NATIONAL GOALS FOR THE EDUCATION AND TRAINING OF
PERSONNEL FOR A NATIONAL SYSTEM FOR SCIENTIFIC AND
TECHNOLOGICAL INFORMATION (OBJECTIFS NATIONAUX
DE LA FORMATION DE PERSONNEL EN VUE D'UN SYSTEME
NATIONAL D'INFORMATION SCIENTIFIQUE ET TECHNIQUE)

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ABSTRACT

Effective utilization of scientific and technological
resources for the achievement of national objectives
is highly dependent upon a nation's ability to develop
an effective system for the acquisition, storage,
retrieval and dissemination of scientific, techno-
logical and socio-economic information. The success-
ful planning and implementation of a Canadian national
system for scientific and technological information
will be highly dependent upon the available human
resources. Manpower requirements will include those
for individuals possessing a wide variety of educational
backgrounds and experience. A concerted effort on the
part of all Canadian schools of library and information
science to provide interdisciplinary programs for the
education and training of STI specialists will be
required. Educators in these schools should also be
prepared to accept the challenge of contributing sig-
nificantly to the design and development of programs
of instruction for STI users, and to the provision of
programs of continuing education for practising STI
specialists, and to the development of reliable methods
for assessing the effectiveness of such programs.
(L'exploitation efficace des ressources scientifiques
et technologiques en vue de la réalisation d'objectifs
nationaux dépend beaucoup de l'aptitude d'une nation
à élaborer un système efficace d'acquisition, de
stockage, de recherche et de diffusion de l'information
scientifique, technologique et socio-économique. La
planification et la mise en oeuvre réussies d'un système
national canadien de documentation scientifique et
technologique dépendra largement des ressources humaines
disponibles. Il faudra un personnel compétent, y com-
pris des individus possédant une formation et de
l'expérience dans beaucoup de domaines différents. Il
faudra également un effort concerté de la part de toutes
les écoles canadiennes de bibliothéconomie et des
sciences de l'information en vue d'offrir des programmes

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interdisciplinaires pour la formation des spécia-
listes de l'IST. Les éducateurs de ces institu-
tions devraient aussi être prêts à jouer un rôle
important dans la conception et la mise au point
des programmes d'instruction destinés aux usagers
de l'IST et dans la préparation des programmes de
formation professionnelle continue destinés aux
spécialistes actifs de l'IST, ainsi que dans
l'élaboration de méthodes sûres servant à évaluer
l'efficacité de tels programmes.)

The awareness on the part of both highly developed and developing
countries of the importance of scientific and technological research and
development for sustained economic growth has led these nations to adopt
policies designed to promote the effective utilization of their scien-
tific and technological resources. The beneficial effects of science
and technology in improving the quality of life have been well demon-
strated, as well as the serious undesirable consequences which ensue
when industrialized countries fail to exercise prudence in the use of
technology. National policy makers have come to recognize their
increasing dependence upon the ability of experts to forecast not only
the technological consequences but also the social consequences of the
successful exploitation of technological innovations. The formulation
of national policy in many areas is thus highly dependent upon the
availability of relevant and timely scientific, technological and socio-
economic information obtained from both national and international
sources.

Users of scientific and technological information include not
only scientists and engineers but also policy makers, planners and
managers both in government and industry, as well as the general public.
The primary goals of national STI systems are the effective utilization
of accumulated knowledge in science, technology and related fields in
order to achieve national objectives for the benefit of society; the
promotion of the development of science and technology and the production
of new knowledge; the provision of adequate information for management
and policy makers in both the public and private sectors; and the focus-
sing of the attention of all interested individuals and organizations
on problems relating to the availability and use of information. Although
much of the information required may be national in origin, it is
obviously in the self-interest of every nation to gain access to the
world's output of basic scientific knowledge and that portion of techno-
logical information which is applicable to the national R & D effort.

The acquisition, organization, storage, retrieval, and dissemi-
nation of the total world output of scientific and technological infor-
mation is an undertaking too vast in scope for any one institution,
agency or even any one nation to undertake. Provision for access to a

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substantial portion of this information on a national scale requires the cooperation of many institutions, agencies, libraries and information centres scattered throughout the country. Arrangements for providing access to additional information can be made possible through various types of international exchanges both formal and informal.

The successful planning and implementation of a comprehensive national system for scientific and technological information in Canada will be highly dependent upon the human resources which can be effectively directed towards contributing in a significant way to the realization of that goal. Manpower requirements will include those for individuals skilled in library and information systems analysis and design; individuals possessing a thorough understanding of the design, operation and effective utilization of various types of systems for the storage and retrieval of information in and about the fields of science and technology; information specialists possessing a high level of familiarity with the use of conventional primary, secondary and tertiary sources as important access tools to specific types of information; subject specialists possessing a substantial background of knowledge in specific subject areas of science and technology; information technologists skilled in the use of specialized equipment for information processing, for the storage of documents in microform, and for their reproduction using a wide variety of reprographic techniques; as well as specialists in management sciences who will hopefully have had some opportunity to acquire, in a formal educational setting, an understanding of the problems associated with the provision of information services in libraries and information centres, and through the mechanism of a highly developed national system for the dissemination of STI, having as its focal point a national science library or national centre for scientific and technological information. Many of the individuals who will play important roles will have received most, if not all, of their formal education in institutions other than schools of library and information science, while others, although not having completed a formal program of professional education in library or information science, will hopefully have participated to some extent in the education and training programs offered by these professional schools.

Effective user-system interaction requires that the information specialist, whose education and training will be based primarily in the professional schools of library and information science, and whose role will be that of serving as an intermediary between the system and the user, possess a thorough understanding of the organization of information sources within the system, as well as the ability to match these information sources to the true information needs of the user. Effective performance in such a role requires that the information specialist be well informed concerning the various subject areas of the fields of science and technology and their interrelationships; in addition, he must be able to interpret the information needs of the individual user, in the context of the scientific or technological community or other organization of which he is a member.

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Optimal utilization of the total information system available to the potential user is largely dependent upon his knowledge of the system, its capability, the effort he must expend in order to gain access to it, and the cost-effectiveness of the system judged in relation to his actual information needs. For many individual users or groups of users, the most effective method of introduction to the system would be through participation in well-designed programs of user education presented by skilled and experienced instructors and scheduled, in respect of time and location, with special regard to the convenience of users. Educators and students in the area of library and information science should give serious consideration to the possibility of their making significant contributions to the design and implementation of such user education and training programs, and to the development of appropriate techniques for the evaluation of their effectiveness.

The essential components of education and training programs for STI specialists, whose basic professional training will be obtained in schools of library and information science are: (1) a study of scientific and technological communities and their information needs; (2) a study of the organization and growth of knowledge and the relationship of science and technology to other areas of knowledge; (3) a study of the sources of scientific and technological information and (4) a study of techniques by which the information needs of scientific and technological communities may be met. A detailed outline of the topics which might be included in such a program has been embodied in a special report prepared by the Secretariat of the Advisory Board on Scientific and Technological Information, and distributed to the schools of library and information science in Canada. Studies relevant to many of the topics suggested might however be more profitably based in departments and schools of universities other than the schools of library and information science and might be made available to interested students in other departments of the university.

Since the efficient operation of an organism as complex in design and function as a national system for scientific and technological information requires the utilization of a wide variety of human resources, it is important that educational programs for personnel who may be involved in the operation contain a significant interdisciplinary component. Precautions should be taken to ensure that the various types of specialists involved have sufficient knowledge to permit them not only to perform their own role in an adequate fashion, but also to possess an understanding of the roles of other personnel, so that they may have a proper appreciation for the contribution of each individual to the proper functioning of the system.

Although many professional schools of library and information science in North America have in the past, provided and still continue to provide excellent education and training programs, containing elements which are not only relevant but indeed essential to the professional

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preparation of individuals planning careers in the field of scientific
and technological information, only rarely has any school attempted to
provide a comprehensive program of studies, especially designed for the
production of STI specialists, that is, those individuals who through
their education, training and experience, possess not only a thorough
familiarity with the literature of the many and varied fields of science
and technology, and the many secondary services which provide biblio-
graphic access to the primary literature, but also a comprehensive knowl-
edge of the principal research and development agencies and institutions,
which not only constitute the largest group of users, but also the largest
group of producers of scientific and technological information.

However, the importance of STI was widely recognized, as is
evidenced by the extensive activity which developed in several areas of
research relevant to STI. The primary objective of much of this research
was the development of more efficient and effective systems for establish-
ing adequate bibliographic control over, and a wider and, at the same time,
a more selective dissemination of, the voluminous output of scientific
and technical literature which accompanied the worldwide expansion of
research and development activities in the field of science and technol-
ogy. Although this research, aimed primarily at improving methods for
the storage and retrieval of information, was accompanied by numerous,
heavily funded and unusually productive and illuminating studies of the
role which the diffusion of scientific and technological information
plays in contributing to the expansion of scientific knowledge, and the
process of technology transfer, probably the main consequence of these
research programs was the production of experts in extremely specialized
areas of scientific and technological information and scientific and
technological communication.

Generally speaking, there has been an absence of broad scale
application of the findings of the majority of these investigations to
the design of economically viable information systems and services to
meet the needs of a wide variety of scientific and technological communi-
ties, in a manner designed to permit the optimal utilization of informa-
tion resources, with the aim of increasing scientific productivity, tech-
nical innovation, economic growth, and thus the attainment of more
general national and international goals. Thus, there is still much
reason to believe that we have not yet reached the necessary level of
knowledge and understanding of the true value of information, that is,
the right information, relevant to human needs; nor have we been able to
formulate policies for ensuring that such information is made available,
in a useful form, to all who need it.

The ever-increasing volume of scientific and technological litera-
ture, as a result of the emergence of new areas of scientific and techno-
logical knowledge, many of a highly interdisciplinary nature, together
with the shifting research interests and new information requirements of
many individuals whose professional and organizational responsibilities

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are becoming more frequently subjected to rapid change, has produced a continuously increasing demand on information-providing facilities, be they industrial libraries or information centres, university libraries, or information service units for individuals employed by governmental agencies at local, provincial and federal levels. The achievement of self-sufficiency of any type of library or information centre in meeting the information needs of its primary clientele is thus becoming virtually impossible. Consequently, there has resulted an increasing need for interlibrary cooperation. In order to make such cooperation economically and functionally feasible, it is necessary to aim at a higher level of coordination of all activities related to library operations and the provision of information services, than that prevailing in the past.

The application of computer-based techniques to many areas of information handling has resulted in an increased need for cooperation in the establishment of standard methods for the creation and use of machine-readable bibliographic records. Resource-sharing among libraries is largely dependent upon the availability of continuously updated access tools, such as national union catalogues, union lists of serials, and directories of information sources, employing standardized formats. In addition, there is an increased requirement to utilize in a more effective manner than in the past, human resources such as scientific and technical personnel possessing a high level of expertise in highly specific subject areas.

Recent years have witnessed an increasing degree of international cooperation in all aspects of the provision of library and information services, with the goal of achieving greater levels of compatibility between the information systems currently being operated under national control or sponsorship, or by national professional societies and commercial organizations.

International organizations such as Unesco, the International Council of Scientific Unions, the International Federation for Documentation, the Organization for Economic Cooperation and Development, and the International Federation of Library Associations, are becoming increasingly effective agencies for promoting the coordination of the development of national information systems and the international exchange of scientific and technological information.

Educators in schools of library and information science have a very serious responsibility to bring to the attention of their students, and to awaken in them an interest in, the many attempts at cooperation and resource-sharing which are beginning to play an extremely important role in the formulation of national information policies and the promotion of international cooperation.

Moreover, professional schools of library and information science should endeavour to provide for their students a realistic assessment of

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their future responsibilities, and to create within them a true sense of professionalism by providing for their students and thus for all future practitioners, an education based upon a firm foundation of knowledge of the science, art and practice of their profession.

It is unlikely that the challenge of meeting the future national and international needs for effective information services will be met except through the continuing efforts of individuals who are willing to commit themselves to a lifetime program of learning. Schools of library and information science can play an important role by providing in cooperation with professional associations such as the Canadian Association for Information Science and the Canadian Library Association, opportunities for continued personal and professional growth through the planning and implementation of readily accessible and well-designed programs of continuing education.

In view of the high level of competence and degree of specialization that will be required of information specialists who will enter the field of scientific and technological information, it seems highly unlikely that the future national manpower requirements will be met, unless the schools of library and information science are willing to incorporate in their curricula, provision for specialized educational programs for future STI specialists. At the same time, the necessity for providing their students with a firm foundation in the fundamentals of librarianship should not be overlooked. The development of adequate programs will require an extensive cooperative effort on the part of all Canadian schools of library and information science, so that economically feasible programs for STI specialists may be made available to interested, qualified students throughout all of Canada. The successful implementation of an effective and efficient national system for scientific and technological information will require well trained, highly motivated and highly qualified information specialists to man the many libraries and information centres scattered throughout Canada, without whose cooperation no truly national system can ever become operational.