broad priorities of member states to find expression. With the present spectrum of international organizations, it would seem that the most logical focus for such a review is in the committee structure of Unesco's General Information Programme.

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Errors or omissions remain, of course, the author's responsibility.

V NOTES AND REFERENCES

1. Statistics Canada has the important role of providing the statistical information required for understanding the Canadian economy and society. One of its publications, the "Canada Handbook" (Statistics Canada, Catalogue No. CS11-203/1977; ISBN 0-660-00870-X) presents an overview of life in Canada, and a summary of recent social, cultural and economic developments.

2. STI dissemination in Canada has been the subject of a number of studies and reports. However, institutional arrangements have changed little in the interim. Further information may be found in the following:

   (i) Science Council of Canada, Special Study No. 8, Scientific and Technical Information in Canada, Queen's Printer, Ottawa, 1969-70. (The Tyas Report)

   (ii) Science Council of Canada, Report No. 6, A Policy for Scientific and Technical Information Dissemination, Queen's Printer, Ottawa, September 1969. (The Katz Report)

   (iii) Organization for Economic Cooperation and Development, Review of National Scientific and Technical Information Policy: Canada, Paris 1971.

3. For example: (i) Scientific and Technical Information (STI) is defined for purposes of their program by the National Research Council of Canada as "all information derived from the endeavours of the natural sciences including health, life, physical, environmental, mathematical and engineering sciences and related technology. It also means information on the status, progress and results of research, development and other scientific and technical activities, and on the application of such results together with any other information of potential use in any scientific or technological activity."

   (ii) Statistics Canada definitions are as follows. In the natural sciences:

   > "The costs attributable to this (i.e. the scientific information) activity are those for the operation of scientific and technical libraries and for the dissemination of information and knowledge by means of scientific and technical journals, books, newsletters, computer tapes, exhibits, films, scientific conferences and symposia."

   In the human sciences the attributable costs are those of:

"all services intended to provide information of potential use in any other scientific activity. They include library, archival, abstraction, translation and specialized information retrieval services; conferences, publications and films for general scientific information."

4. Statistics Canada has since 1959 collected data on the resources devoted to scientific activities by the Federal government. The results of annual surveys are published in reports which display the range and type of information collected. For further definitions and information see the following publications and reports:

   i) Federal Government activities in the natural sciences; Statistics Canada, Catalogue No. 13-202 Annual.

   ii) Federal Government activities in the human sciences; Statistics Canada, Catalogue No. 13-205 Annual.

   iii) Federal Science Programs; Supply and Services Canada 1977 Cat. No. ST21-3M78.

   iv) Federal Science Expenditures 1975/76-1977/78. Ministry of State, Science and Technology. Research and Information Services Report No. 100-3 1977.

5. Short descriptions of the NRC's scientific activities and those of other federal departments and agencies can be found in item (iv) under reference (4) above. The National Research Council of Canada is a major science-based federal agency which manages a Scientific and Technical Information Program, as well as an Engineering and Natural Sciences Research Program.

6. The National Library of Canada operates under the aegis of the National Library Act, which empowers the National Librarian to administer the collections of the National Library, to administer a national repository of books published in Canada, to co-ordinate library services within the federal sector and also to act as a national focal point for domestic and international co-operation in matters of library services.

7. The Canada Department of Agriculture has a Departmental Library in Ottawa and a network of 24 Branch Libraries scattered across Canada. The main resource, of national stature, is the book collection of some 400,00 volumes. The Department has non-bilbiographic collections of national stature also e.g. the Canadian National Collection of Insects and the National Mycological Herbarium.

8. See item (iv) under reference 4 for further information.

9. See "Activities of the Science and Technology Sector 1975-76, Canada Dept. Energy, Mines and Resources, ISSN 0383-3399, 214 p."

10. See item (iv) under reference 4.

11. Further details in:

    (i) Brisbin, W.C., and Ediger, N.M. Editors, 1967, A national system for storage and retrieval of geological data in Canada: Nat. Adv. Comm. on Research in the Geological Sciences (available from Geological Survey of Canada), 175 p.

    (ii) Burk, C.F., Jr. 1973, Evolution of the Canadian System for Geoscience Data, 1964-73: Proc. First Conference on Information Science in Canada, Montebello, Québec, Cdn. Ass. Info. Sci., p. 138-147.

    (iii) Longe, R.V., Chairman, in press, Computer-based files on mineral deposits: Guidelines and recommended standards for data content: Canada Centre for Geoscience Data, Dept. Energy, Mines and Resources.

12. The role and activities of the Canada Institute for Scientific and Technical Information (CISTI) are summarized in the recent "Report; October 1976-March 31 1977" (NRC Publication No. 16016)

13. See reference 9 above

14. By mutual agreement the National Research Council (through CISTI) collects published STI in natural sciences and engineering fields: the National Library collects primarily in fields of humanities and social sciences. Other federal agencies collect the publications required to support their own particular activities.

15. Further indications of the range of library resources in Canada is to be found in:

    i) Williams, E.E., Resources of Canadian University Libraries for Research in the Humanities and Social Sciences, National Conference of Canadian Universities and Colleges, Ottawa, 1962.

ii) Simon, Beatrice V., Library Support of Medical Research in Canada, Association of Canadian Medical Colleges, Ottawa, 1964.

iii) Bonn, George S., Science-Technology Literature Resources in Canada, Report of a survey for Associate Committee on Scientific Information, National Research Council, Ottawa, 1966.

16. More detail is given in the CISTI Report cited above in reference 12.

17. AnnualReport of the National Librarian 1975/76 (Supply and Services Canada 1976 Cat. No. SNI-1976)

18. See reference 12 and:

(i) CAN/OLE: a technical description J. Heilik Proceedings of 4th Canadian Conference on Information Science held May 11th to 14th 1976, London, Ontario. Page 47.

(ii) CAN/OLE: Point de rencontre entre l'utilisateurs et le système: Ibid. Page 41

These papers describe both the system and its related training and liaison arrangements.

19. See reference 12.

20. See reference 12

21. The Information Sciences Division of the IDRC provides information on development through co-operation with United Nations agencies to establish worldwide information services with developing countries, improvement of industrial extension services, the creation of centres supplying specialized information on subjects of interest to developing nations (e.g., tropical crops), building of information services on family health and family planning, library services, and map-making from satellite images. To date the centre has made grants of over $3 million for information centres and systems.