

# International Cooperation in Information Systems and Services

A. Neelameghan and J. Tocatlian

*Division of the General Information Programme, Unesco, Paris 7e, France*

This article considers information exchange as an essential element in international cooperative arrangements. It examines in some detail the information systems of the United Nations and its specialized agencies and their impact on and contribution to international cooperation. The library, archives, and information programs of Unesco are described. The article considers recent trends observed in the establishment of a global information network, under the auspices of the United Nations, in order to facilitate a more equitable distribution of technological information and promote technical cooperation among developing countries. Certain features of Unesco's regional approach to information network development are reviewed and their advantages are described. The impact, both beneficial and disadvantageous, of information technology on international cooperation in the information area is examined. The special problems faced by developing countries wishing to benefit fully from international (cooperative) information systems are discussed as well as some of the strategies adopted in an effort to find solutions to some of these problems. The authors conclude that in the coming years the transfer of information will have to be considered as a whole encompassing the production, recording, processing, distribution and use of information, the economic aspects of related industries, the sociopolitical and socioeconomic characteristics of the countries participating in a given information system, and the contribution of the information communication industry to the economic development of nations.

## Introduction

### *Working Definitions*

For the purposes of this article: The term "information" is used in a generic sense, irrespective of the sources, form of presentation, or transfer medium used. The term "data," when used, denotes numerical and statistical data. The term "information system" is used in a generic sense to denote libraries, documentation and information facilities, data banks, information dissemina-

tion services, information clearinghouses, etc., as well as networks of these components.

### *Information: The Essential Ingredient of International Cooperation*

In a discussion on alternative models of international cooperation, Nobel Laureate Jan Tinbergen noted that "information" and "information exchange" were among the main elements in, respectively, the "objects" category and the "activities" category in such cooperation [1]. Yet, Nobel Laureate Kenneth Arrow remarks [2]: "If one nation or class has the knowledge which enables it to achieve higher productivity, why are not the others acquiring that information? . . . The problem turns on the differential between costs of communication within and between classes (or nations)." In the past three decades, the experience of the United Nations agencies, and Unesco in particular, in facilitating the development of national information infrastructures and of international mechanisms designed to enhance the capacity of Member States (and especially the developing countries) to handle, transfer, exchange, access, and effectively utilize information in development-related activities bear out these views on the real-world situation—the need to use information effectively and to solve the problem of providing the users with the appropriate information at the right time in a convenient form.

## The United Nations Framework

### *Common Goal and General Framework*

After the Second World War, the United Nations System, composed of countries cooperating voluntarily to attain a common goal—peace and economic and social order within and among all nations—provided an appropriate framework within which a cooperative information network open to all nations could be initiated as well as a forum where the concept of such a network could be discussed. Indeed, it became increasingly apparent that

such a mechanism for the exchange of ideas and the sharing of experience was essential to the attainment of the common goal. In general, the information systems and services developed by most of the UN specialized agencies are of two interrelated types: (a) systems intended to provide decision-makers and program managers in the specialized agencies with the information and data designed to facilitate judicious decisions and effective program management in their respective areas of concern, and (b) systems designed to help Member States obtain information and data in the fields of competence of the specialized agencies. Along with the latter type, any given agency may assist Member States in developing the national and regional infrastructure required for operational information systems.

### Impact of the UN Information Systems

In an analytical study in 1980-1981 of the impact of some 200 UN information systems listed in a comprehensive United Nations directory [3], Haas and Ruggie [4] comment that: "The UN distinguishes among libraries, bibliographic systems, referral centres and services, clearing houses, information analysis centres, and data banks, and these represent a continuum, from 'least' to 'most' processing of information" [p. 194]. There has been a rapid increase in the number of systems during the past decade. An increasing number of these systems carry out more data processing activities than they did in the past; deliver information to users, as distinguished from the mere provision of bibliographical references; and "in terms of the supply of information at any rate, the United

Nations has been extremely responsive to the particular needs of the developing countries." Table 1 shows the range of subject coverage of the UN information systems.

"To some extent, this development might have taken place in the absence of UN systems, under the auspices of private firms or national governments, for example. But it is doubtful whether any other external means could duplicate the perceived legitimacy of UN systems, and whether many national governments, especially in the developing world, would have generated an interest in information systems in the absence of at least some measure of external stimulus" [4, pp. 196-197].

Thus, according to Haas and Ruggie, information systems can affect the international system by:

- (1) giving decision-makers greater access to information not otherwise available and thereby improving national and international policy,
- (2) compensating the poorer countries of the world for their lack of material bases of power,
- (3) Structuring concepts and retrieval tools, thereby affecting cognitive frameworks within which problems are defined, understood, and acted upon.

### Patterns of Cooperation

It is worth noting that the UN systems have also developed some models of international cooperation in the information field. For example, the International Nuclear Information System (INIS) and the International Information System for the Agricultural Sciences and Tech-

TABLE 1. United Nations information systems: types of facilities and subjects covered.

	Total	Libraries, Bibliographic Services	Referral Services	Clearing- houses	Information Analysis Centers	Data Banks
Applied social sciences <sup>a</sup>	61	23	9	11	5	13
Technology <sup>b</sup>	30	9	1	6	3	11
Biology <sup>c</sup>	25	9	1	3	2	10
Social sciences <sup>d</sup>	22	8	1	1	6	6
Environmental sciences <sup>e</sup>	16	4	6	2	0	4
Agriculture <sup>f</sup>	13	1	2	3	1	6
Multidisciplinary <sup>g</sup>	9	7	1	0	0	1
Physical sciences	8	3	0	0	1	4
Informatics	5	0	1	1	1	2
Humanities	3	2	0	1	0	0
Total	192	66	22	28	19	57

Source: Haas and Ruggie [4].

<sup>a</sup>Management science, industrial relations, social welfare, education, development administration, demography.

<sup>b</sup>Engineering, transport, communications.

<sup>c</sup>Genetics, medicine, public health.

<sup>d</sup>Economics, sociology, political science, anthropology, law.

<sup>e</sup>Physical, chemical, biological pollution and deterioration, meteorology, human settlements.

<sup>f</sup>Agricultural economics, agricultural management, agronomy, commodity trade and forecasts, fisheries, forestry, animal/plant health.

<sup>g</sup>Subjects from more than one of the above.

nology (AGRIS), sponsored by UN/IAEA and UN/FAO, respectively, provide for decentralized input, centralized processing, decentralized access and utilization of information, and a mechanism for the international coordination and monitoring of the system. There have been attempts to use this or similar models in other subject- or mission-oriented cooperative information systems [5,6]. The UN Environment Programme (UNEP) set up INFO-TERRA mainly as a mechanism for referral service, i.e., to direct users to sources of information. The UN Industrial Development Organization (UNIDO) system combines referral, retrospective search, and the provision of some consolidated and repackaged information. The World Weather Watch (WWW) provided by the UN World Meteorological Organization (WMO) is considered as among the most successful and truly global cooperative information networks in the world. Some 20,000 weather data monitoring stations operated by national weather services are coordinated in the Global Observing System. The collected data are processed and analyzed by the Global Data Processing System for real-time applications and stored for use in non-real-time, through the efforts of three centers located in Melbourne, Moscow, and Washington. The data are then distributed worldwide by the Global Telecommunication System (GTS), which also transmits weather observations to the data processing centers. The telecommunication system links the national weather services with one or more of the 29 regional telecommunication hubs and 25 regional centers. Service is free and any national system offering facilities to WWW is entitled to receive the data.

## Unesco

Among the specialized agencies of the UN, the United Nations Educational Scientific and Cultural Organization (Unesco) occupies a unique position in so far as it:

- has specific and sizable programs devoted to information *per se*, ranging from libraries and archives to information and data systems, and covering methods of information and data handling as well as application areas;
- covers a wide range of the knowledge spectrum: education, science and technology, the social sciences, culture, and communication;
- organizes information exchange among peoples of the world in order to promote international understanding in accordance with its charter.

As stated in its Constitution of 1945, Unesco's role is to contribute to peace and security by promoting international understanding through the free exchange of ideas and knowledge and by contributing to the development of means of communication between nations. During the past 35 years or more, Unesco has assisted its Member States (currently numbering 161), and especially the de-

veloping countries [7] in establishing library infrastructures and documentation capabilities.

In the late 1960s, Unesco collaborated with the International Council of Scientific Unions, which was then pursuing a similar objective, in a feasibility study for establishing a global program for the exchange of scientific and technical information. Following up on the recommendations of the feasibility study [8], the UNISIST program was established. The program produced a set of methods, norms, standards, and guidelines designed to help in the creation of compatible information systems and services and their interconnection in order to facilitate information exchange throughout the world. In 1976, the General Information Programme (Programme général d'information or PGI) was established to provide a focus for Unesco's activities in the area of scientific and technological information, documentation, libraries, and archives management. An Intergovernmental Council consisting of representatives of 30 Member States determines the policies and programs of PGI. The UNISIST II Intergovernmental Conference of 1979 [9] recommended the extension of the program to cover information and data for development so as to meet the needs of development planners, policymakers, and administrators at one end of the user spectrum and, at the other, those of people at the grassroots level.

Unesco's activities are essentially designed to enhance the capacity of Member States to handle, transfer, and share information and information resources, and the effective utilization of information and data in development activities. Such information and data may be either generated within the country or flowing in from abroad or else accessed there. Unesco's action involves assisting Member States in formulating national information policies; developing library, archives, and information system infrastructures; training information personnel; and making users increasingly aware of the value of information *per se*. Such assistance may take the form of support for consultant missions; the provision of norms, standards, and guidelines for information handling and systems interconnection; the organization of seminars and conferences; and support for training courses, workshops, and demonstrations of information systems and their use. The PGI/UNISIST program has provided a framework within which Member States and international organizations can collaborate by sharing resources, developing compatible international information systems designed to be linked to a flexible global network for the exchange of information, and taking part in program activities.

During the first phase of the implementation of the program, Unesco's activities concentrated on the formulation of information policies, norms, and standards for information handling and systems interconnection, and on the provision of assistance for the development of infrastructures and information manpower. In its Second Medium-Term Plan, 1984-1989 [10], following upon the

recommendations of expert consultations and the suggestions of Member States, PGI/UNISIST has placed emphasis on (a) users' needs, (b) operational activities, (c) regional cooperation, and (d) the introduction of modern information technology in developing countries. This shift in emphasis will also facilitate the move toward establishing a global cooperative information network.

Through its programs in science and technology, education, and communication, Unesco has promoted and supported the application of "informatics" in Member States. And in many cases such programs involve international cooperation and joint activities. The increasing attention given by Unesco to informatics as a discipline is also worthy of note [11]. The Organization has established an Interim Intergovernmental Council on informatics.

## The Global Information Network

### *The Complexities of Modern Societies*

Beginning in the 15th century with the opening of intercontinental sea routes and the invention of printing, the concept of a "global information system" has gradually evolved and various attempts have been made to establish such a network—the compilation of international bibliographies, the network of peoples created by means of various links, and, lastly, the work of international agencies, especially the UN agencies. Despite these efforts which are still continuing, and the power of the new information technology, there is, in fact, a visible and growing imbalance in the exchange of information and in the ability of the developing countries to use such information and benefit from it. The complexity of modern society which arises in a large measure from its ability to handle information and information sources, and the consequences entailed for Third World countries, have been discussed in another paper [12]. Many of the problems of modern society—arising from its growing complexity, that is, from its multiple interactions and interdependences—have important consequences on developments observed in the information field.

The resolution of the problem is twofold: to create political and administrative structures taking into account the new scale of social demands, and to develop a more comprehensive and coherent policy that diverse people can share. Limits to growth arise from limits to resources. In the long run, the production, gathering, and handling of information may be the only growth industry because the expansion of knowledge and of information is the very type of growth which is based on resources which are not irreplaceable and which does not squander energy. To make the enjoyment of that knowledge possible, our knowledge-recording institutions must be preserved and new ones developed [13] and technology must be applied if the burden of brute toil is to be lifted from men's shoulders and a "human use of human beings" at last intro-

duced. International organizations have important roles to play here, with a view to achieving a balanced flow of information and enabling peoples to share information and information resources and information technologies, and make an optimal use of them.

### *The Buenos Aires Plan of Action*

The Buenos Aires declaration called for a greater South-South dialogue as a step toward a more equitable information flow and the promotion of technical cooperation among developing countries (TCDC). Among the objectives of the Buenos Aires Plan of Action were "...to increase and improve communication among developing countries, leading to a greater awareness of common problems and wider access to available knowledge and experience as well as the creation of new knowledge in tackling problems of development [6,53]." In 1979, UNDP arranged with the Inter-Press Service (IPS), Rome, for a multiregional study of the feasibility of linking up some 60 developing countries via satellite or terrestrially. The IPS report [14] called for "a new flow of a computer-operated South-South network, providing a full horizontal exchange of mutually supportive development information between developing countries." The Communications for Development Foundation (CODEV) in Italy supported a report [15] on the proposed Netwok (DEVNET) for South-South cooperation. Although the IPS service mainly concerns news, the telecommunications setup could also be used for other messaging systems and for the transfer of scientific, technical, and development information among developing countries.

### *The UN Conference on Science and Technology for Development*

In the papers and discussions dealing with the transfer of information issued by the United Nations Conference on Science and Technology for Development (UNCSTD), Vienna, 20-31 August 1979 [16], Member States expressed their need and wish for a mechanism set up under UN auspices to facilitate the global flow of scientific and technological information for development, convenient access to this information, and its effective use. The functions of such a global information network were set out in the Conference's recommendations, some of which are outlined below.

National information systems and networks should aim to ensure access to, and facilitate utilization of, national and international sources of information on science and technology in order to stimulate endogenous development and national capacity for innovation as well as to support the assessment, transfer, and adaptation of technology. This requires *inter alia*:

- (a) the training of specialized manpower;
- (b) the development of infrastructures, including communication facilities, data banks, libraries, docu-



mentation centers, archives, backup literature, hardware, and software;

- (c) the development of the necessary information handling procedures and techniques, tools, methods, norms, and standards;
- (d) the improvement of the stock of primary documents in developing countries taking into account the establishment, when this proves necessary, of central libraries or documentation centers;
- (e) that care should be taken that all countries should have access to the information systems of developed countries permitting searches "online."

Taking into account the urgency of the task, the scientific and technological international information network should be developed sequentially and in an evolutionary fashion so as to meet particularly the needs of the developing countries, ensuring the maximum availability of information such as (i) information required for development of science and technology, (ii) information regarding the national capacity in science and technology, (iii) technological information contained in patent documents, (iv) national programs in science and technology.

Priority should be given to covering scientific, technical, socioeconomic, legal, and other aspects needed for decision-making in the selection and transfer of technology. The existing information systems within the United Nations and other international bodies—set up for the exchange of scientific and technological information and also serving as industrial technology data banks—should form an integral part of the proposed global network. Data from the developed and the developing countries on available technologies, conditions of licensing, identification of suitable experts, and engineering and consultancy services should be widely available so as to promote their effective utilization, thereby strengthening the concept of the global international network.

### *The Implementation of the Global Network: Obstacles and Requirements*

To respond to the resolution of the UN Conference on Science and Technology for Development, the UN Administrative Committee on Co-ordination (ACC) Task Force, at its Third Session in February 1982, established four working groups. Working Group I dealt with the Global Network of Scientific and Technological Information. Working Group I was entrusted with two distinct but related tasks: the early identification and assessment of scientific and technical developments, and the terms of reference of the Global Network of Scientific and Technological Information [17].

In treating the Global Network, Working Group I considered that the practical problems encountered by existing international sectoral information systems established by organizations of the UN system point out a number of obstacles to be overcome. The major obstacle

to establishing the Global Network, particularly acute in developing countries and to be solved mainly at the national level, is the lack of resources which hinders access to both the information available commercially at relatively high costs and to the information provided by international information systems established by organizations of the UN system as well as by other international/regional organizations.

There are various other serious obstacles in developing countries: a lack of adequate national information infrastructure and absence of information flow between decision-makers and the productive sector, a scarcity of specialized manpower and of continuous training, difficulties in accessing primary documents, and the absence of adequate computer facilities and telecommunications.

Furthermore, since the bulk of scientific and technological information originates outside the UN system, Working Group I recognized that efforts by the organizations of the UN can only constitute part of the contribution involved in the setting up of the Global Network. As stated in the Operational Plan for the implementation of the Vienna Programme of Action [18], it should be realized that the establishment of the Global Network is an enormous task that cannot be the subject of a single action but rather must be an evolutionary process taking place over several years during which considerable efforts will have to be made and large financial resources expended by national administrations, regional intergovernmental organizations, and the UN system as well as the international scientific and technological community at large.

On the basis of the above, the main requirements, primarily at the national level, which would lead to an efficient and effective Global Network could be summarized as follows:

- strengthened information systems and services,
- training in information handling procedures,
- use of standards for information handling such as uniform rules for recording and structuring information and references to information, including subject control (terminological) tools,
- adequate computer and telecommunications facilities.

Regarding the efforts of the UN system toward the establishment of the Global Network, the Group noted that most UN agencies had not made any specific budget provisions for their participation in the development of the Network, including some whose 1984-1985 budgets had already been finalized and approved by their governing bodies. Although some on-going activities can be considered as contributing to the establishment of the Network, e.g., those aimed at strengthening existing or creating new information infrastructures in Member States, as well as those of existing international sectoral information networks, the budgetary situation as mentioned does not preclude that many agencies might be able to provide

funds in future budgets for the establishment of the Network. It was noted that contributions toward the establishment of the Global Network had been foreseen by Unesco and UNCTAD (the United Nations Centre for Science and Technology for Development) in their programs and budgets (1981-1983 and 1982-1983, respectively) as well as in their Medium-Term Plans (1984-1989). Nevertheless, these contributions can in no way be considered as sufficient for launching the Global Network. Extrabudgetary resources, as well as the reallocation of funds by agencies, will definitely be required.

### *New Initiatives*

The Global Information Network, however, need not remain a utopian concept. The available and emerging information technologies, the considerable experience already gained by several of the UN specialized agencies in developing and operating international cooperative information systems and programs, and the national and regional information infrastructures already established—all these combined could be instrumental in finding a solution to the problems posed by the planning and implementation of the Global Network.

The development strategy proposed by the Group was to build up the Global Network from the foundations by first placing emphasis on the creation of new infrastructures or on the improvement of existing ones as well as on the development of essential technical tools. Once this was done, work would start simultaneously in all areas required, within the limits of currently available resources. The initial operational goal of this development strategy would be the implementation of the referral function of the network.

The following joint activities have been identified by the Working Group:

*Project 1:* Development of national nodes for the Global Network of Scientific and Technological Information (a pilot project).

*Project 2:* Preparation of a directory of major information services in science and technology.

*Project 3:* Elaboration and application of international standards for information handling in support of the establishment of the Global Network of Scientific and Technological Information.

*Project 4:* Development and use of a generic indexing vocabulary in support of the establishment of the Global Network of Scientific and Technological Information.

*Project 5:* Setting up a general framework for a stepwise design of the Global Network of Scientific and Technological Information.

The long-term development objective of these projects is to achieve a more effective flow of information between information demand-and-supply centers through the establishment of a Global Network in support of the development process in different regions. More specifically, the project aims at promoting and stimulating the dis-

semination of technological information with a view to encouraging the utilization of such information in the development process. Some initiatives have already been taken for the implementation of the projects [19].

### **Regional Approach**

Over the past decade during which UN agencies and particularly Unesco, in association with the United Nations Development Programme (UNDP), assisted in the establishment of national information infrastructures, we have witnessed the emergence of regional groupings of countries for cooperation purposes in the areas of politics, economics, and development. In many cases these countries have considered regional cooperation in the field of information as a necessary basis for the strengthening of their cooperation in all other fields. EURONET of the European Commission, the on-going effort of the Arab League Documentation Centre in the League's Secretariat in Tunis, the fledgling Pan-African Documentation and Information System sponsored by the UN Economic Commission for Africa, similar network development efforts made by the Economic Commission for Latin America (and the Caribbean) (CARISPLAN) and those of the Social and Economic Commission for Asia and the Pacific are good examples of regional groupings of countries with common interests. There are also subregional efforts toward cooperation in the information field, for instance in south and central Asia, the Pacific, the Caribbean area, the southern African region and ASEAN group of countries. Regional and subregional information networks are also emerging in specialized fields such as the marine sciences, microbiology, renewable energy, the chemistry of natural products, etc. Many of these networks, supported by UN agencies, including Unesco, international nongovernmental agencies, for example, the International Council of Scientific Unions, and the International Development Research Centre, have also played important roles in several of these developments.

Unesco's recent activities in the field of regional information network development have their origin in the wishes of Member States strongly expressed at the highest (ministerial) levels. Such is the case of (a) the Regional Network for the Exchange of Information and Experiences in Science and Technology in Asia and the Pacific (ASTINIFO) [20], a followup on the recommendation of the Second Conference of Ministers Responsible for the Application of Science and Technology to Development and Those Responsible for Economic Planning in Asia and the Pacific (CASTASIA II) held in Manila, March 22-30, 1982, and (b) the Regional Network for the Exchange of Information and Experiences in Science and Technology in the Caribbean (CARSTIN).

A regional approach to the development of cooperative information systems appears attractive to the Member States concerned in that it focuses attention on their spe-

specific needs and fits into the framework of other cooperative programs in the social, economic, and cultural fields. The possibility of sharing their resources for the development of national information infrastructures and for the improvement of their capacity to utilize international information systems, services, and programs is also a positive feature of regional cooperation. The planning, implementation, management, and evaluation of regional networks is a cooperative exercise that entails the undertaking of joint ventures by the participating countries of a given region. Whenever problems have to be solved or activities undertaken, an intercountry approach is adopted and the bilateral or, as the case may be, multilateral collaboration taking place is likely to increase substantially the effectiveness of the service offered to users. Similarly, the sharing of resources among countries of the same region results in greater effectiveness, particularly with regard to the training of information personnel, the use of telecommunications, the elaboration and application of norms and standards, and the improvement of access to information sources.

The choice of specific programs and projects to be carried out is made by each of the countries concerned and is based on a flexible approach resting on the principle of reciprocity. While an entire program may be based on the common needs and interests of the participating countries, each of them is free to select its own activities from a list jointly established and periodically updated by the participating nations. Certain countries experiencing particular types of problems to which they have found worthwhile solutions may serve as sources of expertise for other participating countries with similar problems. Thus, continuing innovative ventures are undertaken at the regional level and are encouraged by international assistance; this develops the self-reliance and self-development of the countries involved, in the spirit of the Declaration on Technical Cooperation among Developing Countries (TCDC).

International assistance is also provided to support and supplement national projects, programs, and activities to develop the pooling and the productive use of national, regional, and international resources, e.g., finance, expertise, information processing facilities, information sources, computer hardware and software, and telecommunications.

In this framework, information services suitable for a wide range of user groups or of individuals involved in development-related activities, such as development planners, policy-makers and managers, professionals and paraprofessionals, researchers and technicians, and users at the grassroots level, are to be developed. Bibliographic and nonbibliographic (e.g., numerical and statistical data) information provisions are covered by these services whenever necessary. As far as practicable, information specialists and information users work together in the design, development, and operation of the components of the networks.

The judicious use of modern technology in information handling is an important aspect of network development. Mechanisms for national and regional coordination and management of the network projects are being established as suggested and agreed upon by the participating countries.

Existing regional and subregional specialized information networks are invited to become associated networks in order to minimize duplication of efforts and resources and, to increase the participating countries capability for information handling and transfer.

## The Impact of Information Technology

The impact of information technology—a combination and integration of the technologies of computers, communications, audiovisual media, and especially microelectronics—on information handling (that is on information and data capture, recording, storage, processing, retrieval, and dissemination) is now recognized, even if its economic and social consequences are as yet unclear. Developments in telecommunications have made long distances negligible as far as the transfer of information to any part of the world and even to nonterrestrial stations is concerned, be it by voice, text, graphics, or facsimile.

In the field of library, archives, and information services which is our immediate concern, the effects of technology on international cooperation are perhaps most noticeable in the following areas:

- (1) the creation of databases by means of decentralized (international) inputs,
- (2) access to online information and data services and remote databases by a number of users simultaneously,
- (3) the exchange and procurement of databases for local users and the generation of information services based on these databases,
- (4) downloading of data and information records from different databases in order to merge them with local databases and to create new ones,
- (5) the networking of people (specialists, users) through such mechanisms as computer messaging systems, teleconferencing, electronic mail,
- (6) document delivery, using facsimile transmission,
- (7) cooperative electronic publishing.

In the wake of these developments that provide solutions to some of the problems posed by global information transfer, access to information, and the sharing of information resources, new problems and issues have arisen which could hinder the developing countries from deriving the full benefits which can be expected from the use of the new technology (see the section on "The Problems of Developing Countries").

In the mid-1970s, it was predicted that the emerging technological environment would prove to be a turbulent one, with new developments following one another in rapid succession, and that the management of the changes taking place would prove difficult for information personnel, both individually and as a body.

The impact of technology on society has both negative and positive consequences which may occur either concurrently or separately and which may affect individuals and institutions to varying degrees, thus resulting in their different attitudes toward international cooperation in the information field.

The positive consequences of the use of technology include:

- the extension of sensing ranges through the application of technology,
- an increase in the volume of personalized information exchanges and of communications,
- the enhancement of the capability to communicate, with more frequent interpersonal and intergroup dialogues, conferencing through telecommunications, and media technology applications,
- the possibility for users to wield new technological information tools in order to develop their personal awareness of the various information sources available, make choices more freely and voluntarily, enjoy more widely distributed and more varied social privileges, minimize the difficulties and cost of research by the use of simulation, acquire knowledge and pursue their careers and personal growth according to their own wishes.

On the other hand, the application of information technology may entail the risks of:

- an information overload,
- infringements on the right to privacy,
- the manipulation of means and media in an attempt to control information and influence public opinion,
- a weakening of social cohesion, along with a fragmentation of attitudes and motivations,
- an increase in discrimination resulting in unequal chances being given to people to learn the advanced skills needed to use information technology effectively,
- the collapse of time in computerized information processes—a phenomenon to which man may find it difficult to adapt.

## The Problems of Developing Countries

### The General Situation

Developing countries wishing to benefit fully from international information systems and to take an active

part in such systems encounter specific problems. Some of these problems arise from the national situation. For example, studies have shown that:

(i) Information systems and services are underutilized.

(ii) In building up information infrastructures, emphasis, has been placed mostly on the supply of information services and little importance attached to resource mobilization to meet future demand.

(iii) In several countries, development planners and administrators do not use existing national information services effectively and endeavor to introduce new information services of their own which tends to be counter-productive.

(iv) In many countries, access to home-produced information and data is not satisfactory.

(v) Access to foreign and international information and data is restricted by its high cost, the small proportion of the total world sources of information which is held in each country, the dispersion of information sources among different institutions and the paucity of cooperative arrangements designed to provide access to these sources, and the users' limited ability to read foreign languages.

(vi) The national coordinating mechanism and the policy institutions for information systems and services are inadequate, and consequently information does not receive priority funding.

(vii) Certain international support actions have been beneficial, especially those designed to solve specific information problems or to increase the information capability of particular countries, but the enormous efforts made to develop new systems and services have been of less immediate value.

Barriers to the intercultural and international flow of information are due to a variety of factors:

**Language difficulties:** These arise from the fact that information is produced in a great variety of languages, information specialists tend to use their particular professional jargon and neologisms which are not always understood by the nonprofessionals, and there are many language constraints in man/machine interaction.

**Difficulties arising from the cultural environment:** The applications of information technology, regarding both theory and practice, may be alien to local reality and experience and this may cause misunderstandings and resistance to change (in attitudes, customs, etc.). Also, information providers from the industrialized countries often lack a sufficient knowledge and understanding of the local culture and practices of those to whom they cater.

**Difficulties of a psychological or intellectual nature—the presentation of information:** Too many items of information having to be processed too fast as well as the great variety and complexity of the information to be processed can put a strain on local users or processors of information and result in information overload. Local users may be reluctant or unable to use the information or the infor-



mation services available, which, for example, may not be in keeping with their intellectual level. Or, the nature of the information supplied may be such that it suffers from high rate of obsolescence.

**The "pollution" of information:** The information provided to users may not be in perfect condition. It may either be redundant or contain errors. It may also be produced and disseminated with the intention to mislead (as in the case of propaganda or misinformation). Messages sent may be distorted, either deliberately or because of a faulty or inappropriate communication medium.

**The economics of information systems:** Authorities in developing countries may hesitate before deciding to take part in international information systems in view of the human and financial efforts involved, particularly because of heavy financial burden incurred in the collection, processing, accessing, and publication of information, the costs of running document delivery and translation services, and the investments to be made in information technology.

**Legal and administrative barriers hindering the flow of information across national borders:** Compliance with existing rules and regulations of a legal or administrative nature often restricts the flow of information. These regulations are enacted in order to preserve the confidentiality and secrecy of certain items or certain types of information, maintain copyrights, regulate the downloading of records from databases and transborder exchange of information source materials, as well as to restrict the transfer of information technology including software. (For further reading on the impact of information technology, see [21-26].)

### *Some Necessary Strategies*

The following strategies should be adopted and implemented in order to enhance the capacity of developing countries to use information and information services effectively in development-related activities, and to participate and benefit optimally from regional and international information programs and systems [27]:

(a) A substantial shift in emphasis should take place from increasing the supply to stimulating demand for development-related information.

(b) High-level planners and administrators should be further involved in the provision and use of information and have an increased understanding of the latter's importance for development planning and implementation.

(c) The quantity and quality of trained manpower in the information field should be raised. Special attention should be given to the training of development-oriented information specialists, capable of applying new information technologies in order to attain development objectives.

(d) New approaches to the financing of information services should be found. In technical cooperation proj-

ects, in general, provision should be made to include an information component.

(e) New information policies as well as educational, social, and cultural policies should be formulated, designed to foster a greater awareness in the general user population of the value of information.

(f) More attention should be paid to the marketing of information as a long-term solution to the problem posed by the low use of information services.

(g) Access to and the availability of information and data of special value to development programs and projects should be improved (such as unpublished reports, national statistics, inventories of current research and development projects, profiles of experts, institutions, facilities, and technology), as should the quality of analysis and consolidation of information and that of information digests.

(h) Access to foreign information and databases should be facilitated.

(i) The application of new technology in information processing and transfer should be encouraged by the adoption of practical measures, such as (1) increasing the technological component of professional education by the provision of appropriate equipment; (2) encouraging the use of mechanized information retrieval; (3) testing the suitability of existing equipment for use in developing countries; (4) providing appropriate low-cost software; (5) widening the scope of experimental and demonstration projects, with special emphasis on relatively inexpensive technologies such as microcomputers and computer/microform systems, and on utilizing videotex systems (based on converted TV sets) as they become available in developing countries.

International assistance agencies and the developed countries have important interests and roles to play in implementing these strategies.

### **Concluding Remarks**

Present-day societies are complex, in both the industrialized and the Third World countries, the difference between the two groups being merely the degree of complexity of their respective societies. As the latter have evolved, they have moved away from a traditional economy based on agriculture to an economy based on industry and technology. As a consequence, land, labor, and capital are now no longer the only factors influencing the economy; neither is their possession the source of power. Increasingly, the possession of knowledge—especially technological know-how—and the ability to apply it appear to become the important differentiating factors between economic development and underdevelopment. Another aspect of this complexity is that one cannot deal with one component of the national infrastructure in one sector without affecting, to a greater or lesser degree, the infrastructure in some other sector. Often the factor linking the various components of a given sector or the vari-

ous sectors of the economy is the sum of their information transactions.

It is impracticable to dissociate "information" from the society in which it is generated, processed, and used. Hence, any international cooperative information system will be influenced by, and has to cope with, the different socioeconomic and sociopolitical characteristics of the participating countries.

The socioeconomic level of a nation or its capacity for development appears to be closely linked to its capacity to mobilize and use information effectively in activities related to development—research and development, technology transfer, industrialization, business, management, planning, etc. This presupposes the existence of a minimum infrastructure designed to stimulate the use of information and data. Therefore, the mere availability of reliable information or the existence of good information systems at the international level may not by themselves ensure their adequate and effective use. It is not clear whether the underutilization of information is the result of underdevelopment or vice versa.

The information field is becoming a flourishing industry in several countries and as such is subjected to market forces. It is interesting to note that the products of the industry—information and information flows/services—are in themselves vital to the development of the other sectors of the economy. This being so, the development of these other sectors can be influenced by the manipulation of information and information flow. The issues and regulations relating to transborder data flows center around this characteristic of information. Second, the production and distribution of the components of the information industry—information sources, systems, hardware, software, telecommunications technology, etc.—are also becoming important elements of the economy to be treated as commodities and services for which the providers look for adequate returns on their investments, and the related economics affects the information user community. For example, if we consider the lowering of telecommunications tariffs for data transmission for library purposes, the income from the transactions will be reduced and the industry may not have adequate returns to sustain and develop the telecommunications systems which contribute to the overall economic development of the country.

In the coming years, therefore, information transfer within a country and across national boundaries will in an increasing measure have to be considered as a whole. This will include the production, recording, processing, accessing, and distribution of information; the economics of the industries involved in this chain of information processes; the contribution of the information/communication industry to the overall national economy; and the socioeconomic and sociopolitical environment in which these information transfers and transactions take place.

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