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The Future of Scientific, Technical and Industrial
Information to Third World Users - A Donors View
The Experience of the International Development
Research Centre (IDRC), Canada

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ABSTRACT

Access to scientific information by poorer countries, sometimes referred to as the "South", is limited in contrast to the countries in the "North". The South lacks the infrastructure, management and technical expertise to develop and support the range of services now commonplace in the information rich industrial countries of the "North". The programme of support to information systems and services in poorer countries by the International Development Research Centre (IDRC) is described with specific examples drawn from its industry and technology information programme. Third world countries are in a difficult position and need help to keep on the cutting edge of new information-communication technologies. Any help, however must focus on such factors as persistence, impact and sustainability of information systems and services.

The Future of Scientific, Technical and Industrial
Information to Third World Users - A Donor's View.
The Experience of the International Development Research
Centre (IDRC), Canada

by K.P. Broadbent & R. Lafond

**"What is called science today consists of
a haphazard heap of information".**

Leo Tolstoy: (1828-1910).

Decision makers today have to deal with increasing amounts of scientific and technical information. The need to handle and interpret this information has grown more important. Modern information and communication techniques have given us all a valuable, new window of opportunity, but not all of us can expect to participate in the benefits unless some form of equity is introduced so that third world scientists can keep up to date in their respective research fields. The modernization of information-communication techniques is occurring at a rapid pace and unless we can help third world users keep on the cutting edge of these new techniques the technological gap will widen to a lacuna, with little hope of it ever being closed, creating a permanent dependency relationship of the poor "south" on the rich "north". This situation has been well documented by many authors. However, there are several trends which have developed that bear analysis if we are to understand the conditions necessary for balanced development. The principles of "development" require us to continually look out for opportunities to redress the growing technological gap. Therefore, an understanding of current trends is important.

One of the main trends of new technologies especially information technologies is a tendency towards concentration of resources and geographical clustering of information activities whether it be science parks or data banks. The information-communication nature of advanced technology and the need for face-to-face communication, favour location in areas where accessibility to similar information rich environments can stimulate and complement one another. Information centres make up a major part of the R&D infrastructure of a country and aim at transferring research results to users in the industrial, agricultural, commercial and public sectors. It is clear now that the creation of information centres is vital for the expansion of national R&D infrastructure and in industrialized countries such information centres are now considered indispensable components in regional economic development strategies(1). Overall, there is a geographical concentration of information centres in the rich countries. The situation in third world countries is critical. Because they are weakest in planning, management and decision-making, they are rapidly becoming overtaken by events.

First of all, there is the sheer speed of innovation. The Gutenberg Revolution was a major factor in the spread of knowledge because the rate of recording and disseminating information increased after printing was invented. Printing created income, profits increased and, hence, it became more and more attractive to people. We are now in the Second Gutenberg Revolution. In a recent book, "Eyewitness to History", professor John Carey tells of how a correspondent of the Times of London was sent to France to cover the Franco-Prussian War in 1870. After the decisive battle of Sedan, he rushed back to England by train and boat, staying up all night to write up an account of the event. But he arrived in London only to find that a competing newspaper had published an account of the battle two days earlier(2). The Times had blundered into a new era of communication with the arrival of the telegraph, by which information could be transmitted from almost anywhere to almost anyone at any hour of the day or night. "Arguably the advent of mass communication represents the greatest change in human consciousness that has taken place in recorded history", Carey wrote. "The development, within a few short decades, from a situation where most of the inhabitants of the globe would have no day-to-day knowledge of or curiosity about others, to a situation where accurate reports are readily available about just about everything, represents a revolution with incalculable effects." The principle of public access to information became established. Canada is one of the countries in the world where the right to information has been established in legislation.

This right to information mostly applies to information in government hands or the media. The problem with scientific information is that it is not always in the public domain. Another trend we need to consider, therefore, is the increasing privatization of information. Increasing amounts of important research such as is occurring in biotechnology is being done by private enterprises who either charge large sums of money for the results or make it hard to obtain. Another trend we have to consider is the increasing indebtedness of third world countries and the rising costs of information. The result is that many third world scientists simply do not have the foreign exchange to purchase information needed for development.

The IDRC has supported international cooperative information systems, such as AGRIS, from its inception to the present day, largely as a means to combat these trends. One of the ways in which IDRC is unique amongst development agencies is that it has maintained a major programme in the Information Sciences. This programme provides grants for the establishment of information systems designed to help developing countries mutually share scientific information. The mission underlying the programme is:

"to promote the social and economic advancement of developing regions by providing researchers, policy makers and practitioners, in developing countries, access to the scientific, technical and other information they require for application to the problems of

development."

The basic principle is to get people to help themselves. The general strategy is to support improvements in the flow of information from source to use. The basic tactic is to provide the means. Information management is, therefore, a basic element in our programmes.

The project which the Information Sciences Division of IDRC supports attempts to:

- improve systems, services and tools for managing and using information;
- build indigenous capacity; and
- foster cooperation through information sharing.

The programme we support is committed to this mutual sharing of information. "Knowledge", Dr. Johnson (1709-1784) claimed, "is of two kinds. We either know a subject ourselves, or we know where we can find information on it." In this sense, knowledge is power - "Nam et ipsa scientia potestas est", as postulated by Sir Francis Bacon (1561-1626). If left to arbitrary devices, the current information revolution will reinforce power dynamics in the global situation by the polarization of scientific information in the north. The knowledgeless south will then be in a permanent dependency relationship for access to information banks in the north for information for development.

This is why IDRC support for the management of national information systems, coordination between national, regional and international systems has long been an important plank in our platform of support.

In order to provide the necessary conditions for developing countries to participate in the innovations taking place in information-communication, IDRC has been active in promoting what it believes to be those type of projects that will give countries a base or foundation on which to consolidate their national information services and move forward according to their own priorities. In 1989, we adopted a strategy for support for Science and Technology Information and formulated the basis of our support according to twelve critical factors grouped together under three main headings(3).

Responsiveness to Identified Information Needs

The idea of responsiveness is an essential approach taken by IDRC as a whole. We do not approach an institution with a pre-conceived agenda of action, rather with a series of matching conditions designed to enhance local capabilities and do things that they would do if they had the funds.

- Indigenously Determined Priorities

The role of local knowledge in solving local problems is considered to be of basic importance. IDRC, as a whole, stresses a preference for indigenously determined solutions over external approaches to development issues because this is more likely to create the conditions for long-term results and makes research a more effective contributor to development. Projects that are consistent with national development priorities command our attention.

- Development Oriented Goals and Objectives

Working with a set of guidelines that are acceptable, attainable and measurable in the local context is considered to be the best guarantee of success. National conditions define these objectives and determine the level of resources allocated to them to obtain optimum results.

- Relevance to National Needs

Understanding local needs is a basic step in establishing credible national programmes in science and technology and designing information infrastructures to serve those needs. Information will be costly and ineffective if it is not both timely and relevant. Decision-making will be difficult if users are fed a diet of irrelevant information. Effective STI for developing countries, based on a clear understanding of local issues, is essential. Because they cannot afford to carry out extensive searches, well-targeted information services should be the norm.

- Effectiveness of Methods

Once priorities are determined and user needs are known, proper methodologies should be adopted to handle information cost effectively. Projects need to understand their capabilities and the appropriateness of particular methods designed to solve their particular problem. What works in one place may not work in another. This is where IDRC's accumulated knowledge and experience is valuable in assisting developing countries design projects which can deal with an information problem in a manner that ensures that the mutual exchange of information works to the benefit of its clientele.

Strengthening of National Capacities

This is an important element in getting developing countries to help themselves be self-reliant and cooperate with each other. Only by gradually building up local capabilities to deal with development issues can we expect any long-term benefit. This requires an in-depth understanding of the basic constraints at the national level, limitations in both human and technical skills, as well as lack of capital. By concentrating on national capacities we do not ignore important linkages to regional issues which need to be factored in to any national capacity building effort to avoid unnecessary duplication of effort on particular development issues.

- Development and Management of Human Resources

The development of information systems and services in developing countries requires a long period of gestation based on the nurturing of skilled staffs. It is recognition of the need to build a team and allow it time to grow that is a cornerstone of the STI programme. Management skills are also important to keep the team on track with overall goals and objectives.

- Development and Management of Technical Resources

The main principles of management deal with the effective operation of services. Management of information projects involves design, formulation, monitoring and evaluation. Generic management issues relating to financial and physical aspects of the project also need attention. Provision for strengthening each of these factors remains a central part of our project support.

- Sustainability and Long-Term Planning

Establishing an information service in science and technology requires a long period of support. Eventually, donor support will terminate. In order to maintain services, serve users and complete all objectives some perspective planning is called for. IDRC provides start-up costs. Provision of on-going operational costs needs to be built in from an early stage.

- South-South Cooperation

Linkages between countries in the same region or neighbouring regions working on similar problems are encouraged. Dependence on information from within the region discourages reliance on information from outside the region that may not be relevant.

- Network Support

National information systems and services interested in strengthening their capacities in the area of mutual exchange of information need to link with others working on similar problems. Information is a key element in research networks. Network support augments knowledge on external information needs where similar research is being carried out in several countries, optimizes training, resolves such questions as mandates or priorities and increases compatibility for mutual exchange of information.

Impact of Information

Information services are derived from a clear understanding of user needs. Thus, one has to view the problem from the demand side and not the supply side. The principle of effective dissemination of information is based on feedback, user consultation, and self-evaluation. Information systems and services should aim at disseminating research results with a view to long term practical application of outputs, thus contributing to socio-economic change.

- Satisfaction of User Needs

Application of science and technology information systems and services requires that one keeps the ultimate beneficiaries in mind, otherwise one runs the risk of recreating the dependency relationship at the national level - the rural poor dependent upon the urban rich. By giving poorer sections of the economy a share in the information process, not only will it ensure more equity, but it will also create a situation whereby technology works for the poor rather than against them.

- Utilization of Research Results

Our focus is on methods that ensure speedy assimilation of tactical knowledge at the base level. We encourage the principle that those who obtain research results have a responsibility to ensure its dissemination to those who are meant to benefit from it. Where possible we encourage participating methodologies to bring users and beneficiaries into the research process as a means of transferring a sense of ownership of the outputs of research. Projects should have a major part devoted to promotion and marketing of outputs.

- Feedback to Aid Decision-Making

The two-way flow of information is a major factor in aiding decision-making. By fostering the feedback loop, information will have a positive impact on the development process. Involvement of users at all stages ensures that innovations are correctly adopted and refinements can be made.

The goal of providing developing countries with the tools to achieve self-sufficiency in information may be difficult to achieve. We realize that the pace of change in information technologies is difficult to keep up with. Innovation is a moving target and one has to take a "pot shot" and take advantage where one can. IDRC realizes that building information systems and services is a long-term process. One has to recognize that teams have to be put in place and allowed time to develop and adapt. Therefore, we increasingly look at phases of support for projects and a minimum of ten years support is needed to permit a fledgling information service put down its roots and grow.

Under these circumstances we are looking more and more at persistence and sustainability of support to ensure self-reliance as a goal. It is not the quantity of projects we support, rather the quality of our projects that commands our attention. Therefore, we stress management, leadership and training of information staffs. Most developing countries lack exposure to basic needs in these areas and this shows up in poor performance in some areas. Attention to modern management methods, careful monitoring and follow-up has shown success. In 1988, our STI sub-programme ran a course on the generic issues of management and decision-making and have followed this up and continued to build on its outcome(4).

In order to understand the forces of technical change associated with the future of science and technology information in developing countries, one has to deal with different cultural values and alternatives. It is this cultural context which is most important. It is a concept which figures prominently in any analysis of change and changes brought about as a result of the new information techniques must be seen in this light. Therefore, it is important not to treat such change as a "black box" phenomenon - something that exists outside the socio-cultural realm. The introduction of new information technologies in developing countries should be analyzed against the background of the environment in which they must operate on a day-to-day basis. It is the social system in which information technology is merely one dimension. The technology is neutral, but its application is complex.

From IDRC's point of view, we have to consider not only what will work, but what is sustainable in the local environment. The major consideration for information practitioners and others involved in transferring new information technologies is to first understand the cultural, political and social milieux and then the system and services. It is a mistake to believe all one has to do to serve the needs of developing countries to help close the technological gap is to provide donor assistance for each new technology as it appears. New information technologies present themselves as a moving target, so at any given time, one has to opt for a particular technology that suits a given set of needs and priorities, but being careful to put in place all the component parts to sustain the technology. We hear a lot, for instance, of CD-ROM and its impact on the developing country users. But in a recent article in the Ottawa Citizen, Ulla de Stricker of Micromedia Ltd., a Toronto firm involved in CD-ROM distribution also says even Canadian librarians are surprised at the amount of staff time needed to train and assist CD-ROM users and fix and maintain the equipment. This is a cost and constraint that cannot be overlooked.

When we consider application of any new technology, we tend to know a great deal about processes in use, but less about alternatives. Differences between alternatives are critical in application of information technologies. It is a case of "a little learning being a bad thing". There being a basic amount of knowledge less than which cannot reasonably be acted upon. Everything depends on the state of recipient knowledge for any new device. If the recipient knows very little, they can only be expected to produce very little because it is difficult to generate complex detail that is often required to execute the required skill level of my new technology. On the other hand, those that have a lot of innate knowledge will be capable of dealing with complex detail and will be able to react to even a small amount of information. This is why it is difficult to transfer new technology to many developing countries, but not at all difficult for the newly industrialized countries (NICs) of Asia to accept new information - communication technologies.

In spite of the effort by information industries to make new products user friendly, the degrees of skills necessary to accept new information technologies is generally becoming more complex. Five criteria can be identified in the transfer process listed in order of the easiest to the most difficult:

1. Equipment
2. Systems
3. Skills
4. Motivation; and
5. Management

Developing countries which have the weakest infrastructures and lowest skills need to consider this list in the reverse order. That is why we at IDRC stress infrastructure development as a precursor to technical change and improved project management as an important component of our program strategy. Essentially this comes down to recognizing that an information centre needs leadership, team building and appropriate tools acceptable locally to do the job of serving users with the type of information that is area specific. Our program provides the seed money for this to happen and, hopefully, the support in the medium term to help the team grow and sustain itself.

As to future technologies, it is impossible to pin point any one development that is going to revolutionize information dissemination in the course of the next decade. We know, for instance, that within the next few years mechanical disk drives may be replaced by data storing micro chips. Already a new type of chip is being tested that holds much promise - ferro-electric random access memory - which gives a response ten times faster than existing technology. Does this mean CD-ROMs will go the same way as the old 78 r.p.m. records and disk drives will be obsolete too? A hundred years ago new technology was well spaced and took years to perfect. At present, innovations flourishes survives but a few years to be replaced by newer products. The information industry is the most competitive in this respect. The next ten to twenty years will indeed be most interesting. The situation will be, however, critical for developing countries, if they are not to be left out of the development process.

But all technological wizardry aside, it comes down to realities in terms of basic needs. We don't see much change on the horizon. Today the critical issue is document delivery. For most developing countries, access to journals and scientific texts is the major problem. There is no technical development capable of improving this situation, with the possible exception of the Adonis project already described in one of the papers presented at this conference. But, scientific publishers in the agriculture field, which accounts for over 80 per cent of all economic activity in developing countries, have so far shown no interest in collaborating in an Adonis type activity for the benefit of developing countries and additional technical problems remain to be resolved. Whilst in the long term there may be a technical solution,

most developing countries will have to contend with empty library shelves, missing issues of journals and lack of foreign exchange for photocopies.

Our efforts therefore, must persist in solving the economic and political issues of document delivery, so that developing country scientists can have the same access to scientific texts as their counterparts in industrialized countries. This must proceed a technical solution and represents a challenge to information development in the next decade.

The Science and Technology Information Programme of IDRC is just one component of the entire information programme of the Information Sciences Division which encompasses Socio-Economic Information and Information, Tools and Methods. This is an important factor in that countries building an R&D capacity need to consider the total information needs for economic development. In recent years the analyses of long-term growth patterns of structural changes have become key issues in economic research at both national and international levels. It has been demonstrated quite convincingly that the process of technical change not only in a technological sense but also in a managerial-institutional sense, is a major driving force in the complex mechanism of economic growth (or decay) of countries, and the integral role of information dissemination of technical changes is a major component. Therefore, IDRC stresses the total picture so that time and means are provided for third world countries to create the necessary infrastructures to fully participate as equal partners in the world economy.

It is impossible to give examples of all our programmes. This paper, therefore, will focus on one sector highlighted by this conference, namely the industrial sector, specifically that of the small to medium enterprise and its information needs.

For small industries, science and technology information is required to apply technical knowledge to production processes and to the development of new and competitive products and processes. Industrial information is broader in scope than science and technology information since it covers information on marketing, products, labour, training, as well as on management techniques. Industrial information, therefore, calls for a wide variety of information sources and given the relatively weak information infrastructure of countries in the "South", the gap between developed and developing countries in industrial information services is also very wide.

Considering the broad scope and the large number of potential sources of information at the national, regional and international levels, it is difficult for the managers and staff of small and medium industries to familiarize themselves with these sources and obtain the required information. To help them, it becomes necessary to provide access to information through "information brokers" who will help

identify their problems, identify and tap the information sources and repackage this information to suit their needs, and then apply this information to the solution of the problems.

Small and medium industrial development is an important factor in the development process of a country. It results in the creation of employment, improved income generation and contributes to the overall well being of the population. Given the importance of this sector and the need for scientific and technological information of small and medium industries, IDRC's Information Sciences Division established, in 1984, an Industry and Technology Information sub-programme within its Science and Technology Information programme. The objectives of this programme are to bring information to the level of small and medium industries so that this knowledge can be applied to increase their technological capacity, resulting in better quality products, and to increase the ability to use local raw material and local technologies; and also to provide better opportunities for developing countries to become more competitive in a world of rapid technological development and fierce competition in international trade. The programme therefore focuses on direct support to small industries, in the formal and informal sectors, with information services that will assist them in dealing with day-to-day technical problems and with information that will help them improve the level of technology used to manufacture goods.

To ease the problem of developing countries in accessing industrial information, and to encourage innovation and competitiveness of small and medium industries, information services must be developed at two levels:

- a) the development of dynamic industrial information services; and
- b) the development of national information infrastructures including science and technology information systems as well as trade and marketing information services.

At the first level, extension and consultancy services are essential to determine the need for information, encourage the demand for information and services and to tap the world knowledge in order to find a solution to identified problems. The establishment of such services calls for a marketing plan to increase the demand for services and in the long term prove that information is a commodity worth buying and one that can generate profit.

The Industry and Technology Information programme was implemented after over 10 years of experience with Technonet Asia, an information network grouping 16 institutions in 10 countries and aiming at improving the quality and efficiency of production in small and medium industrial enterprises. This general concept was applied in 1984 to the Caribbean region with support for the development of the Caribbean Technological Consultancy Services (CTCS) operated by the Caribbean Development Bank (CDB). The rationale behind the development of the CTCS is that small

industries of the smaller countries of the Caribbean have little access to information and expertise of the region and were often going outside of the region to obtain information or consultancies that were often inappropriate when experts were sometimes available within the Caribbean.

The general objective of this project was to increase the capacity of Caribbean countries to meet their own technological requirements for efficient operation of existing industries and the development of new productive enterprises.

The specific objectives were to:

- establish a network for sharing skills and information on industrial matters between Caribbean countries which could eventually be self-supporting;
- provide industrial information support to national focal points;
- make available to industrial enterprises, at the lowest possible cost, a wide range of key technical advice leading to improved productivity, quality, pricing and marketing; and
- provide practical know-how for local endeavours and opportunities.

Extension engineers of CTCS visit small industries to identify production problems and when the problem cannot be solved by provision of previous documentation or with their own advice, they identify a specialist, private or from an institution of the Caribbean region, to conduct a consultancy in the enterprise. Between January 1985 and April 1989, nearly 900 technical requests were received requiring over 250 field visits by private individuals, consulting firms or institutions. Over 600 requests required written information and provision of documentation. New or novel answers to queries result in a file being created for future uses.

An evaluation of the project conducted in 1989 concluded that it was successful; that services provided responded to a need of the region and were cost effective(5).

In 1989, in Latin America, we supported the "Centro de Innovacion y Desarrollo" (CID) in Uruguay for the development of a Documentation and Information Centre for Small and Medium Industries (CEDOIN) with the Instituto de Investigaciones Socio Economicas y Tecnologicas (INSOTEC) in Ecuador and with an Information Service for Industry with the Asociacion Colombiana Popular de Industriales (ACOPI) in Colombia. Another project is in the course of finalization for an industrial information service in Peru with the Instituto de Investigacion Tecnologica Industrial y de Normas Tecnicas (ITINTEC). In Asia, a similar project was initiated in 1989 by PUPUK, a Non Governmental Organization (NGO), to serve small industries in the rural areas of the Province of West Java, and in Africa our support was provided to SONEPI in Senegal, the Ministry of Industry of Mali and the Ministry of Industry and Commerce of Somalia for similar activities.

All of the above projects establish a pattern of support that will deliver information services to small industries through some form of consultancy or extension services. In most cases, the projects will aim at being closer to the target users of information, and in Ecuador, Colombia, Peru and in Indonesia, the information services are decentralized in sub-regional or provincial offices and form a national industrial information network.

At the second level, science and technology information services must also be developed at the national level in parallel with other information systems in socio-economic information in the framework of a national information policy and more specifically of a science and technology policy so that information produced nationally can be tapped to enrich worldwide knowledge. Given the difficulty of accessing worldwide information and the costs associated with it, an industrial information service must count on good national information and documentation services to be efficient. Among them are patent information services and information services on industrial standards as well as commercial and marketing information services. With patent information, the Organisation Africaine de la Propriété Intellectuelle (OAPI) benefited in 1985 from our support to initiate the development of technological information network in francophone African countries. A similar initiative followed in 1987 at the Economic Commission for Latin America and the Caribbean (ECLAC) for a Patent Information and Documentation Unit (PIDU) to disseminate the technological content of patent documents to industrial enterprises and research institutions of the Caribbean region. A third project is currently under consideration with the African Regional Industrial Property Organization (ARIPO) in Zimbabwe for English Speaking countries of Africa. All of the projects are linked in a broader "project" network and is described in the IDRC Report. In the field of standardization, support was provided to the African Regional Organization for Standardization (ARSO) based in Nairobi to establish an information network in this field for ARSO member states.

A growing concern with the need for sustainable development should also bring environmental considerations into the choices of technology as well as the social impacts into the work and concerns of the industrial information officers. Our programme of assistance in the future must give priority to industrial information services that will also include environmental protection in the selection process of industrial technologies.

Finally, although we consider that information services for small and medium industries will remain essentially the same in the next decade and will continue to develop in the form of consultancy services based on personal contacts, we cannot ignore the development of new information technologies that can ease access to technological information. Therefore, several projects have contained elements of testing and utilization of new technologies. For example, projects with

INSOTEC in Ecuador and ITINTEC in Peru will test electronic communication to transfer information between the national focal point and the regional information units. An information network on food technologies currently being established in Africa with IDRC support by the African Regional Centre for Technology (ARTC) will test a number of communication tools for exchange of information within the network. In this particular case, the project is jointly supported by the Information Tool and Methods (ITM) programme of the Information Sciences Division which is active in the development and testing of new information tools.

The trend towards privatization of information and competition is expected to increase. As a result, access to industrial information will be at a premium and demand for information services are expected to increase. A growing interest in industrial associations, conglomerations and chambers of commerce is expected to grow in developing countries and their role in dissemination of information can be expected to increase.

In the development of this programme, we ensure that our assistance to institutions of developing countries complements the work of others, particularly the work programme of the Industrial and Technological Information Bank (INTIB) of the United Nations Industrial Development Organisation (UNIDO), so that recipient institutions can participate in this global information network and benefit from exchanges of information with other countries.

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