AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY

1. SUBJECT CLASSIFICATION

A. PRIMARY: Science and technology — TA00-0000-0000

B. SECONDARY: General

2. TITLE AND SUBTITLE

Scientific and technical information services for sociceconomic development

3. AUTHOR(S)

Slamecka, Vladimir

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1979	150p.	ARC 029.S631

7. REFERENCE ORGANIZATION NAME AND ADDRESS

ISTI

8. SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*

(Papers prepared for the 1979 UN Conference on Science and Technology for Development) (For Summary, 22p.: PN-AAG-597)

9. ABSTRACT

10. CONTROL NUMBER

PN-AAG-596

11. PRICE OF DOCUMENT

12. DESCRIPTORS

Science and techn logy
Information services
Information dissemination
Networks
Development
Information systems

13. PROJECT NUMBER

14. CONTRACT NUMBER

AID/DSAN-C-0055

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

029
S631

PN-AAG-596

Volume II - Research Paper

SCIENTIFIC AND TECHNICAL INFORMATION SERVICES FOR SOCIOECONOMIC DEVELOPMENT

Edited by

Vladimir Slamecka

April 1979

Prepared for:

Agency for International Development

Contract No. AID/DSAN-C-0055

by:

International Science and Technology Institute, Inc.

Washington, D.C.

PREFACE

The papers in this document were written in preparation for the forthcoming 1979 United Nations Conference on Science and Technology for Development, in anticipation of the importance to be accorded by this conference to scientific and technical information as a tool for socioeconomic development. The first paper, by Tefko Saracevic, surveys the views on scientific and technical information expressed by developing countries and international organizations. The second paper, by Davis B. McCarn, surveys the information resources of the United States, particularly from the viewpoint of their relevance and availability to less developed countries. The last paper, by Vladimir Slamecka, summarizes the dimensions involved in the use of scientific and technical information for advancing socioeconomic development, and it suggests a U.S. position vis-a-vis this important resource.

The papers were prepared as part of a project directed by Vladimir Slamecka under a contract from the Office of Science and Technology of the U.S. Agency for International Development. The project has benefited from the guidance of an advisory committee consisting of Scott Adams, Lee Burchinal, and Glenn Schweitzer, and from frequent consultation with John Fry, Ludwig Rudel, Judy Werdel, and Lee White. Assistance in identifying and acquiring relevant resource materials also was provided to the study team by the International Scientific and Technical Information Project of the National Research Council. It is a pleasure to acknowledge this cooperation with much appreciation. Responsibility for the views expressed in this document is, of course, that of the International Science and Technology Institute, Inc. (ISTI) and the authors.

B.K. Wesley Copeland
President, ISTI

CONTENTS

Page

PREFACE

I. PERCEPTION OF THE NEEDS FOR SCIENTIFIC AND TECHNICAL INFORMATION IN LESS DEVELOPED COUNTRIES (Tefko Saracevic)

1. Introduction. I-1
2. Recognition of the Needs for STI in Development I-3
3. Availability of STI I-15
4. Accessibility of STI. I-32
5. Utilization of STI. I-41
6. Education and Training. I-44
7. Conclusions and Summary I-48
8. References. I-68

II. UNITED STATES INFORMATION RESOURCES AND SERVICES (Davis B. McCarn)

1. Introduction. II-1
2. Primary Scientific and Technological Information Services. II-4
3. Secondary Scientific and Technological Information Services. II-26
4. Tertiary Scientific and Technological Information Services. II-36
5. Selected Bibliography II-44

III. INFORMATION FOR DEVELOPING COUNTRIES: SUGGESTIONS FOR U.S. POSITION (Vladimir Slamecka)

1. Dimensions of the Problem of Information Transfer III-1
2. Propositions and Recommendations. III-4
3. Epilogue. III-8
4. Appendices

A. Factors in the Information Transfer Process III-12
B. STI Transfer Strategies III-15
C. Highlights of U.S. Government Actions III-17
D. Summary of Previous Recommendations III-18

PERCEPTION OF THE NEEDS FOR SCIENTIFIC AND TECHNICAL INFORMATION IN LESS DEVELOPED COUNTRIES

Tefko Saracevic
School of Library Science
Case Western Reserve University
Cleveland, Ohio 44106

1. INTRODUCTION

1.1 Aims, Scope

The purpose of this paper is to survey and analyze the literature emanating from less developed countries (LDCs) and international agencies and dealing with their perception of the needs of LDCs for scientific and technical information (STI) in relation to social and economic development.

An attempt is made to synthesize the perceptions arising from three different vantage points and as formulated by three different constituencies (active in LDCs and/or in international organizations):

1. scientists, engineers, and technologists as the "proper" users of S&T information

2. information specialists, information scientists, librarians, and educators as purveyors of information

3. government officials, politicians, strategists for development and planners as users of decision-aiding information.

Each of these constituencies is found to have somewhat different perspectives and emphases in their perceptions, primarily because of the differing role they play in relation to STI. Also, each shows the effects of different factors that have influenced the formation of their specific concerns:

1. Perception of scientists and engineers emphasizes more of the historical and traditional perspective related to the proven role of STI in the success of science and technology during the past few centuries.

2. Perception of information specialists (librarians, information scientists and other professionals) emphasizes more of the present day, modern approaches to the problems of "information explosion," including building of new information systems and networks based on modern information technology.

3. Perception of policy makers (officials, politicians, etc.) emphasizes more of the strategic aspects of the role of STI in the development of science and technology, which are considered vital to national development, particularly predominant in discussions of the United Nations.

Clearly, it is hard and even dangerous to generalize conclusions for all LDCs because different countries are at different stages of development. These differences (coupled with differences in cultural, political, and social environments and tradition) greatly affect the perception of STI problems and needs. For the purposes of this paper

three levels of development are distinguished: (1) pre-industrial (agricultural), (2) beginning industrialization, and (3) relatively advanced industrialization. Difficulties with this classification arise, however, in many countries where all three levels of development coexist in different regions or sectors. Thus, not all of the conclusions in this paper hold generally; generalizations are at best limited to a class of countries with some similarities in common.

1.2 Organization

This paper is organized into seven sections.

Section 1: Introduction and scope of the paper. The nature and limitations of evidence used.

Section 2: Recognition of the role of STI in the process of development as reflected by the connections made between STI and development; by actions of UN agencies; by the type of international and national STI systems that have been established in LDCs; and by national STI plans and policies.

Section 3: Availability of STI. The kind of STI that is considered important. The difference in STI requirements with the level of development. Problems of selection from the mass of STI literature. Problems of acquisition (i.e. obtaining documents). Awareness of STI resources in the U.S. and economic considerations.

Section 4: Accessibility of STI. Problems of organization, housing and dissemination of STI. Applications of information technology and information networks.

Section 5: Utilization of STI. Extent of use of STI systems. User education and requirements. Promotion and marketing. Evaluation of STI efforts.

Section 6: Education and training of STI professionals, as a major aspect of STI infrastructure. University education. Training and continuing education.

Section 7: Summary of main points and conclusions.

1.3 Evidence: Nature, Extent, Limitations

The synthesis in this paper is based on a survey of a large number of available literature, including: reports of UN agencies; specific reports in preparation for UN Conference on Science and Technology for Development (UNCSTD); plans and reports of various governments, regional organizations, and intergovernmental bodies; reports from various international professional associations and from conference

proceedings; and vernacular journal articles and monographs (including technical reports) by scientists, technologists or information specialists.

In general, the literature on the subject of STI in LDCs is highly uneven. The records are scattered, elusive and fragmented, imitative in nature, and often written from the point of view of information professionals who are concerned with setting their best foot forward. This imposes evident limitations on the synthesis of such literature.

There is a particularly serious problem with factual evidence on the basis of which statements found in the literature were made, in that the lack of valid and reliable facts, data, statistics and similar hard evidence in connection with most of the discussions found in the literature on STI in LDCs is appalling. The opinions and recommendations may quite often indeed be a reflection of reality, but as a rule they are not substantiated. Hundreds of surveys, trip reports and descriptive articles exist on some or other aspect of STI in LDCs; fortunately many are shallow. This is particularly true of numerous reports done by and for UN agencies, where trip reports are substituted for studies.

2. RECOGNITION OF THE NEEDS FOR SCIENTIFIC AND TECHNICAL INFORMATION IN DEVELOPMENT

2.1 On the Establishment of Connection Between Development and Information

The recognition of what array of elements are important in development keeps changing; it is still an evolutionary process. As a result, emphasis on resource allocation keeps changing and broadening. Recognition of importance, of the value of a given element in development, is a prerequisite for support and allocation of resources.

Among the latest elements that have entered this process of recognition is information in general, and scientific and technical information in particular. It is slowly, very slowly beng recognized that the organic process of development involves, in addition to the human, economic, technical and physical factors, information as well. Many reports perceive that if there is any one factor to be isolated as a greatest internal and external obstacle to the beneficial use of STI in development, it is the low level or even lack of recognition of its potential role and value, particularly among decision makers and officials of higher rank in LDCs. Even where there is recognition it is often only in lip service form when measured by the proportion of resources allocated to STI activities. The extent of concern with STI is illustrated by the fact that out of 190 consolidated recommendations for UNCSTD, 38 or 20% pertain to some or other aspect of STI [39].

Although statistics are hard to come by and should be used with caution, it has been found in general that the highly developed countries (such as the U.S.) use some 2-3% of the R&D expenditures for STI

activities. This proportion is considerably smaller in LDCs: in relatively advanced industrialized countries (such as Brazil) it falls to about 1% or less, and in others it gets to be around a few promills [8].

Since the recognition of the importance of information is perceived as fundamental to the resolution of all the other information problems, there were great many efforts devoted to promote such recognition [e.g., UNESCO reports]. The low level of awareness of the importance and value of information is also the subject of concern in preparation for UNCSTD [e.g. 39, 40]. However, many of these efforts do not seem to move beyond rhetoric. From the literature survey, one gains an impression of an almost ritualistic necessity to start a discussion about STI in relation to development with phrases such as:

"Information is a resource in development"
"Information is power"
"There are information rich and information poor countries,..."
"Denial of information and lack of development..."
"STI is a basic requirement for development"
"Information resources play a significant role in decision making..."
"The widening gap in STI between developed and developing countries..."

The problem is that the literature reveals little research, little collection of hard data, little verification of these and similar statements; in a sense these statements are assumptions. The correlation between information and development is intuitive, and it needs evidence. A basic recommendation to be made is to conduct fact finding studies on STI in LDCs, using improved methods of study, developing reliable and comparable indicators; and collecting meaningful statistics and correlations. The first step is to identify what type of information should be collected, so as to establish a direct bearing on the situation and to be able to assess the particular information requirements for a particular developmental situation or level.

2.2 UNESCO Based Efforts and Perceptions

Among the UN agencies, UNESCO has had one of the stronger involvements with STI. An analysis of UNESCO efforts in many ways characterizes the perception about needs of STI in LDCs on the level of UN and other international non-governmental organizations (professional, scientific).

Up until 1977 UNESCO activities in STI were located in two divisions (Division of Scientific and Technical Information in the Science Sector and Division of Documentation, Libraries and Archives in the Communication Sector). The first division evolved a program called UNISIST (a non acronym standing for World Science Information System); the second division, a program called NATIS (National Information Systems). On the basis of a resolution of the 19th General Conference

of UNESCO the two divisions and programs were consolidated in 1977 into a Division of General Information Program. For the period of 1977-1978 there are four objectives [55]:

1. Promoting the formulation of national policies and plans for STI, including social and economic sciences.

2. Promoting the establishment and application of norms and methods suitable for interconnections between STI systems.

3. Contributing to the development of information infrastructures and to the application of modern techniques of data collection, processing, transfer and reproduction.

4. Promoting the training and education of information specialists and information users.

These objectives coincide with some of the main concerns of LDCs.

Over the years UNESCO produced, sponsored or inspired many guidelines, studies, projects, country reports, consultations, recommendations, conferences, workshops, training courses, stipends, etc.; these vary in quality and degree of success. In general UNESCO is credited by LDCs for its work. The major success of UNESCO was the creation of international ideas and trends that are predominant today, and the raising of consciousness about STI worldwide. A large number of countries have been directly affected by these efforts, particularly through UNESCO consultants.

At the same time, only a fraction of the stream of recommendations has been fruitfully transformed into reality; many were unrealistic and were made withut a solid base of evidence. Complaints were voiced in LDCs that there were just too many recommendations from too many agencies, many of them confusing and conflicting. As many UN agencies, in addition to UNESCO, took up dealing with STI, sending missions, consulting, etc., the situation had a number of undesirable effects [e.g. 43, p. 37]:

> "...Time of the already overburdened policy makers is taken up in servicing various missions.
>
> ...There is no complete follow-up action on any one mission.
>
> ...Individual missions pursue their particular interests to the exclusion of the general goal of strengthening scientific and technical capabilities...thus creating confusion in setting national priorities.
>
> ...Governments find it difficult to identify and evaluate the most appropriate recommendations and sources of assistance."

Suggestions are made that the whole system of advising LDCs need to be re-evaluated.

Other criticisms that emanated from LDCs about UNESCO efforts, particularly about UNISIST as its most visible activity in STI, include the following:

> ...A number of information professionals voiced their complaint that the choice for the UNISIST Focal Point[1] in some countries was not appropriate, namely that institutions or ministry departments were chosen which have little to do with STI activities in a practical sense.
>
> ...Skepticism was voiced that UNISIST can provide an appropriate framework for standardization (which is one of the major UNISIST goals), partly because of an inherent lack of power to do so effectively.
>
> ...As to the subject emphasis somme criticism was voiced that UNISIST is aimed at scientific as opposed to technological information, while the latter is much more needed than the former.
>
> ...It was also voiced that UNISIST is not aiming toward discrimination from the large quantity of available STI which is "choking rather than helping;" UNISIST is not coming to grips with the "information explosion."
>
> ...Internal UNESCO conflicts resulted at times in conflicting guidelines, particularly in the area of national planning, which was at times a point of biting remarks.

On an ideological/philosophical plane some critical views of UNISIST and other international efforts were voiced about the relations being supported/created between the developed and developing countries. It was perceived that UNISIST, and most other similar efforts, emphasize links between developed and developing countries rather than promoting developing - developing links, thus reinforcing rather than transforming the dependency relationship. These efforts are being viewed in some circles as having a tendency to avoid promotion of "horizontal cooperation" among developing countries. In more extreme cases a general dissatisfaction is voiced about the dependency for STI on developed countries. Depending on the idelogical orientation this dependency is either resented, or it is considered a form of exploitation or even neo-colonialism. In these views all efforts by developed countries in regard to STI for LDCs cause suspicion. It may be of interest to note that such views were not found in literature by information professionals or scientist/engineers, but only in report quoting officials.

---

[1] By 1978 there were 49 national focal points and 46 national committees for UNISIST.

2.3 International Information Systems: Some Representative Efforts

A large number of UN and other international agencies (particularly ICSU - International Council of Scientific Unions) were also involved in STI activities oriented toward LDCs. Within the aims of this paper, of particular interest are those efforts that resulted in successful operational information systems on an international scale, because their philosophy and design principles were, in a large part, formulated in accordance with perceptions and arguments put forth by LDCs. The direct and growing participation of many LDCs in the operation of these systems is a reflection of their needs, capabilities and of operational feasibilities.

The Directory of UN Information Systems and Services [49] lists in 30 UN agencies some 108 information systems (including libraries) of which about 80 are related to some area of STI. Of course, these information systems and services are for all countries of the world, but to a large extent they are particularly oriented toward the process of development and LDCs.[1] Thus, an analysis of the subjects of their coverage provides a more specific insight on the perception of UN and its members about the particular subjects for which information is needed. In general, there is a heavy orientation in areas of agriculture, environment and ecology, communications, health science and in a number of technologies.

The selection for discussion of three widely accepted information systems, as provided below, is an attempt to analyze, in a representative way, the perceptions about the type of systems that are needed.

1. INIS (International Nuclear Information System) was developed and is being operated, since April 1970, through the International Atomic Energy Agency (IAEA) in Vienna. It is a computer based information retrieval system on the subject of peaceful applications of nuclear energy. The principle of operation is:

a. decentralized input preparation, i.e. an agency in each of the participating countries collects the literature on the subject produced in the country and prepares forms for machine readable input according to mutually agreed standards.

b. centralized processing, i.e. this input is collated in Vienna and computer tapes are prepared, together with Atomindex, (a printed abstracting periodical issued semi-monthly) and microfiche sets of nonconventional literature.

c. decentralized dissemination, i.e. the agency in each of the participating states receives the tapes, and other products, and provides dissemination services as it is capable and as

---

[1] However, many of these systems serve primarily the UN agencies' programs.

are needed e.g. SDI (selective dissemination of information) services.

The philosophy here is that each participating country is an equal partner in the enterprise contributing its own output of literature on the subject (this is sometimes referred to as "territorial formula"). Developed countries, as the U.S., may also find the mode of participation beneficial (for instance, because of participation in INIS the U.S. stopped publishing its own Nuclear Science Abstracts). The philosophy and design principles of INIS are now championed as models for cooperation between LDCs and developed countries in international information systems. This is particularly deemed suitable by LDCs that are at a level of relatively advanced industrialization, as seen from the list of participating countries (some 50 countries contribute to INIS input).

2. AGRIS - International Information System for the Agricultural Sciences and Technologies, operational since Janury 1975, is sponsored by FAO. It is also a decentralized system with FAO acting as the coordinating center responsible for receiving, integrating and processing bibliographic data submitted by national and regional input centers all over the world. Some 87 countries, at all levels of development (including U.S. and other developed countries) are participating. FAO is assisting in the development of AGRIS centers in a number of countries including staff training and start-up support. AGRIS provides computer tapes ad publishes AGRINDEX. An interesting feature of AGRIS design is that it is progressing in levels, roughly corresponding to the perceived needs of the levels of development. The present Level 1 is oriented toward current awareness services. Level 2 is envisioned as a network of specialized centers for given subjects or countries providing customized information to users, up to rural populations.

In some countries where AGRIS centers are becoming operational on a wider scale, specialized information services are being instituted toward rural extension services which have peculiar constraints because of their spread and remoteness. The ideas of (i) levels of system development, (ii) of FAO's active support in establishment of AGRIS centers in LDCs including manpower training and (iii) of services to rural extensions, is striking a particularly responsive cord in LDCs. In many ways AGRIS is actually a creation of LDCs and their perceptions.

A recent evaluation of AGRIS [9] found most illuminating disparities in views about AGRIS in LDCs and in developed countries. The LDCs attitude was summarized as follows:

"(1) We need a single comprehensive data base covering the world's agricultural literature, in conventional and non-conventional form, to replace the multiple data bases now in existence.

(2) We want a participatory program in which we are partners and have equal rights. We do not want to feel completely

dependent on a product fully controlled by one of the developed countries.

(3) AGRIS has been a great stimulus to the development of national and regional capabilities for the control of agricultural literature. It has provided a structure within which funds for development of capabilities (e.g., from UNDP and IDRC) have been made available and it has provided excellent training opportunities in the developing countries.

(4) AGRIS is already better than most other sources in its coverage of the agricultural literature of the developing countries.

(5) It would be a serious setback to the development of national information programs in many countries if AGRIS were not allowed to continue."

On the other hand the attitude of developed countries was:

"(1) We are already well provided for by existing services.

(2) Tropical agriculture, a major concern of many of the developing countries, is not our primary interest.

(3) A data base not accessible on-line is of very limited value.

(4) Too much material of low scientific value is accepted into the data base.

(5) We have very little to gain from participation in the program.

(6) Participation on our part would involve giving but not receiving. It would be a form of foriegn aid.

(7) Departments of agriculture (insofar as these agencies are responsible for AGRIS in various nations) are not foreign aid agencies."

Among other things the study found that: (i) the major achievement of AGRIS, so far, is more in relation to promise than actual performance but that it has a wide support; (ii) the coverage, as yet, is incomplete and the system is not widely known and the products not widely disseminated; (iii) the level of commitment by FAO and other agencies is uneven; (iv) operational standards are not fully adequate; (v) many countries have no resources to participate. The greatest failure of AGRIS coverage is considered to be the inability to secure U.S. input. Namely, U.S. National Agricultural Library (NAL) is in a precarious position: AGRIS standards for input differ from its own, thus NAL has to double up on input to AGRIS (in 1977 only about 20% of its database).

3. UN Industrial Development Organization (UNIDO), through its Industrial Information Section, is a prime force in the world promoting the value and use of industrial information in development. Some 130 countries participate in UNIDO information activities with direct input and/or having contact points.

Activities include: seminars, conferences, training courses, assistance in establishment of various industrial information centers in many countries, and establishment of centrally run information systems. The systems include:

1. INDIS (Industrial Information System) for managerial, economic and technological aspects of industrial development; incorporates Industrial Inquiry Service for specific inquiries - since 1966 some 16,000 inquiries were answered, half of which are equipment and technology related; the majority of inquiries were related to chemical, food, metallurgical and light industries, pulp and paper, statistics and marketing, and addresses of manufacturing firms -- giving an idea of subject of interest [50].

2. INTIB (Industrial and Technological Information Bank), operational since January 1978, provides technological information for decision makers in LDCs to assist in selection of appropriate technology at the planning stage of new investments in industrial development.

INTIB, the newly established information bank, was started on a pilot basis after surveys on industrial information in 13 developing and 12 developed countries. The surveys uncovered needs for specific and assessed (evaluated) information about choices in alternate and appropriate tehnologies. They also uncovered that the voiced needs in different parts of the world cover a much wider range of information than what is usually surmised under "technological information." This is of interest here because it specifically relates to the question of what kind of information is perceived as needed. Here are quotes on the subject from the executive director of UNIDO in the report Establishment of an Industrial and Technological Information Bank [52]:

> "In the case of African countries, for instance, the consultants pointed out that the proposed Bank should lay emphasis on the areas of agriculture, public health and engineering, and that in addition to the collection and storing of information, the Bank should assist its clients to analyze their information needs in order to adequately respond to their specific requirements and development objectives. In the case of Asian cuntries, on the other hand, technological information was meant to cover the processes of industrial planning, technological choice and transfer as well as industrial operations. It was also felt that the proposed Bank could serve as an appropriate mechanism whereby comparative analysis of relevant data and technological information

could be pursued in a systematic manner. In the Latin American countries, the need was stressed for techno-economic information to enhance the bargaining position of recipient countries and in particular, for negotiaions of licensing and patents and emphasis was placed on the need to differentiate the various degrees and stages of development of these countries, bearing in mind their own industrial strategies and technological capacity."

INTIB eventually plans to provide, in addition to publications and question/answer services, also computer tapes, and even assessments of specific situations and on-site advice. INTIB's evolution is planned to be heavily dependent on requests from Member States.

The Bank is a response to the increasing perception for a need for appropriate technology and requests for action in this area. UNIDO believes its services in areas of industrial information and appropriate technology are a direct reflection of perceptions emanating from many LDCs.

2.4 National Information Systems

An examination of the type of STI systems established in LDCs can provide a further insight into the perceptions about the recognition of information problems and subject areas of needs. Academic libraries were first to emerge, parallel with establishment and evolution of universities; they still remain a very basic and most important, albeit also a very neglected source of information. With the advent of other types of STI systems in developed countries, efforts at establishment of similar systems were also undertaken in LDCs. Some of these systems have been in operation for two or more decades, but most of them were established within a decade. Continuous change and evolution is one of the characteristics of these systems; thus the information about factual situations on what exists, under what names, auspices, organizational patterns, subject coverage, processes, services, products, etc. is chronically out of date. This is one of the reasons for numerous country surveys by international organizations, remarked about previously, and one of the reasons for preoccupation in these surveys with interviews on the existence and state of STI systems.

As to the subject coverage, four categories or classes of STI systems can be distinguished in LDCs:

1. National STI systems with general coverage

2. Specific subject oriented information systems in an area of science and technology

3. General industrial/technological information systems

4. Sectoral industrial/technological information systems in an area of an industrial product or service

An additional category may be considered - countries that have no specifically organized systems for STI. Some STI activities (in a given subject or for industry) in some of these countries are carried out through a Ministry or a Chamber of Commerce, but there seem to be no information centers as such. Most of these countries are rather small, or are islands, or are isolated.

1. A large number of LDCs have chosen to establish a national system for scientific and technical information. Examples of these are listed in footnote 1.

The STI activities, products and services, and the depth and breadth of involvement of these national STI systems vary widely from country to country. In general, they are more product than service oriented, i.e. more toward production of bibliographies, catalogs etc. than toward services directly oriented to users (such as question answering).

There are two major general difficulties that emerge from writings about these national systems:

1. Difficulties in defining the scope of their coverage

2. Difficulties in finding a direct relation and a fitting place in the scheme of development in the given countries.

On the positive side these national systems can be a focal point for a lot of national STI activities and promotions. Probably their biggest contribution over the years is the creation and support of information professionals in STI as a vital aspect of information infrastructure. Their national and international activities in promotion of STI is sizable; a country that has a national system has more people involved in such promotion than one that does not have a national system. The role of national STI systems in provision of products and services may not be as great and significant as in promotion of the recognition of STI in general.

Less positively, it is fair to observe that national systems often are political conceptualizations rather than operational realities. However inevitable the governmental decrees and laws specifying their establishment may be, they tend more to represent a series of goals expressive of economic needs to centralize as much of the information resources and manpower available within the country as possible.

2. Subject oriented STI systems are those that are covering a given subject traditionally recognized as a scientific and/or technical area

---

[1] Algiers, Argentina, Bangladesh, Bolivia, Brazil, Chile, China, Costa Rica, Cuba, Egypt, Guinea, India, Indonesia, Iran, Jamaica, Lebanon, Mexico, Morocco, Pakistan, Peru, S. Korea, Senegal, Sudan, Thailand, Togo, Turkey, Uruguay, Venezuela, Zaire

of activities or research. Generally, four broad subjects in which such systems have been established in a number of LDCs:

1. agriculture and related areas

2. health sciences

3. nuclear energy and other energy forms (e.g. petroleum)

4. environmental sciences

These subject systems have a greatly emphasized international orientation, primarily because they have been instituted with assistance of some international agency dealing with that subject. They are also assuming, as are national systems, a missionary role in relation to their clienteles and government administrations in their areas, and are a significant source for education and training of information professionals, including usage of information technology.

It may be of interest here to draw a comparison between subject oriented systems in developed countries and LDCs. In developed countries, as a rule, we will find fewer national systems, but more subject oriented systems and in many more subjects. Every area of science and technology will have one (or more) information systems devoted to it (e.g. chemistry, geology, physics, engineering, biology, metallurgy, etc.). In LDCs there are no counterpart systems in most of these subjects. The subject systems in LDCs are limited more or less to the four subjects mentioned. This may be the biggest difference between developed and developing countries in regard to systems for STI.

3. General industrial information systems have been established in some 30 to 40 LDCs. It is hard to ascertain the exact number because of great variations in organizational patterns of institutions and ministries devoted to industrial development.

The nature of industrial information systems is quite different than the nature of national or subject STI systems reviewed above -- starting from the type of information collected to the type of services provided. The variation in form, organization, services etc. among industrial information systems in LDCs is much greater than the variation among national or subject STI systems. There is no one general pattern for the industrial systems. One often found variation is where such an information system is located with in an industrial development (or research or promotion) institution and it provides information services closely connected with the industrial devlopment services of the parent institution; the most advanced form of this is provision of industrial consulting together with information services. Another variation of such service is to provide answers to planners or industrialists to questions arising in their acivities, often only in terms of referral. Many industrial information systems are also found that are "buried" in some ministry or similar high office.

Here are some problems often voiced in relation to such general industrial information services:

> ...they are attempting as are their parent institutions a broad industrial coverage, but they are ending up supporting only a select number of larger industries
>
> ...they are not effective in technology transfer, particularly not in relation to appropriate technology
>
> ...they provide too much bibliographic and referral information and too little direct and simple answers to questions or information in repackaged (scaled down, synthesized) form
>
> ...their power of assessing the accuracy, value etc. of information is low, including assessment of reliability of industrial contacts.

Although these criticisms are voiced often, there is also a realization that there is relatively little that any industrial information system can do about them. Namely, it seems that the change or expectation of these systems in LDCs is to provide information that in the U.S. will not be obtained only by querying information systems, but much more by doing market research, laboratory testing, industrial research and the like. Industrial information systems of smaller developed countries that do not have the capacity to do market, laboratory and industrial research at a scale of U.S., try to resolve the problem by having experienced engineers do information work, rather than information specialists; they also institute very close personal contact with industrial personnel and face-to-face communication as an information service. A number of LDCs (particularly from Latin America) have voiced the opinion that models and methods of industrial information systems in Denmark, Canada and other smaller countries are much more relevant to their needs than the methods used in the U.S. For instance, the quite successful industrial information centers in Mexico (INFOTEC/CONACYT) and Equador (CENDES) were started and run by engineers -- and became a model for establishment of similar centers in Latin America.

4. Sectoral industrial information systems are devoted only to one class of industrial products or services. Information centers can be found in LDCs related to:

> leather; fisheries, metallurgy; paper and pulp; textiles; food and food technology; machine tools; mining; rice; small enterprises; chemical technology and chemistry; and in a host of other areas.

For instance, the Asian Institute of Technology in Thailand operates international information centers on: (i) geotechnical engineering, (ii) renewable energy, (iii) rural sanitation and (iv) ferrocement [53]; the last one is an interesting case because it was established in 1976 on the recommendation of the U.S. NAS Board on Science and Technology for International Development which identified ferrocement

as an overlooked labor intensive intermediate technology material with wide potential, particularly for rural areas.

The advantages often cited of these sectoral systems include the ability to better analyze the users and better concentrate on the satisfaction of their needs. Although they are being strongly promoted in the literature, there is no evidence that the number of such centers is large (in comparison to the number of other systems discussed above) or that they are being established at a high rate. It seems that the need for such centers is there, but the relatively small number of users and uses prevent larger investments.

2.5 National Plans and Policies for STI

One of the ideas and recommendations that constantly recurs in the literature (particularly in reports to or from international organizations) is about a need to establish national plans and policies for STI activities. Despite this recommendation, few countries have made an effort to draft such a plan or policy.[1] There has been no discussion published on the effect of existing policies on the provision of STI services.

One must realize that policy formulation is a political process and that, as such, it has to do with the formulation of goals and objectives. Efforts to achieve national policy for scientific and technical information should therefore be viewed as efforts to assert the importance of this factor as countries develop their overall goals, objectives and priorities. Indeed, a number of countries have incorporated some or other aspect of STI in their general development plans. At this time, however, there is little participation in this activity by the grassroots professions of information scientists and librarians, or by information users. Another obstacle to derivation and implementation of STI policies is said to be the absence in many LDCs of adequate functional and integrative relationships between planning ministries and operational institutions dealing with STI.

3. AVAILABILITY OF STI

3.1 Overview

In order to be utilized, information has to be first available and second accessible. This section deals with the perceptions in LDCs about the needs and problems related to availability; the next section deals with accessibility. This breakdown into availability - accessibility - utilization parallels the main functions of information

---

[1] National information policy has been formulated by Bolivia, Brazil, Ghana, India, Indonesia, Mexico, Nigeria, Taiwan, Venezuela

systems, including libraries. It is important to divide the discussion in this way in order to be able to understand the nature of classes of different problems that require solutions of their own.

Availability is defined here as involving and depending on three factors:

1. Definition of information that is desired and needed as to subject, type, level, language and other characteristics. In a practical sense this should result in criteria for selection from the mass of existing literature, criteria that are needed as the base for input; it may also result in criteria for creation of some specific literature or of repackaging of information.

2. Selection of information and/or literature from all that is available. These are the decisions on which specific items, how many items are to be included in a given information system (or in a locality, country, region etc.) in accordance with (i) criteria and (ii) available resources.

3. Acquisition of information and/or literature that has been selected for inclusion, meaning obtaining physical possession of documents and other items where information is recorded.

3.2 Definition of Needed Information

3.2.1 On the Rationale for Definition

What information is needed in relation to development? It is, of course, a key question, because the answer will determine the contents of files and services of information systems. The rationale for the answers found in the literature from LDCs is generally one of experience, common sense and opinion. These are effected by aspirations and concepts of what are the developmental goals and what is development all about. These are also affected by the currency of international drives (for instance, at present the topic of appropriate technology is very much on the agenda, which spurred discussions of appropriate information).

Opinions on the subject, type and other characteristics of information needed were voiced very frequently, over a long period of time and by all the constituencies involved in STI. It is the most often discussed topic in the literature. Many items in the literature had thoughtful and thorough discussions coupled with presentation of some data for the support of conclusions. But it also should be mentioned that many opinions were voiced (particularly as reported in surveys by international consultants) by people who according to their titles have no direct connection with either information processing or use in the subject commented about, and without evidence for their conclusions. At times one gets an impression from looking at the literature that everybody is an expert on this topic.

Another striking aspect that emerges from surveying the literature is the paucity, nay absence, of studies (in the scientific sense of the work "study") on the information behavior and needs, and other characteristics of potential information users studies which were aimed at definition of needed information and/or literature; or studies on the subjects, characteristics and behavior of literature itself that may help such definitions. Thus there is a dire need for conduct of scientifically based studies that will help define information needs in given developing countries.

One other thing should be underscored. There is little direct connection between the many discussions on the definition of information needs and a follow up in terms of actual implementations in the form of information systems and services for these needs. Rather, the discussions are aimed at creation of a concensus to be used for action.

3.2.2 Categorization of STI

It was widely recognized in the literature that there are a number of different categories of STI and that each of the categories has a different utility in the process of development.

Many perceptions on the division of STI in certain categories according to development needs have been brought forth. Here are some of the more typical and reoccurring breakdown of categories:

1. In terms of levels of information needed for LDCs a distinction was made between:

   - Policy and management information, enabling decision on choices of alternate strategies and an increase in negotiation capabilities

   - Scientific and technical enabling learning and technical decisions

   - Operational information enabling production and services

2. In terms of necessary knowledge a similar distinction as above was made between:

   - Know-why information (more scientifically oriented, generally readily found in the literature and easily transferable);

   - Know-how information (more technically oriented, not so readily found in the literature, and harder to transfer);

   - Show-how information (operational training, maintenance etc., not found in the literature, needs creation, repackaging, hardest to transfer)

3. As to STI resources an often made distinction is between:

   - Formal information resources: the open literature including report literature and the infrastructure associated with it: libraries, abstracting and indexing services, data bases etc.

   - Informal information resources: personal contacts, consultancies, "invisible colleges," meetings, training sessions etc.

   - Specialized and negotiable information resources: patents; licences; data on industrial processes and products; operational information; marketing surveys; statistical information; and other information not readily available in formal resources. Great stress is often made on the importance of this type of information for development purposes.

4. Distinction is sometimes made between information for different levels of users, such as STI information for:

   - scientists, engineers

   - business managers, industrialists

   - administrators, policy makers

   - extension workers

   - semi-educated persons

   - illiterates

These various categorizations are overlapping but not necessarily contradictory, and they illustrate different concerns and conceptualizations. In order to recount some of the more common themes that are evident from the mass of literature on this topic, and particularly from reports in preparation for UNCSTD, we shall discuss next the perception of information needs in three areas: (1) scientific information, (2) industrial and technological information, and (3) policy and decision making information.

3.2.3 Scientific Information

When it comes to discussions of STI in LDCs the "S" is very small and the "T" looms very large. There can be found little discussion about the needs for information and literature strictly scientific, particularly about literature from basic science. In some reports a stance is taken that basic research (at times this means scientific research in general) is not an affordable activitity of LDCs, thus literature on these subjects is not of direct interest to information needs. Other writings are directly negative or even

hostile to scientific literature. At times, the literature is viewed as simply "academic" and inappropriate to needs; at other times the hostility is a consequence of a dissatisfaction with the role science has played in development in some LDCs. For instance, the report "Impact of Information Services on National Development" produced by ICSU/COSTED [5] discusses the

> "...negative aspects of education in science that...resulted in several distressing aspects like brain-drain, frustration among all sections of technical people, underemployment and unemployment...Science as it is now practiced seems to have no influence on the life-style of over 80 percent of the population. This obviously is because of the fact that priorities and policies in science, are laid down by the 20% of the people who are actually in the field of science and even these people are guided by their counterparts in the more advanced countries. [The report then recounts the science based achievements in India in nuclear energy, communication, space research etc.]...Amidst such outstanding achievements of science, we see conditions of appalling poverty with millions of people living in conditions which can hardly be called habitable. One frequently asks the question if science, and more particularly technology, has failed in its objective of social utility...High sound theories are aired, more to win recognition in the academic field than to seek solutions to the piling problems of backwardness, squalor and malnutrition...Undoubtedly scientific excellence has been achieved in several areas but there has been no meaningful impact on...the quality of life of common man...on industry [and] industrial research in India [which has] apparently failed to deliver the goods."

This passage is a characteristic reaction to scientific achievements in a number of LDCs. The scientific priorities are questioned and with them the scientific information and literature. The mentioned report provides, in addition, a number of statistics and further analyses of the areas of problems, such as health, agriculture, small industry (in this substantive analysis it is rather uncharacteristic); however, in the recommendations about STI information it unfortunately does not go beyond general suggestions that proper information should be provided to various segments of population from scientists and managers to illiterates. The perception that all is not well with science, and thus with scientific information as applied in LDCs is coming through very loud from many countries.

When it comes to areas of health sciences and agriculture-related sciences the stance is not as negative or harsh. To the contrary, these are areas of concern, thus scientific information in these areas is perceived as very necessary and desirous. However, as for many other subjects, it is being advocated that a relevant proportion of this scientific literature should be scaled down, translated, to the level of understanding of a mass of people. Popularization of

science is being called for, primarily in these two subjects (health and agriculture), as well as in a number of other subjects.

It is also of interest to note that scientists (especially leading scientists) in LDCs are by and large bypassing STI activities in their own countries and are "plugging" themselves directly into the mainstream of global scientific communication channels. Their best works are published in international scientific journals, they attend international conferences on the peers, belong to "invisible colleges"...and in general behave in relation of use and communication of scientific information in much the same way as their colleagues in developed countries. The biggest complaint about STI resources emanating from scientists in LDCs is a lack of good library resources, particularly in relation to scientific journals.. More direct contacts between scientists from LDCs and those from developed countries are being urged in many items in the literature (trips, fellowships, research exchanges etc.). Programs such as Fulbright are in great favor.

3.2.4 Technological and Industrial Information

This is the area that attracted most discussion and recommendations from LDCs. It reflects the great concern with industrialization and technology application as the backbone of development. However, the perceptions of what particular information on these subjects should be included vary according to:

...the level or stage of development of a country

...the conception of what should be the direction of technological and industrial development

...detection of flaws in the previous applications of technology and industry in development

The countries that are on the first (pre-industrial) and second (beginning industrialization) level of development perceive their information needs in much more basic terms than in more developed countries. Their understanding of technological information is considerably different from that of the more developed countries, and it has almost no relation to the understanding of the U.S. Such basic information is much harder to provide and it requires efforts in mass education, basic technical training, and the like, rather than just provision of printed materials in any form. The perceived needs for technological information and for training and education are inseparable. This comes through from many reports. Rather than to recount them, here is an illustrative example from [18]:

> "This example should be cited here since it illustrates clearly the importance of technical information for the productivity of a unit and the survival of an industrial enterprise. These two factories, [for sisal and kenaf] members of the National Textile Corporation (Texco), were

installed by an Italian firm. The sisal factory was completed in 1968/69 with an initial cost of 55 to 60 million shillings and the kenaf factory in 1072 with a cost over more than 20 million. Instruction manuals for the operation and maintenance of the machines were furnished in Italian. As a result the local engineers and technicians were unable to read them and could not maintain the machines as required. Moreover they could not even work the machines efficiently or order spare parts when the necessity arose. For the last couple of years, the situation in the sisal factory is dramatic. Some machines are out of order and the others are working below capacity or producing too much waste. The losses are very heavy and Texco has requested the assistance of a foreign expert for a diagnostic study. The consultant visited the factory and noticed a visible lack of management, technical expertise, supervision, maintenance, control and safety measures.

The kenaf factory has encountered fewer problems because the machines are not so old and the processing of kenaf is an easier operation. For maintenance purposes, they have succeeded in finding someone in the region who knows enough Italian to assist them in reading the manuals. According to the manager and his senior technicians, there is little need for information other than that required for maintenance. However, they will be interested to purchase more books and magazines if they are provided with a list of relevant titles. It appears that no one in the factory knows how to get this information. The chief-engineer, newly appointed, expressed the need for some books and magazines on mechanical engineering and said that he had written to some publishers for bibliographic information.

...The need for information on research and development activities is more understood by those involved in industrial operations based on evolutive techniques like chemical processes. This is the case, for example, in the tanneries and to a lesser extent, the textile company for dying and finishing operations. One senior technician in the tanneries mentioned that relevant references and abstracts are often found in the few magazines they receive on leather technology and chemistry but, he and his colleagues do not know how to get the original articles with the present restrictions on foreign exchange."

To underscore: three elements that are treated as separate problems in the U.S.: (i) general education, (ii) technical training and (iii) technological information are all perceived as one problem of technological information in many LDCs, particularly in the countries on the first two levels of development.

The countries on the third (relatively advanced industrialization) level of development perceive their needs in technological and industrial information in relation to a number of different concerns:

...creation and extension of technical know-how;

...development of new industries and/or new products; diversification of industrial areas;

...increase in the efficiency of production;

...increase in industrial employment;

...assistance to small industry

One of the failures of a number of developmental efforts in countries that are on the beginning or relatively advanced stage of industrialization relates to the import of advanced technologies and/or ready made installed ("turnkey") factories. These were proven to be often:

1. beyond the capacity of a country to absorb and integrate in a profitable manner (thus becoming "sick industries")

2. above the level of technical expertise of the available broader work force (thus becoming operable at a low level of production or inoperable) and

3. highly capital intensive and not enough labor intensive (thus draining the resources but not creating desperately needed jobs).

To counter these failures the idea of appropriate technology was developed. Within the past few years this became a pivotal concept in international discussions about science and technology, warmly embraced and promoted by most, if not all, LDCs. In many countries it also became a central thrust for reordering national priorities for industrialization. It was also seen as a way to provide developing-developing links, and reduce the dependency on highly developed countries.

One integrating definition [23] suggests that appropriate technology is:

1. In terms of resources, it is technology that is intensive in use of abundant factors, labor, economical in use of scarce factors, capital and highly trained personnel and intensive in use of domestically producted inputs.

2. In terms of scale: it is technology that is small scale but efficient, readily replicable, operated, maintained and repaired, low cost and accessible to people and enterprises with low income.

3. In terms of compatibility it is technology compatible with local cultural and social environment.

Alongside the concept of appropriate technology emerged the concept of appropriate technological and industrial information. There is hardly any present day discussion on STI in LDCs that does not have at least some reference to needs for appropriate technology and appropriate information. This is a present day central theme of discussion on STI, a theme that became central only within the last 2-3 years and that is very much present in recommendations for UNCSTD. Being this new, the theme of appropriate information is not yet well conceptualized and it means many things to many people. The range of meanings include:

...on one end of spectrum, the meaning is related to technology and information oriented toward the poorest people and the uses of local resources -- small scale, labor intensive technology designed to meet basic needs and raise productivity [e.g. 9, 5, 15]

...related to the notion of "museum technology" i.e. technology used in developed countries when they were at stages similar to LDCs; suggestions are made for searching of museums and synthesis of findings

...the other extreme view related to technologies a country would choose given as wide a range of choices as possible; in this case the task of appropriate information is that of widening the available spectrum of technologies [e.g. 54]

However, the problems and obstacles in obtaining appropriate information are considerably simple because it does not exist, most of the time, in readily available form. Thus discussions encompass needs for:

...Generation of information materials for development problems which are identified but for which scientific solutions are not fully available

...Repackaging of information (synthesis, translation to a language and level) to directly relate to technology adaptation and use, particularly on a local level

...Screening and evaluating technological information; provision of technology assessment information

...Reduction of technological dependency;[1] e.g. provision of maintenance information on the level of maintenance personnel

---

[1] A Brazilian definition of technological dependency is when an assembly line which has been in operation for some time breaks down and a "little old man from Preoria" has to come and fix it.

...Importing information on successful technology applications from other LDCs.

...Emphasis of information for small scale industries, together with help in defining their technological needs/opportunities; stress on small scale technologies and connections with small scale industries in developed countries (a connection which does not exist, as a rule, the usual connections are with large industrial enterprises)

...Emphasis on provision of "information and answers" vs. "documents and references"

...In relation to rural needs, the emphasis to be on information suited for segments of the population, a yet largely unserved, particularly extension workers, semi-literates and illiterates[1]

...Use of conventional channels for distribution of information -- radio programs, films, picture books, illustrated manuals etc.

The evident theme here is a desire to increase the absorptive capacity in a number of potential users by gearing information in direct relation to their levels, needs, tolerances; to make non-users into information users; and to try new avenues of approach, as short-cuts to development.

It is realized (but in very few reports) that the greatest obstacle to the implementation of ideas on appropriate information is that it is not readily available in the scientific and technical literature. It has to be created, and in itself, this is a monumental task. This idea does not include only distribution of what exists, it incorporates creation.

A criticism of one concept of appropriate technology is that it implies inferior technology - one that will keep LDCs locked per manently in low stage of development and permanently dependent. A different criticism argues that developed countries are not willing to provide appropriate technology and information because it is in their interest to continue to provide expensive large scale technologies and finished products and prolong the dependency of LDCs.

---

[1] This includes emphasis of information in areas such as: soil preparation; conservation; fertilizers; pesticides; traction power, including plows; improved seeds; use of agricultural waste; water managements; tools, implements; animal husbandry; forestry; wildlife; fishery; beekeeping; handicrafts; housing; sanitation; health; transportation, etc.[5]

3.2.5 Policy and Decision Making Information

As the discussions of STI for LDCs began some 15-20 years ago, it was conceived initially that the main thrust is toward bibliographic information in sciences and engineering proper. This was expanded some 10 years ago to include the social sciences and the numerical data from sciences and engineering. Then it came to another expansion of the concept to include technological data, industrial data, etc. as discussed in the previous section. Most recently another expansion occured to include data, information, documents that are of direct aid to making policy decisions, from decisions on general strategies, to decisions on specific purchases, among alternatives, to decisions on marketing of products/services, to choices for specific designs. This is for use for a wide range of decision-makers: from politicians and ministry officials to managers in banks, business and industry, to industrial designers, to plant engineers. An important aspect of this evolution of information services is the fact that these different user communities have different points of view on the value of bibliographic information, and that some communities (e.g., managerial and policy makers) lack the formal information transfer institutions of the scientific and engineering communities.

The range of the type of information that is mentioned as required for decision makers is very wide. It includes information related to:

1. Business and management information: financial and commercial data; names, addresses, volumes, reliability of firms in given sectors, productivity, inventories, resource distribution etc.

2. Marketing information: markets, products, forecasts, costs and pricing.

3. Negotiable information: licenses, patents, consultancy assessments.

4. Design information: standards, specifications, blueprints, industrial catalogs, regulations.

5. Operational information: maintenance and repair manuals; replacements; process specifications and guides.

6. Laws and regulations: international and in various nations.

Often mentioned are desires to provide:

...Analysis of such information and particularly to assess its value and appropriateness

...Reviews on various topics (e.g. of existing technological processes and associated hardware) with a clear and quick presentation of relevant elements to permit informed choice of the more appropriate technological alternatives

...Assessments of future primary and secondary impacts of technologies before its application to improve present decision making

...Information aimed at increasing negotiating capabilities including information from other LDCs to their negotiations, prices achieved etc. (stressed very strongly by Latin American countries).

One view gaining in popularity is that arbitrary limitation of information to its bibliographic form or to information in predetermined fields of human endeavour have "lost meaning" and that to plan STI systems at the national level solely for the tranfer of bibliographic information has "become anachronistic" [34]. In terms of U.S. practices and divisions, this means inclusion of management information systems, business systems, patent and license registry systems, financial information systems, market research and marketing systems, and the like, into the university of STI.

Again it should be stressed that such information is not readily available anywhere -- a point very rarely mentioned by LDCs. Such information requires extraction[1] and even generation, which while clearly possible will require commitment of resources and expertise on a much higher level than it is presently commited to STI activities anywhere.

3.3 Selection Problems

The discussions of the problems of selection and of acquisition emanated almost solely from information scientists and librarians -- people concerned directly with the practical issues in running information systems. These are operational problems and already relate to building of information infrastructure. It was widely recognized that selection and acquisition present severe obstacles to successful operations of libraries and other information systems in LDCs.

The modern worldwide problem of selection of materials for scientific and technical information systems stems from the very large amount of scientific and technical literature available in the world, the level and format of information, language comprehension and, above all, inadequate training in the ability to seek out and successfully match specific units of information to the indigenous needs. And as the amount is growing at a high rate (the phenomenon referred to as

---

[1] In the U.S. such information is often extracted, synthesized and provided by various business information services and may be accessible for on-line searching. Many aspects of STI information explained here would classify as business information in the U.S.

"information explosion"),[1] the selection problem became acute and it is getting worse. The reason is that the rate of growth of STI literature is much higher than the rate of growth of resources of libraries and other STI systems. The crunch is felt not only in LDCs but also in the U.S. and other developed countries, where many efforts (resource sharing, automation, networking, research on utilization for decision making etc.) have been initiated to counter the situation. Similar efforts cannot be as yet found to any larger extent in LDCs, although librarians and information scientists from many LDCs showed in their writing an awareness of the need for smilar resource sharing efforts [e.g. 32].

The increase in mere quantities of publications does not have a direct relation to quality or impact of such publications. But it does make for even more difficulty in finding and selecting the qualitative items in all that mass of quantity. Discrimination is ever harder, and ever more necessary, because there simply is no money for indiscriminate selection. Some information scientists and librarians in LDCs are displaying a high degree of awareness of this problem as seen in their discussions, but others are not (as seen by the lack of discussion on this problem). The recognition of this quantity/quality problem is not universal.

The discussion of the problems of selection of appropriate STI also centers at times on the problem of translation and even creation of such information (as remarked previously). Namely, it is being noted that users in much of the available literature cannot be used because it is not in the language and/or on the level of the potential users. To cope with problems of different languages many countries and information systems instituted translation efforts, but because of the very high costs in relation to relatively low use, the translation efforts are not wide spread. Thus translation is very often listed as one of the major problems for which no satisfactory solution has been found as yet. As more countries are producing their own literature, the language and translation problem is increasing rather than decreasing. This factor is also seen as an obstacle to furthering links among the developing countries.

---

[1] The scientific and technical literature is growing at some 7% a year, thus doubling every 14-15 years. The major contributors to this literature, up to about a decade ago, were the developed countries (U.S. and USSR in particular). However, more recently the percentage of contribution from developing countries is falling off, but the contribution of literature from developing countries is rising, [evident from a number of studies by D.J. de S. Price and E. Garfield]. The growth is still 7%, but the contributors are divided differently; here we can clearly observe one of the rising effects or indicators of development. However if impact of literature is measured with the relative amount of citations that an article or journal receives, then it can be seen that the highly recognized journals from developed countries still have the highest rate of impact.

As to creation of appropriate literature the difficulties are even greater, much greater. Some libraries and information centers in LDCs found themselves in position of writers, rewriters, synthesizers, popularizers and publishers of literature -- a role for which they are not well suited. Calls were made for organization of special departments in information systems or even special institutions that will deal with creation and publishing of appropriate literature, while the information systems then will organize and disseminate it, as is their traditional function. The relations between information systems and publishers in LDCs are not close, which poses still another problem. It should be noted that there are no calls in U.S. or other developed countries for libraries and information systems to assume a role of a rewriter and publisher in the above sense.

A further problem in selection often voiced pertains to the inaccessibility and lack of tools from which selection can be made; tools such as book and journal lists and reviews, publisher catalogs, union lists, announcements, indexes of technical reports, etc.

An often mentioned approach to selection problems is cooperative selection, or distributive selection; the idea is that a number of libraries or information systems in a country or a region should cooperate in parcelling the selection, making sure to minimize the unnecessary duplication and spread more widely the coverage. Unfortunately, such ideas have rarely been put to effect. It is often lamented that the situation is often just the opposite and that the degree of cooperation among information systems and libraries, even in a given city, is very low. This lack of cooperation is found in relation to many other functions, not only to selection.

Above all the problems related to selection loom the complaints about great disparity between available resources allocated for selection and the available mass of literature from which to select.

3.4 Acquisition Problems

Acquisition pertains to ordering and obtaining the physical copy of a document; this is often referred to as "document delivery," "document procurement" etc. Being so tangible, the problem received a great deal of discussion. Excerpts from a paper on the problems of acquisition of bio-medical literature in Nigerian libraries is quite illustrative of the problem in general [12]:

> ..."Tight budgetary and administrative controls give them [libraries] little elbow room in the acquisition of the materials they need. The jounals more than books present the greatest amount of problems.
>
> ... Delays in transportation [cause] delay in receipt of the journals from publishers...Orders take four to six months to be serviced...because of surface mail, as air freight would raise the total cost of the subscription far out of proportion

to the library's budget for journals. Journals are lost in transit...poor postal service.

... Delay causes inability to claim missing issues of journals... because publishers demand that claims be made within sixty to ninety days...overpaying for the missing copies when reordering [i.e. they are paying twice].

... [Because of such losses] gaps frequently occur in the collection.

... It takes as long as four to six weeks to get a photocopy [from a U.S. or British library]...minimum of eight weeks from continental Europe or Eastern Europe.

... Lack of competent book dealers in the country.

... A few biomedical periodicals published in Niger...are even more difficult to obtain from publishers than journals from abroad."

Beside the chronic lack of resources the problems of acquisition are myriad and generally out of the realm of influence of information systems themselves; problems such as this are listed:

... Currency restrictions in many LDCs that give low priority for foreign exchange funds for STI materials

... Inadequate postal services as one of the general problems of infrastructure

... Inadequate telecommunication services, domestically and internationally for direct contacts

... Inadequate attention to special problems of acquisition in LDCs by publishers, book and journal dealers and other agencies providing physical copies of documents in developed countries

... Copyright restrictions related to copying of materials (including problems of fair copy use vs. pirating)

... Photocopying equipment and services within LDCs and obtaining photocopy services from developed countries

... Administrative obstacles in ordering and purchasing; an excess of bureaucracy in procedures

... Ever increasing costs of publications, which are growing at a particularly high and prohibitive rate

... Very low degree of success in plans for exchange of publications

... All the problems cumulatively causing considerable scarcity of current publications

Many international efforts to ease these problems have been launched, but with rather limited success. Many calls are made for more effective schemes in solving the acquisition problems; considerable assistance from developed countries is expected.

At times some of the acquisition problems are viewed as restrictions imposed on LDCs and as forms of exploitation (this is done without consideration that these are general restrictions, and that many of the problems are internal to given LDCs).

At a different level the problem of acquisition is being intensified with the introduction of bibliographic and other data bases, with on-line or batch access to such data bases and with general wider accessibility to indexing and abstracting journals. In relation to specific questions by users search of such data bases or indexing journals provides the users with citations of documents which at times seem exactly what is wanted. But where to get the actual document? The "hardcopy" delivery causes considerable user frustration. In countries that have some backup in library services the problem is eased, but in others where there are no adequate library collections in STI the problem is intolerable; e.g. in Equador the Industrial Development Center (CENDES) offering information services to industry (among others a current awareness bulletin) has to "send abroad 100 percent of its requests for copies of articles from primary journals, patents, specifications etc...[because the] corresponding library facilities in Equador are totally inadequate" [4[illegible]]. The introduction of modern and computerized information approaches in LDCs brought home very vividly the necessity for adequate and corresponding STI library resources. Introduction of computer services without library backup is seen by some as counterproductive in that it raises users' appetites and with it the frustration in not satisfying the appetite, thus turning users away from information services.

As mentioned, the amount of STI materials published in LDCs is increasing at a high rate. It may be of interest and somewhat surprising to note that in many instances the information scientists and librarians in LDCs are reporting that they have considerable difficulties in obtaining their own native STI materials; sometimes the difficulties are said to be greater than in obtaining the materials from abroad.

3.5 Awareness of Available STI Resources in the U.S. and Economic Considerations

It is widely recognized in LDCs that the U.S. is the principal country in the world in terms of STI resources. The export of journals, books, indexes, data base services etc. from U.S. to LDCs is sizable, particularly to countries on the level of relatively higher industrialization; e.g. the number of international subscriptions to U.S. journals

rose from 7.1 million in 1960 to 17.2 million in 1977 [8]; a good proportion of this rise was in LDCs. According to every citation study, the U.S. journals receive the highest number of citations, worldwide, indicating their use. There is no major scientific/technical library in LDCs, without a sizable proportion of its collection being U.S. materials. In general, there are many indications showing a relatively high rate of acquisition of U.S. materials in LDCs.

Realizing the need for awareness of STI resources in general, UN agencies commissioned studies that resulted in directories or handbooks of STI resources and approaches [e.g. 1, 13, 27].

A number of other international directories, handbooks, bibliographic guides (e.g. UNIDO series of bibliographies on industrial information) and similar listings appeared over the years; all prove to be very popular. Most STI resources listed in these come from the U.S. Recommendations were made to have more directories published and in more specific subjects. A number of particular recommendations were for making and easier access to: (i) names and addresses of individuals, enterprises and agencies in the U.S. to whom can be written about specific requests for STI resources, documents or answers to questions and (ii) photocopying services for specific journal articles, technical reports and other STI materials. Photocopying in particular is a sore point with many information systems.

However, not many specific discussions of STI resources in the U.S. can be found in the literature of LDCs or (besides the mentioned directories) in the reports/recommendations of UN and other international agencies. There is no discussion on how widespread and how specific is the awareness of U.S. resources. From personal observation and discussions, I can conclude that the awareness in LDCs that U.S. is the major supplier of STI in the world is very high, but the awareness of the specific resources (e.g. names of specific journals, indexes, statistics, business information sources, patent listings etc.) is very low in general. It is not even very high among librarians and information scientists. The lack of specific knowledge of the existence and names of specific STI resources is one of the obstacles in higher utilization of U.S. STI resources.

Marketing of U.S. STI resources in LDCs by U.S. firms and agencies is at a very low level and very sporadic. For instance, only recently did NTIS (National Technical Information Service) start organizing outposts in Latin America and providing promotion material in Spanish. Some data base services (NLM, Lockheed, SDC) showed some interests toward LDCs, but in no way as much as toward developed countries (e.g. National Library of Medicine (NLM) has bilateral agreement for MEDLINE services with 10 countries -- two of them LDCs -- and with Pan American Health Organization (PAHO) for Latin America). Publishers showed also relatively little interest toward marketing in LDCs. More marketing, more marketing materials in local languages are urged.

High costs and lack of foreign exchange are cited most often as a barrier for higher use of U.S. STI resources in LDCs. These costs are

sometimes considered as exploitative. Suggestions were often made that STI should be shared with LDCs free, or at greatly reduced costs -- this is also urged in UNCSTD reports. There is no particular discussion of the economics of information, nor is there any evidence of an understanding about what elements enter into economic considerations, such as costs, price, value etc. (It should be mentioned that there is no consensus on the matters in the U.S. either, despite many discussions). Cost/benefit discussions related to STI services, such as found in the U.S. are absent from LDCs literature. Some papers mention information as a reusable commodity and information systems as utilities [e.g. 34]. In the recent suggestions and calls for appropriate information, repackaged information, business information etc. there are no economic considerations present. In general, there seems to be a surprise at the relatively high costs for STI resources and for STI systems and services, and even a hint of resentment at these costs.

4. ACCESSIBILITY OF STI

4.1 Overview

In order to be eventually utilized, information has to be not only available at some place, but also physically accessible to users. To provide such accessibility information systems intellectually organize materials in some fashion, house them appropriately and provide dissemination services. In more recent times information technology has been utilized for these functions. Also, various information networks have been built to increase both availability and accessibility; at their base these networks have a concept of resource sharing.

These aspects have been of great concern to librarians and information scientists in LDCs, quite naturally because it is the backbone of their professional activities. The importance of the activities related to accessibility lies in the fact that they are a basic aspect of information infrastructure -- without them there would be no utilization. Selecting and acquiring information is just the first step in the chain of information transfer -- however, this is often not fully realized either by policy makers or even users. For this reason there is much more discussion by the officials of what type of information is needed than of what type of systems are needed that will make this information accessible once it is acquired.

One thing that comes out clearly from the literature is that information scientists and librarians in LDCs are in a general battle for recognition of the aspects related to accessibility of STI. Almost all of the perceptions presented here come from this constituency.

4.2 Intellectual Organization of STI

Organization refers here to indexing, classification, coding, cataloging and/or creation of other intellectual forms of representation or

bibliographic control. It also refers to creation of union lists (e.g. list of holdings of journals or other materials among several information systems), and similar tools necessary for resource sharing.

In order to provide for intellectual organization, it is necessary to establish a prior scheme or procedure on the basis of which such an organization can be done. And as in the U.S., there were many discussions and perceptions about such schemes in LDCs. Tools for vocabulary control, particularly thesauri, are mentioned most often as lacking and needed. Multilingual thesauri in various subjects are promoted as one of the solutions to vocabulary control problems. UN and other agencies published a few such thesauri, but there could be found no discussion on their specific applications. Subject heading lists, as another form of vocabulary control, also received considerable discussion particularly from library concerns. There were many calls for development and/or adaptation of thesauri and other vocabulary control tools that are suitable for specific situations in a given LDC. Classification schemes, the traditional library tools, have not received nearly as much attention in discussions as the vocabulary controls. This is probably a reflection of the similar U.S. trend in intellectual organization of STI, where classification is not wisely employed in modern data bases.

Procedures for analysis and indexing of STI literature also received considerable attention. In response to these needs UNESCO (and other agencies) published manuals for indexing, abstracting, analysis etc. More procedure guides are requested.

Another often broached topic is standardization of schemes and procedures for handling STI. Standardization and harmonization is seen as a prerequisite for cooperation among systems. Most standardization that was achieved was simply by wide adaption of some specific practices, rather than by acceptance of international standards. However, some of the international standards (for instance for international book numbers) proved clearly to be beneficial, and more work on standards is called upon.

Creation of tools such as union lists of holdings is another aspect of organization that is necessary for resource sharing and cooperation among libraries and information systems. Such tools are common in the U.S., but greatly lacking in the LDCs; this is one of the reasons why each library and information system in an LDC is usually an island onto itself. In some LDCs union lists of journal holdings for a set of libraries were produced in a cooperative effort (usually as a prolonged and painful effort with little resources assigned to it); but the big problem proved to be updating and maintaining of such lists. Little assistance from developed countries is ever given for such efforts. Need for such tools is constantly expressed [e.g. 6].

The way things are done in the U.S. in regard to intellectual organization had great world wide impact. Many LDCs are using or adapting many U.S. approaches. For instance, U.S. produced thesauri

are routinely used in many institutions in LDCs; the subject heading lists of National Library of Medicine and of the Library of Congress are used or even translated in libraries in many LDCs; procedures for coordinate indexing developed in the U.S. are now used world wide, East and West. Thus U.S. is looked upon not only as a prime source of STI materials, but also as a prime source for procedures and schemes for organization of such materials.

4.3 Housing of STI

Housing refers to the physical location and arrangement of documents and other information sources or artifacts. Characteristically, in most LDCs the physical facilities from buildings to computers for housing STI are inadequate. Although a great building doesn't make a great library, or a large computer doesn't make a good information system by itself, physical facilities are of obvious importance. The lack of adequate facilities is often cited as a great obstacle to users and to provision of a variety of information services.

Another characteristic is that in most LDCs the pattern of geographic and size distribution of libraries and information systems is very biased. There are a few larger libraries and information systems but no small ones. These larger systems are usually centrally located in the largest city or within some large institution, university, etc. Smaller collections of STI do exist, but they are hardly substantial, or they can hardly qualify as libraries or information systems. As a rule there is some geographic distance between the potential users and these larger systems. This distance is acting as a very effective barrier to utilization, especially in view of transportation and communications problems. These difficulties are often discussed in literature and many recommendations for dispersion or branching of information systems were made. Bringing information to where the potential users are is a goal of such recommendations. However, most LDCs registered very few accomplishments in this area. One of the recommended approaches to decentralization is to provide centralized organization and housing, but decentralized dissemination. For instance, one of the more successful efforts along this philosophy is the East African Literature Service in Kenya [Munn, 1973]; they acquire and process centrally a large set of journals on agriculture and related areas and provide extention stations and other institutions first with copies of journals' content pages and then upon request with photocopies of articles in these journals. Many recommendations were made for institution of similar efforts.

4.4 Dissemination of STI

Dissemination of STI from libraries and information systems involves a number of products and services in addition to traditional products, such as bibliographies and traditional services, such as circulation. For instance, selective dissemination of information (SDI), retrospective searches, assistance in question formulation,

on-demand bibliographies, information analysis and synthesis, reference (question/answering) services, referral, photocopying, citation tracing, bibliometric analyses, etc. The effectiveness and quality of each information system depends clearly on the number and quality of its dissemination services, particularly if they are diversified to meet diversified user needs; e.g. an information system that just produces generalized bibliographies or a library that only circulates its materials provides only a fraction of possible dissemination services. Unfortunately, this is exactly the range of many information systems and libraries in LDCs -they do little more than make general bibliographies or circulate materials (and some have very restrictive circulation policies). This is often mentioned in the literature [e.g. 5, 15, 25, 43].

An examination of various country reports or surveys on STI systems for or by UN agencies provides a picture of these systems being much more product than service oriented [25, 41, 46, 47]. Especially in many national information systems the resources are channeled in production of bibliographies, key-word indexes, newsletters and the like, and not into direct information services to groups or individuals on request. The value of these products to scientists and engineers is open to question; i.e. although many subject bibliographies have a value as a national record of production of national STI literature, they have little value in answering specific questions in that subject. The product vs. service orientation is at times a subject of considerable debate in STI systems and the situation seems to be slowly changing in favor of service orientation. But the whole concept of STI systems being search oriented which is quite prevalent in the U.S., is not prevalent in LDCs. The resources are not allocated in that direction. This, of course, is another barrier to effective utilization of STI for development.

One reason for low service orientation is a lack of proper information resources. To illustrate from a Nigerian article [12]:

> "There are not very many indexes and abstracts in the libraries either, and the absence of these makes literature searches very difficult..."

4.5 Applications of Information Technology

Examples of utilization of computers and other technology for processing and dissemination of STI in the U.S. and other developed countries had a great impact on the aspirations of information scientists and librarians in LDCs at all levels of development [39]. Computer seems to be in many writings a magic word, the expectations somewhat naive and unrealistic. In a number of LDCs (primarily at higher levels of development) computers have been applied by various national or industrial STI systems and by some libraries. In general, they did not have their own computers, but had access to a computer. The applications range from production to simple indexes, and union lists, to printing of bibliographies and catalogs, to information

retrieval applications, and in at least a few instances to building of on-line systems. Thus the range of applications is the same as in the U.S., and in most instances the applications were copies of what was done in the developed countries.

Most applications were simple e.g. KWIC (Key-word-in-context), indexes, which are very popular. There is also a good number of more sophisticated current awareness services, particularly as related to INIS and AGRIS systems that provide files on which searches can be done. More information retrieval operations are hampered by the lack of files (data bases) on which to perform them. Many considerations and even negotiations were made with various data base producers for buying or leasing of their files by LDCs but very few resulted in operational systems. Getting data bases from the U.S. and other developed countries is wrought with many obstacles and then making them work with even more obstacles. This is a matter of great disappointment and great debates. Canada had a program for LDCs to transplant their very successful national information retrieval systems (CAN-SDI and CAN-OLE), and their efforts seems to be warmly accepted; nevertheless, progress is slow [38]. The only moderate success in the data base application areas seems to have been scored by the INIS and AGRIS efforts. Still there are great many calls for data bases and technological application related to them. Also there are many calls for production of local, national or regional data bases.

The big problem listed all the time is software. Here the need was expressed for programming guidelines and packaged programs for all kinds of STI operations. It is in this, the software area, where the U.S. is looked up to for assistance. The computer capacities available for STI are usually greatly underutilized, primarily because of the lack of suitable software. Efforts of multinational companies (such as IBM) involved in the transfer of information technology, hardware and software, have been generally more successful.

There were many mistakes committed in the applications of information technology in LDCs, the same ones as in the U.S. But since the professionals in LDCs have pretty much left this work to themselves with relatively little assistance, these efforts were powerful learning experiences. They may have been less successful operationally but were certainly successful in terms of education and experience. As a result it is quite evident that in many LDCs, a cadre of computerexperienced information professionals exists ready for further developments in this area.

The appetites for applications of information technology for STI problems are very large and growing. However, a few remarks argue that in some STI areas indiscriminate application of information technologies may not be appropriate and may even be counterproductive. In the debate on the issue of gradual evolution vs. quantum jumps in applications of information technologies, the general inclination is toward the latter.

4.6 Information Networks

Information networks are one of the tools aimed at increase of availability, accessibility and thus utilization of information. Many such networks exist in the U.S. (for instance, library networks for interlibrary loans, for cataloging and for resource sharing in general; data-bases services networks; document-delivery networks etc.). Great many calls are made in the literature by all constituencies (officials, information professionals, information users) to institute similar networks in LDCs. There is practically no set of recommendations that does not place information networks high on the list; particular stress on this is made in UNCSTD reports.

As mentioned, many international efforts have been directed toward information networks [list in Section 1.3]. In some LDCs various types of networks emerged aimed at libraries and at information retrieval. However, network development in many instances is hampered by both tangible factors, such as inadequate telecommunications, and intangible factors, such as lack of willingness to cooperate among information scientists and librarians in LDCs. The low level of cooperation or of knowledge of each others activities is cited quite often as a major problem. The talk about internal country networks is considerable, the motivation for their realization seems low. No suggestions can be found on how to increase this motivation and willingness for cooperation.

Of the networks that were realized the more successful are the mentioned INIS and AGRIS efforts. In some LDCs also were realized union lists of holdings among libraries as a cooperative network effort; but the interlibrary loan networks that were to follow were not that successful.

The most often mentioned desired networks were for on-line data base services (such as offered by NLM, SDC, Lockheed, Euronet in the future). A number of institutions in LDCs already are accessing some of these data base services, particularly the U.S. ones, through telex (which is slow and expensive) or through TYMNET or similar telecommunication network. Many demonstrations of these data base services were made in LDCs, which considerably increased the appetites for access. The level of use of these data base services in LDCs is low but apparently growing. Some national STI services such as IBICT in Brazil initiated regular services for users to search, at a fee, SDC and Lockheed files via telex. A number of companies in Latin America (particularly national petroleum companies) made direct contracts for accessing these services. The problem of course is high fees that restrict the usage of these services only to users from the richest companies or institutions.

There are a great many expectations by LDCs that the U.S. will provide an easier access and at lower fees to data base services. There seems to be little understanding of the private (or not for profit) nature of many of these data base producers and services in

the U.S. and of the ensuing economic structure of the U.S. information industry. It is not well comprehended that such a major national activity as the information industry and information networks, are by and large outside of direct government involvement in the U.S. Thus many of the expectations are directed at the U.S. government which is not always the proper party at all. Private enterprises were much more successful in establishing contacts and modes for information networks in LDCs than the efforts by U.S. government agencies.

One type of network receiving considerable attention in LDCs are so called SDI (Selective Dissemination of Information) services [e.g. 14, 38]; these involve periodic computerized searching of given data bases (e.g. as they are updated) for answers to user questions deposited with the system. The problems involve: (i) software for computer manipulations of data bases and for searching and dissemination and (ii) obtaining or building the data base itself. AGRIS and INIS are typically established to enable SDI. UNESCO contracted with the Canada Institute for Scientific and Technical Information (CISTI) for three pilot projects in the period 1974-1976 for transfer of CAN/SDI services on internationally available data bases to Argentina, India and Mexico. An evaluation of the pilot projects showed a good deal of acceptance. The countries are continuing these projects on their own and a new pilot project was initiated in Nigeria. The encouraging results have led to measures to make the SDI packages available on a wider basis involving merging of Canadian software and approaches with the UNESCO/ILO package called CDS/INIS. The main problems involve personnel, training, data base procurements, document scheduling and follow-up; all of these personnel is problem number one. The U.S. was involved in these efforts by at-cost or free provision of data bases.

In comparison to on-line searching services as offered by Medline, Lockheed etc. the SDI is an older development primarily started and based as a batch-mode computer operation. Little exploration was done on the relation between these two types of services in LDCs. The question is quite open: should the promotion of SDI services be continued as done in UNESCO pilot projects, or should on-line information retrieval services be incorporated or even replaced by the SDI services as they were instituted originally? The question also involves the alternative of mounting data bases in the country and not relying on a telecommunication network or relying on data bases, software and hardware available elsewhere and on international telecommunications. It is a sensitive issue that has not been addressed, at any depth, but it certainly will come to a head. As mentioned, many demonstrations of on-line STI services have been made, and a degree of familiarization with these services has been achieved [e.g. 2, 7, 13]. An impression is left that it is so much easier to hook up onto existing on-line services, than for SDI to build its own capabilities.

Considerations of networks for STI also included many aspects of hardware, software and telecommunications (generally labeled in the international parlance as "informatics" and "information technology" in the U.S.) in addition to consideration of information alone. It is

quite evident that at times there is great confusion (or potential for confusion) in discussions of international networks because of this. The recently held Intergovernmental Conference on Strategies and Policies for Informatics (SPIN, Aug. 28-Sept. 6, 1978) was attended by 76 Member States of UNESCO, and demonstrated both a great interest in establishment of networks and a wide range of interpretations on the meaning of network, and in consideration to what is involved in networking. Expectations as reflected in recommendations cover also a wide range of topics, including desired action in the areas of [48]:

... National strategies and policies for informatics

... Education and training in informatics

... International cooperation in informatics

... Transborder data flows

... Telecommunications

... Information industry

... Maintenance of information services

... Standardization

... Transfer of STI in area of informatics

A number of specific proposals (in addition to the SPIN conference) were made to institute or strengthen international (global or regional) networks that involve the informatics technology (computers, telecommunications). The following types of networks are mentioned [e.g. 7 and UNCSTD reports]:

... International time sharing networks

... Networks for scientific computing (e.g. ARPANET)

... Information retrieval networks (e.g. Lockheed, SDC, BRS, Medline, RECON, etc.)

... Human communication networks (e.g. TECHNOTEC, computer conferencing such as CONFER)

... Bibliographic - library networks (e.g. OCLC, BALLOTS, AMIGOS, and many others)

U.S. experiences and/or involvement in institution and operation of such networks are considered indispensable. This is considered a most desirable area for much greater U.S. involvement and probably offering the greatest potential in benefits; one needs to recognize, however, that the aims of international organizations calling for such U.S. participation vary, and are not necessarily apolitical.

The barriers which are most often mentioned that impede network development, of types mentioned above, include [7]:

... Regulatory problems

... Interconnection problems

... Technical problems

... Legal and political problems

... Privacy of personal data

... Privacy and security in broader aspects

... Intellectual property rights

... Economic problems; pricing

Still another type of network being debated at present are networks for information on appropriate technology. Numerous proposals exist for international mechanisms for promoting appropriate technology including:

... UN Inter-Agency Task Force proposal for an interagency network for the exchange of technological information, endorsed by UN General Assembly in 1977 [45]

... UNIDO Industrial and Technology Information Bank (INTIB), described previously, with a pilot project to be completed in 1978 [20, 52]

... World Bank proposal in 1978 for a Technology Referral Service (TRS) [54]

... ILO proposal in 1976 for establishment of a Consultative Group on Appropriate Technology; other organizations made proposals for Consultative Groups in a number of areas [23]

... International Rice Rsearch Institute proposal for an International Center for Appropriate Technology [23]

... US/AID proposal for a program in appropriate technology involving information and communications and organization of an Appropriate Technology Institute to administer the program

Quite clearly, the notion of appropriate technology includes also the idea of networks for appropriate information. As is the nature of appropriate technology subject to different interpretations, so is the nature of associated information networks.

5. UTILIZATION OF STI

5.1 Overview

Institution and operation of information system is quite naturally a prerequisite for obtaining information, but that does not automatically mean that the systems will be used and that information will be utilized. Unfortunately, there is little solid data on the extent of use of the information systems that exist in LDCs, and on the utilization of STI that is provided and/or readily available. A few general conclusions can be derived from various remarks in the literature [e.g. 4, 9, 11, 12, 15]:

1. The use of information systems in LDCs are not very high; they are underutilized.

2. The utilization of STI is not widespread even when readily available; a large proportion of potential users are nonusers.

Lack of use of STI systems and STI in general in LDCs has many a cause, but among the major ones are the people toward whom information is aimed and who could benefit directly from it. The tradition of utilization of STI systems is not well developed and the skills and knowledge of users in utilizing information itself are low. Thus the problems are not only in the areas of availability and accessibility of STI and in STI systems and networks, but the problems are also in the users themselves.

The 'user problems' are perceived as existing in the areas of:

1. User education

2. User requirements

3. Promotion and marketing and

4. Evaluation and feedback

In recognition of user problems, many recommendations have been made particularly in UNCSTD reports, and many sporadic efforts have been attempted but few actual sustained efforts have been recorded. It is perceived that this is an area in dire need of attention. U.S. methods applied to user education, promotion, marketing, study of user needs and requirements, etc. have attracted attention.

5.2 User Education

Two levels of user education problems are recognized involving (i) users and (ii) potential users who have had some exposure to academic education in an STI subject during their formal schooling or in their professional practice.

It is recognized that in many instances formal academic programs do not include emphasis on the use of information sources beyond textbooks, and on the utilization of information beyond rote learning. Thus the user problems start from the outset with students' formal education; STI in its broader aspects is just not a significant part of their education and the utilization of information for problem solving is not an educational objective. Inclusion of STI in the educational process would require a fundamental reorientation of many curricula and educational practices in great many academic institutions. This in turn requires a faculty willing and knowledgeable to do so; which in itself is another problem.

Considering that the U.S. academic institutions have an ever increasing number of students from LDCs[1] a number of suggestions have been made, e.g.:

1. Providing LDC students in U.S., when appropriate, with supplemental education on availability, accessibility and utilization of STI and with training on operations of information systems

2. Sensitizing the U.S. faculty involved with students from LDCs to the special information problems the students will be facing upon return

3. Supporting curricular studies and changes that emphasize use of information within studies for various STI subjects and programs attended by students from LDCs.

Many efforts in user education have been aimed toward already practicing professionals. These efforts included seminars, short courses, presentations manuals etc.; considerably more of such activities are being urged. Suggestions were made for providing short training courses on STI for engineers, scientists and policy makers; these could be in "packaged form" including audio visual techniques. A U.S. involvement in such courses was also deemed desirable, particularly in relation to explanation of U.S. STI resources and on modes of their utilization in the U.S. Also interest was shown in transplanting and adapting U.S. user education practices for use in LDCs.

---

[1] According to Chronicle of Higher Education (Dec. 11, 1978) in 1978 there are some 235,000 foreign students in the U.S., a good number from LDCs. (In mid 1940's there were about 26,000 foreign students). The count is expected to be a million in ten years. Presently foreign students are 2% of all post-secondary education in the U.S. The percent in graduate schools is even higher: 27% of all engineering doctorates are earned by foreign students and 45% of all engineering degrees go to foreign students. A good percentage of institutions enrolling foreign students report that they have substantially altered their graduate programs because of the influx of persons from abroad.

A further aspect here relates to opportunities for direct exchanges and meetings between scientists and engineers in LDCs and those in developed countries. A much expanded number of contacts is urged, including attempts to deliberately establish or strengthen "invisible colleges."

5.3 User Requirements

Two problem areas are included here:

1. Methods for determination of user needs in STI in general

2. Assistance to users in expressing and formulating their specific information requirements and questions.

While the studies of user information needs have a long history in the U.S. and other developed countries such studies are not conducted as a rule in LDCs. User needs are surmised rather than studied. However, many calls were made for study of user needs, for definition of these needs in terms of particular developmental goals and local conditions, for application of more appropriate methods in study of these needs and for 'inventories' of potential users and their characteristics. It is not clear to what extent are the methods for study of user needs as developed in the U.S. applicable to LDCs.

In a number of instances it was pointed out that information users in LDCs, particularly in small industries and enterprises have great difficulties in expressing their information requirements; some estimates even say that up to 95% of inquiries on industrial information are incorrectly formed or are wrong questions (the figures were not supported) [55]. Help in formulation of correct inquiries is perceived as a needed activity in provision of STI. The difficulty is becoming ever greater with the introduction of computerized information retrieval systems, where the method of question handling, question analysis and formulation of search strategies is essential to success. As in other user problem areas U.S. experiences are looked upon as offering potential solutions.

5.4 Promotion and Marketing

The success of a number of efforts in marketing of information systems, products and services in the U.S. did not escape the attention of information scientists in LDCs. In particular, the success of products such as Citation Indexes and Current Contents, and the increase in use of numerous data bases and data base services is in no little measure due to judicial and comprehensive marketing. This includes market research, mass mailing, conference reports and exhibits, direct contacts, user education seminars, demonstrations, mass production and distribution of promotional and educational material, continuous advertising campaigns, integration of training and marketing efforts, etc. Such planned efforts are perceived as needed in LDCs as well. It is quite evident that often the fundamental ideas about promotion of information systems and services are lacking, although

considerable discussion about the need for recognition of their value is present. The connection between the two is not made.

5.5 Evaluation

A number of recommendations have been made for a need to evaluate the various national and international STI systems that have been implemented, the various STI activities and promotions of UN and other international agencies, and the effects of assistance to the LDCs in relation to STI. Many evaluative opinions have been voiced and many evaluative observations have been recorded in trip reports. However, very few actual evaluative studies have been conducted. Examples include studies commissioned by UNESCO on assessing the benefits and promise of AGRIS [9] and on the evaluation of CDS/ISIS and CAN/SDI pilot projects in three countries [14].

Because of scarcity of factual studies it seems that the effects of evaluation efforts (which were largely opinion gathering) were rather marginal, even though the need for evaluation is widely recognized. Calls are made for new approaches to STI project planning and execution that will involve evaluation as a mandatory and integral part. (The U.S. involvement in STI efforts for LDCs was never evaluated in any comprehensive sense. Even good historical accounts do not exist, beyond some histories of U.S. assistance in libraries and librarianship to developing countries [e.g. 3].)

6. EDUCATION AND TRAINING

6.1 General Concerns

The number of discussions of the needs for well educated and trained information professionals for STI services in LDCs has increased considerably within this decade. Concern for education/training in information science, librarianship and computing in LDCs is reflected in a great number of recommendations in country reports, international conferences, and articles in the literature in general [e.g. 5, 11, 16, 19, 22, 24, 29, 39, 55, 56]. Furthermore, various reports (particularly emanating from UNESCO conferences) have emphasized the dangers of involving LDCs in the new sophisticated information systems and technologies where there is an absence of skilled professionals to operate these systems. Examples of concerns can be illustrated with a few quotes:

From article "Problems Involved in Setting up and Operating Information Networks" [16]:

> "The problems which cause the greatest trouble in setting up and operating information networks are of a human order... On the one hand, although there are at present in the developing countries high-level specialists in practically all the areas with which we are concerned (librarians, documentalists, systems engineers, programmers, communications and

telecommunications specialists), there are generally too few of them. Efforts to provide the accelerated training may turn out to be in vain, unless the young specialist is offered a number of economic and professional incentives which encourage him to continue his career within the network instead of being tempted by openings in other sectors.

On the other hand, it is fairly common to meet professional people who, having acquired a little experience in a given area, overestimate their own abilities and tend to think that theirs is the only workable solution."

From a "Seminar on Industrial Information in Latin America" [21]:

"The education/training for industrial information professional development in Latin America stands out as the primary area in which information infrastructure development should take place....Much more is included under this heading than just academic education oriented toward a degree in library or information science."

6.2 Activities of International Organizations

UNESCO and other UN agencies have been deeply involved, primarily because of insistent requests by LDCs, in many education/training activities, including courses, workshops, establishment of schools and programs, provision of teachers and consultants, drafting of guidelines etc. The depth of concern in this area is further underscored by the fact that one of the four major objectives of UNESCO's General Information Program within the UNESCO medium range plan (1977-82) pertains to training and education of professoinals and users of information, more particularly [55]:

... to help LDCs build up facilities for systematic, formal training of needed information manpower

... and in the meantime to provide support for international training of managers and advanced specialists for national information systems, and of teachers to staff national training programs

UNIDO, UNITAR, WHO, FAO and a host of other agencies were also involved in similar activities, as were regional organizations such as Organization of American States and nongovernmental organizations such as Internatoinal Federation for Documents (FID).

All this is mentioned here because most of these educational/training activities were initiated on suggestions and demands from LDCs and show their perception that education of professionals for STI activities is inseparable from provision of STI and building of STI systems. Nevertheless, one of the most often voiced criticisms of initiation of STI activities in LDCs, be that on the planning or the

implementation level, is that too often inadequate attention was paid to education/training of appropriate professionals.

6.3 University Education

For a long time there was a debate in LDCs (as in developed countries) as to whether the necessary education for STI activities should be achieved through formal university-level channels or just through short training courses offering technical details to 'specialists' (people who already have some level of education in a subject). The debate also involved the issue of the level of education: graduate, undergraduate, or lower e.g. certificates for courses extending from a few months to two years. In many LDCs, at the first and second level of development, the question was also raised whether any level of higher education for any information activities is at all appropriate to their needs; the notion of "barefoot librarians and/or information officers" was advanced as being an appropriate response. As these questions were not settled either in the developed countries or in LDCs we have, as a result, around the world educational settings for STI activities in every shape, form and length. This can be clearly seen from the "World Guide to Library Schools and Training Courses in Documentation" [26] which lists some 203 schools or programs from 59 countries; of which 89 schools/programs are in 31 LDCs[1] (no European country was counted here as LDC). The Guide (published in 1972) is now out of date, since then a considerable number of schools and courses in librarianship and information science were added in LDCs; but still this gives an idea of spread.

The trend in STI education in LDCs is definitely toward university level education. Most efforts are within the subject of librarianship and information science, very few in computer science or other subjects. Thus most of this education is centered in library schools and in some instances in independent information science schools or departments. However, there is an increase in information science courses and programs, within or without library schools, that are most directly related to STI activities. For instance [24], in Latin America and Caribbean there are at present 66 schools in librarianship and information science; about half a dozen of these are also on the graduate (masters) level -- all of the graduate programs were instituted within the last few years; there is a marked trend toward inclusion in the curricula of information science courses (including computer related courses) and toward more graduate (masters) education.

The problems listed most often in relation to university level education in library and information sciences are:

---

[1] Argentina, Brazil, Chile, Columbia, Costa Rica, Cuba, Egypt, Ethiopia, Ghana, India, Iran, Iraq, Jamaica, Jordan, Korea(s), Mexico, Nigeria, Pakistan, Paraguay, Peru, Phillipines, Saudi Arabia, Senegal, Thailand, Tunisia, Turkey, Uganda, Uruguay, Venezuela, Zambia.

1. Lack of qualified faculty; this is a universal situation listed most often as in need of great attention and assistance. Import of temporary faculty has great limitations, thus requirements are for teaching of indigenous teachers.

2. Determination of relevant curricula and subjects to be taught. Criticisms are leveled that in some countries educational programs in library and information science as instituted have little relationships to STI national plans or systems or international interconnections made in STI services. Often mentioned is the issue in teaching of computer aspects and advanced STI methods and their relevance/irrelevance to domestic situations.

3. Orientation of programs to satisfy a whole range of needs for professionals for different situations that are encountered; included as most problematic are orientations toward information managers.

4. Career development and professional status of graduates of these programs is often problematic (e.g. their civil service classification is in many countries lower than for other professionals). This does not work well for attracting students with higher qualifications and stronger subject backgrounds.

5. Lack of adequate instructional resources and facilities seriously hampers education. This includes lack of textbooks in the language of students, lack of laboratories, inadequate library and course materials, problematic access to computers in computer or automation courses etc.

A large number of students in information science from LDCs are being educated in developed countries, including in the U.S. A number of U.S. library and information science schools have specific programs or orientations for students from LDCs. An often heard criticism from LDCs is that students educated abroad have been 'over-educated' or educated without socially relevant competencies that are specific to the environment of the country; furthermore, people educated in different countries come back with different philosophies and techniques, making them hard to work together [e.g. 43]. Two suggestions are often made toward the U.S.: (i) to increase the opportunities for education in subjects related to STI for students from LDCs, and particularly for future faculty so that similar schools in LDCs can become self-sufficient and (ii) to increase the orientation of programs attended by LDC students toward problems and solutions as relevant to LDCs.

There were few examples of U.S. schools establishing direct and long term cooperation with similar schools in LDCs in teaching, curriculum and faculty development, course materials development etc. Favorable results of such cooperation prompted suggestions that more direct cooperation between schools is highly desirable. However, the

resources for such cooperation are very sporadic, which limits such efforts.

This area also encompasses many recommendations for greater and easier direct exchanges between STI professionals from LDCs and developed countries, e.g. through meetings, conferences, training trips etc.

6.4 Training and Continuing Education

Need for practical training of STI personnel is an often mentioned problem. A closely related problem is a need to provide already practicing professionals with opportunities to update their knowledge and skills. This is particularly acute in light of rapid changes in information technologies and in STI systems based in these technologies.

No adequate solutions to these problems have been found, despite a number of training courses offered worldwide by various national and international organizations. They were just not frequent enough and often not too good, either. The same type of problems are listed for university education: lectures, content, orientation, professional status, resources, facilities. Formal education programs in universities are said to pay little or no attention to continuing education.

The U.S. did not participate to any great extent in an organized way in continuing education programs in LDCs. However, many lecturers and some institutions from the U.S. gave courses or participated otherwise in continuing education on their own. One suggestion often made is to assist in preparing 'educational packages' (including course and demonstration materials, audio-visuals, particularly videotapes and films) that could be used for continuing education.

7. CONCLUSIONS - SUMMARY

7.1 Aims

The aim of this paper is to survey and analyze the literature emanating from less developed countries (LDCs) and international agencies and dealing with their perception of the needs of LDCs for scientific and technical information (STI) in relation to social and economic development. The literature surveyed comes from three different constituencies: (i) scientists, engineers, technologists as users of information, (ii) information specialists as purveyors of information and (iii) officials, planners and policy makers. Thus the perceptions surveyed come from different vantage points. Some of the perceptions are explicitly stated, others are derived from activities in STI that were either undertaken or are being promoted -- in these cases the actions or proposals implicitly reflect perceptions. All of the conclusions in this paper are based on statements in the literature listed in the bibliography. However, the statements, conclusions and recommendations found in the literature are often made without support or evidence. Particular attention was paid in this paper to the

various UNCSTD reports and recommendations. Out of the 190 consolidated recommendations for UNCSTD, 38 or 20% pertain to some or other aspects of STI.

7.2 Recognition of STI: International and National

7.2.1 Recognition of the Need for STI in Development in General

Considerable efforts were extended in this direction, particularly by UNESCO. Nevertheless, a number of problems and obstacles were mentioned:

1. Still a low level of recognition, particularly by officials and decision makers of higher rank

2. Percentage of R&D budgets allocated for STI activities much lower than in developed countries; often only lip service paid to STI

3. Very few facts and solid studies exist on the relation between STI and development

4. Existing studies are of questionable value because of questionable methods applied

7.2.2 Involvement of UN and other international agencies in promotion of STI activities

Their involvement is broad and well received. Considerable achievements have been acknowledged. Many calls are made for further and greater involvement.

Problems/Obstacles:

1. So many international agencies are involved with STI that in itself this presents a problem. Lack of coordination and cooperation between agencies

2. Too many recommendations are made; some contradictory. Individual agencies and missions pursue their particular interests to the exclusion of general goals of a country. Confusion is created in setting national priorities.

3. Too little follow-up on recommendations. Recommendations are difficult to evaluate

4. Focal points for international STI activities as selected in some countries are inappropriate. They have little or no connection with STI activities in a practical sense

5. Activities are not aimed toward discrimination from the large quantity of STI materials available; problems of "information explosion" are attacked but not of "information pollution"

6. International activities as instituted tend to reinforce rather than transform the dependency relation between developed countries and LDCs; they do not promote links among developing countries

7.2.3 International Information Systems

Application of the "territorial formula" in operations of international systems such as INIS, AGRIS is very popular and deemed appropriate. Calls are made for many more such systems. Their value is recognized not only in relation to information provided, but also as a stimulus for development of national and regional systems, as an excellent provider for training and as a vehicle for reduction of dependency on STI products/services controlled by any one developed country.

Problems/Obstacles:

1. Considerably more proposals and plans were made than actual systems instituted

2. Those systems that are instituted are still not used widely in LDCs. The systems and their products are not widely promoted. They are new and thus infamiliar.

3. Standardization and harmonization between various international systems and national systems is low

4. Differences in input formats, software, and other aspects prevent participation of many countries. It is particularly noted that because of this the U.S. National Library of Agriculture is inputing only 20% of what it is processing to AGRIS, thus depriving AGRIS of a major source of agricultural information

5. Quality of operations varies between countries. Internal quality and appropriateness of indexing and vocabulary controls is questionable

6. Transfer of software from one country of system to another is most difficult

7. Lack of qualified personnel

8. Uncertain commitment of resources for these systems makes for uncertainty in further development to a full potential and even for a likelihood of suspension of operations. This is viewed as possibly significantly impeding the LDCs' access to information of practical nature which could be of immediate utility to them (particularly in relation to AGRIS)

9. Lack of credibility, particularly in developed countries. The latter view these systems differently than LDCs.

(E.g. developed countries say that they already have these services; the systems have too much material of low scientific value; emphasis is on topics not of direct interest; little to gain in participating; participation is a form of foreign aid, rather than of STI value)

7.2.4 National STI Systems

Some 28 LDCs instituted a national STI system in some form or another. Their strength is not only in their products/services provided but also in contributing in development of information professionals.

Problems/Obstacles

1. Difficulties in defining the scope of their coverage, because science and technology covers such a broad range of activities and subjects

2. Difficulties in finding their place and most effective role in the sceme of national development

3. Marginal resources with negative results on operations

4. Often a questionable relation between products/services provided and the actual information needs

A number of countries have instituted information systems devoted to a given scientific or technical subject. The big difference between LDCs and developed countries is that the latter have fewer national STI systems and more subject systems. The subject systems in LDCs are so far limited to just a few subjects: health, agriculture, energy and environment. The problems are similar as above, although they have considerably less problems with definition.

7.2.5 Industrial Information Systems

Many LDCs instituted systems that are generally oriented toward problems of industrial information. There also exist systems oriented toward one industrial sector.

Problems/Obstacles:

1. They are attempting broad industrial coverage but end up supporting only a select number of larger industries

2. Low effectiveness in problems of technology transfer and in recognition/creation of appropriate technology

3. Providing too much bibliographic information and referrals vs. direct and simple answers; low power of synthesizing information

4. Low power in assessing the accuracy and value of information

7.2.6 National Plans and Policies

These are perceived as a very necessary element. Recommendations to institute national plans and policies for STI are constantly made at every international forum.

Problems/Obstacles

1. Despite numerous recommendations very few countries made an effort to actually draft plans and policies specifically for STI. In many cases these are incorporated in broader national plans.

2. It is not clear why the area of STI warrants plans and policies separate from general policies. Should every national activity have a separate plan and policy?

3. In the few cases where separate STI policies were adopted, there was no evidence of compliance and thus of effects.

4. The process of drafting separate STI policies is cumbersome; in part this is because of the confusion between subjects of policies for science and technology, for STI, and general information policies.

7.3 Availability of STI

7.3.1 Categorization of STI

Many perceptions exists on the division of STI into certain categories. The range of what is meant by STI is very wide. Among the more frequently mentioned are:

In terms of necessary knowledge:

- know-why information (more scientific, readily available)
- know-why information (more technical, harder to get)
- know-why information (operational, hardest to get and transfer)

As to STI resources:

- formal resources (open literature)
- informal resources (conferences, contacts)
- special and negotiable resources (patents, licenses)

As to information for different types of users:

- scientists, engineering
- business managers, industrialist
- administrators, policy makers
- extention workers
- semi-educated persons
- illiterates

Problems/Obstacles

1. Wide differences in perceptions of what constitutes STI
2. Wide range of STI requirements in terms of levels of users
3. For some categories the type and level of STI is not readily available
4. For some categories (such as special and negotiable information -- patents, licenses, operating manuals, commercial and economic information, etc.) it is felt that developed countries pose exploitative restrictions.

7.3.2 Scientific Information

There is relatively little demand for and discussion of strictly scientific information. But there are some strongly held views and perceptions of the particular type of science (and thus scientific information) of benefit to LDCs.

Perceptions and related obstacles:

1. In some countries where science played a role in development of some areas, there are calls for a fundamental rearrangement of scientific priorities and applications, i.e. toward the needs of majority of populace in curing social deficiencies (malnutrition, housing, public health, transportation etc.); in this respect needs for different subjects of scientific information are perceived and on a different level of population (e.g. general and rural population). There is a scarity of such information, or it even does not exist in the desirable form.

2. In some instances it is perceived that much of scientific information from developed countries is superfluous; research in relation to needs of LDCs is not carried out to any extent in developed countries (e.g. in tropical diseases).

3. Scientific research (and thus information) is viewed in some instances as not affordable by LDCs.

7.3.3 Technological and Industrial Information

This is the major area of concern by all LDCs. However, marked differences in perception of what type of information is needed exist according to the level of development. The perceptions are markedly different than those in the U.S. What is meant by technological and industrial information in the U.S. is much narrower than what is meant in LDCs.

Perceptions according to level of development:

1. In countries on first (pre-industrial) and second (begining industrialization) level of development information needs are perceived in much more basic terms; in particular the needs for (i) technological information, (ii) technical training and (iii) general education are treated as inseparable (these are dealt as separate problems in the U.S.).

2. In African countries the stress is on areas of agriculture, public health and engineering; requirements are also for assistance in analysis of information needs for specific requirements and objectives of development.

3. In Asian countries the stress is on industrial planning, technological choices, technology transfer, and industrial operations.

4. In Latin American countries the stress is also on technical and economic information that strengthens positions in bargaining and particularly in negotiating for licenses and patents.

5. In general in countries at the third (relatively advanced industrialization) level of development the concern is with information for: creation and extention of technical know-how; development of new industries/products and diversification; increase in efficiency of production; increase in industrial employment.

6. Assistance to small industry is considered in all countries as a particularly neglected area. It is noted that there is no connection with small industries in the U.S. and that smaller developed countries (e.g. Denmark) may be more suitable for help with smaller industries.

One of the notions receiving considerable attention in LDCs is appropriate technology. It is perceived that the cure for many developmental failures (e.g. import of "turn-key" factories that become sick or inoperable industries; or of high capital-intensive and low labor-intensive technologies) is development and application of appropriate

technologies. Closely associated and even inseparable with it is the notion of appropriate information. Discussion of appropriate technology (and with it of appropriate information) is to be expected to be a major theme of international discussions. In a way the notion of appropriate technology is also a refutation of some models of development, stressing development of heavy industries and quantum jumps and acceptance of more moderate models but which will affect a much broader populace.

However, one of the major problems is that the notion means different things to different people, countries and contexts. The range of meanings include:

1. "Museum technology" - i.e. technology that was used in developed countries when they were at similar level of development as LDCs; suggestions are made for searching of museums and synthesis of findings.

2. Technology that is labor-intensive, small-scale designed to meet the basic needs, raise productivity of the poorest people, and use local resources.

3. On the other extreme is the view that this is the technology a country would chose given as wide a range of choices as possible; in this case the task of promoting appropriate technology is that of widening the available spectrum of technologies of all sorts.

4. In terms of resources, it is technology that is intensive in use of abundant factor, labor, economical in use of scarce factors, capital and highly trained personnel and intensive in use of domestically produced inputs.

5. In terms of scale: it is technology that is small scale but efficient, readily replicable, operated, maintained and repaired, low cost and accessible to people and enterprises with low income.

6. In terms of compatibility it is technology compatible with local cultural and social environment.

The problems/obstacles in obtaining the related appropriate information are considerable because it is simply not readily available; it is perceived that there is a need for:

1. Generation (creation) of relevant information materials which are not fully available

2. Repackaging of information from many sources

3. Screening and evaluating information, providing assessment of technological information

4. Importing of information about successful applications of technology from other LDCs

5. Emphasizing information links between developing countries

In general, it is perceived that appropriate technology and information will require entirely new information systems and communication links, but the proposals in that respect are still rather nebulous. One thing is clear: a much higher amount of resources will be needed for such systems.

In a number of cases it is perceived that:

1. Developed countries are not willing to provide appropriate technology and information because it is in their interest to continue to provide expensive large scale technologies and finished products.

2. Appropriate technology will not reduce technological dependency.

3. Inadequate action on appropriate technology prolongs exploitation of LDCs; such technology is necessary for a new economic order.

4. In an opposition view to appropriate technology it is seen that such technology is also an attempt to sell LDCs inferior technology, one that will keep them permanently underdeveloped.

7.3.4 Policy and Decision Making Information

This is an area most recently added to the perception of needed STI. The range of information requirements in this area is very wide because it is meant for use by a wide audience in making decisions, including:

1. Government officials, politicians, planners

2. Managers in banks, business and industry

3. Industrial designers

4. Plant engineers, operational personnel

The type of information needed for decisions includes:

1. Business and management information: financial and commercial data, names, addresses, volumes, reliability of firms in given sectors; productivity, inventories, resource distribution etc.

2. Marketing information: markets, products, forecasts, costs and pricing.

3. Negotiable information: licenses, patents, consultancy assessments.

4. Design information: standards, specifications, blueprints, industrial catalogs, regulations.

5. Operational information: maintenance and repair manuals; replacements; process specifications and guides.

6. Laws and regulations: international and in various nations.

Often mentioned desires are to provide

1. Analysis of such information, particularly with assessment of value.

2. Reviews of various topics; extraction and synthesis from many sources into one or few accessible files.

3. Assessment of future impacts of alternate decisions.

4. Information that will increase negotiating capabilities; similar experiences from other LDCs.

It is also realized that such information is not readily available and that new systems will be needed. There are views that developed countries are not amicable to provision of such information, that too many restrictions are imposed, particularly on proprietary information. It is perceived that such proprietary information in particular and decision-making information in general is of great value to LDCs and for this reason it is highly desirable, but also highly unobtainable.

7.3.5 Selection of STI Literature by Information Systems:

Problems/Obstacles:

1. STI literature is growing at a much higher rate than the resources of information systems, leaving less and less money for selection of more and more literature.

2. STI literature from LDCs is also growing at a high rate, making for more dispersion and harder selection.

3. Criteria for selection of the type of desired information are not well stated, if they are stated at all.

4. Resource sharing efforts for cooperative selection between information systems in LDCs are generally ineffective.

5. Problem of translation is growing rather than receding.

6. Much literature that is desired, does not exist in a form or at a level appropriate for given users, thus creation of such literature is necessary.

7. The problem of selecting qualitative items in the literature from all that quantity is becoming more acute.

8. There is a lack of tools from which to do selection.

7.3.6 Acquisition of Literature (documents) by Information Systems:

Problems/Obstacles:

1. Currency restrictions in many LDCs; low priority for foreign exchange funds for STI material.

2. Inadequate postal and telecommunication services; very slow overseas deliveries; high rate of lost mterials in transit.

3. Inadequate attention of publishers in developed countries to special problems in LDCs.

4. Copyright restrictions.

5. Lack of photocopying services for and in LDCs.

6. Low degree of success of plans for exchange or free provision of books, reports, journals etc.

7. Intensified problems in getting hard copy of documents for which citations were retrieved from data base or indexes.

8. Lack of adequate library collections to fall back for delivery of documents from data base searches.

7.3.7 Awareness of STI resources in the U.S. and Economic Considerations

It is generally perceived in LDCs that many other developed countries are suppliers of technology, but that the U.S. is the prime supplier of STI because of its large information resources and services.

Problems/Obstacles:

1. Despite the above general perception, there is a low awareness in LDCs about specific information resources in the U.S. (existence, names, addresses, contents, area of usefulness, services provided, mode of access, etc.).

2. A number of directories that were published did not perceptively alleviate this situation.

3. The awareness is especially low of sources that do not cover traditional STI areas and literature (e.g. numerical data bases, statistics, business information, patents etc.) which in turn is perceived as highly desirable in LDCs.

4. Marketing of U.S. information sources and services in LDCs by U.S. firms and agencies is low.

5. Interest of U.S. public and private organizations dealing with data bases in establishing modes in and links with LDCs is minimal. The example of NTIS is not followed.

6. Economics of information industry, in the U.S., particularly the private sector, are not understood in LDCs. This causes many false impressions and charges of exploitation or deliberate creation of barriers to STI.

7. Costs and cost/benefits of information systems and services are generally not studied, debated or understood. When the costs are revealed they are perceived as very high.

7.4 Accessibility of STI

7.4.1 Intellectual Organization of STI

U.S. schemes and procedures have a world wide impact; many LDCs are adapting or using them. International standards are perceived as very desirable, particularly because of systems interconnection.

Problems/Obstacles:

1. Deriving specific schemes and procedures reflecting specific environments and requirements in given LDCs.

2. Adapting schemes from abroad; translating available schemes.

3. Obtaining or constructing tools for vocabulary controls, thesauri, in particular, for specific subjects; adapting multilingual thesauri.

4. Specifying indexing, cataloging and similar procedures; quality control of these processes once specified.

5. Still a low degree of standardization.

6. Low number of tools necessary for resource sharing and cooperation (e.g. union lists); great intellectual and technical difficulties in creating them.

7. Low understanding and interest in the U.S. about these issues, particularly in view that U.S. schemes, tools and procedures are widely used.

7.4.2 Housing of STI

Problems/Obstacles

1. Inadequate physical facilities from buildings (libraries, information centers) to computers.

2. Biased size distribution: in many countries there are few larger STI facilities and no smaller ones, particularly in smaller enterprises, schools etc.

3. Biased geographical distribution: STI facilities tend to be in a few larger national centers, often far away from potential users; distance serves as a very effective barrier to use.

4. Few attempts to combine centralized facilities with decentralized services or branches.

7.4.3 Dissemination of STI

Problems/Obstacles:

1. In many LDCs limited range of dissemination services offered by libraries and information centers; tend to stick with traditional services (e.g. circulation) and products (e.g. bibliographies).

2. Information centers are more product than service oriented; STI search orientation often lacking.

3. Relative absence of modern services (e.g. SDI, retrospective searching, photocopying, assistance in question formulation and analysis etc.).

4. STI searching is hampered by the lack of indexes and abstracts; low degree of skills by librarians and information scientists in using such sources where existing.

7.4.5 Application of Information Technology

Examples of usage of computers and other information technologies in developed countries had a great impact on the aspirations of librarians, information scientists and officials in LDCs; this impact is so great that often the expectations are dangerously high and naive, because it is not realized what is entailed and how complex the applications of information technologies are. However, many computer applications for some or other aspect of STI activities are recorded in LDCs. In many LDCs a nucleus of computer experienced information specialists exists. Next to appropriate technology and information, further applications of information technology and related networks for STI is a major topic of perceived needs.

Problems/Obstacles:

1. Lack of access to computers by STI facilities; consequently still a low degree of experience.

2. Lack of adequate software; low in-house or in-country capacity to adapt or produce needed software; too few attempts to transfer software beyond mere provision. When and where attempted, methods used for transfer did not produce high successes. Inability to evaluate ready-made software.

3. Lack of trained manpower -- usually listed as the number one obstacle in applications of information technology.

4. For information retrieval applications: lack of files (data bases) on which to perform them; no (or very small) production of local or regional data bases which are deemed as highly desirable.

5. Great difficulties in acquiring and adapting for domestic use data bases that are commercially available from U.S. and other developed countries. Often it is perceived that undue barriers are put up for doing do. Little interest by data base producers in U.S. toward utilization of data bases in LDCs.

6. Same mistakes committed in applications of information technologies as were in U.S. and other developed countries; little learning from other mistakes.

In a number of instances it is perceived that a number of trading barriers exist for all kinds of aspects related to information technology, (software, hardware, network interconnection, data base purchase, data base access etc.). This is a most sensitive issue and the U.S. is often painted as the villain because it has the most developed information technology, networks and information industry. Often these criticisms are coached in a strong ideological framework. The criticism also involves transnational companies.

7.4.6 Information Networks

As mentioned, information networks (national, regional and international) primarily based on information technology are perceived as a major necessity and solution to problems of tapping the world STI resources. It is a major point of expectations from the U.S. and a major point of impatience, particularly because many demonstrations of on-line data base services were made in LDCs and they whetted the appetites.

Problems/Obstacles

1. Lack of adequate national and international telecommunication facilities and networks on which to base STI networks.

2. For national networks within LDCs: a chronic lack of willingness to cooperate among librarians and information scientists; 'territorial' fears and lack of explanations and thus understanding of network activities and benefits; low motivation for realization of networks.

3. Difficulties in arranging for access of U.S. on-line data base services (such as SDC, Lockheed etc.), low degree of interest on the part of these services toward LDCs.

4. Administrative demands and rules put up by U.S. government on-line services (such as NLM) -- these are often deemed as unrealistic and prohibitive; low assistance in establishing links with such U.S. services.

5. Difficulties in setting up SDI-networks for batch processing of requests (as opposed to on-line searching).

6. Lack of clarification on the connection between domestic SDI services and international on-line data base services.

7. Confusion between the issues related to informatics and STI services; informatics involving all sorts of computation and data transmissions.

8. Legal and regulatory issues in international STI networks; privacy of personal and societal nature; security; intellectual property rights.

9. Interconnection and technical difficulties; standardization.

10. Economic constraints; high costs for realization of networks. Often the prices for access of STI networks are considered as being set-up too high and prohibitive for LDCs; this is resented.

In general, U.S. participated little up until now in the growing debate on international STI networks, while there are many, many accounts by LDC authors of such networks in the U.S. Numerous requests were made that the U.S. and other developed countries provide access to STI networks at reduced prices and some requests were made that such access be free.

7.5 Utilization of STI

7.5.1 Use of STI systems

Problems/Obstacles

1. General underutilization of STI systems and resources where they exist; use of such systems is simply not high at all.

2. Utilization of STI, not widespread even when readily available; large proportion of potential users are non-users.

3. Tradition of using STI systems are not well developed.

7.5.2 User Education

Problems/Obstacles:

1. Low skills and knowledge of users in utilizing information itself; the problem thus is not only in availability and accessibility of STI and in STI systems and networks but in users themselves.

2. Formal academic programs do not condition potential users toward use of information; emphasis on textbooks and rote learning; broader aspects of STI are not a significant part of education; faculty and curricula simply not oriented toward STI.

3. Sporadic efforts (seminars, courses etc.) in user education (those working already as professionals) by STI systems.

4. Institution of curriculum and materials for short user training courses; making users willing to attend such courses.

The U.S. has a considerable number of students from LDCs; in particular graduate schools in many universities are teaming with LDC students. Suggestions were made: (i) to supplement the education of LDC students in STI disciplines with special education in availability, accessibility and utilization of STI and with training on operations of STI systems, (ii) to have the U.S. faculty become more involved with LDC students and more sensitive about STI problems in LDCs, (iii) to support curricular changes that emphasize use of information within various STI programs attended by LDC students.

7.5.3 User requirements

Problems/Obstacles:

1. Relative absence of studies of user information needs; lack of methodologies and ready made procedures appropriate for such studies.

2. Difficulties by users in formulating and expressing their information requirements and questions; these are increasing with introduction of computerized STI systems.

3. Low degree of assistance by STI systems to users in formulation of their requirements and questions.

7.5.4 Promotion and Marketing

Problems/Obstacles

1. Low degree of recognition of the need for promotion and marketing of STI products and services.

2. Lack of promotion and marketing efforts, techniques and methods; absence of market research.

3. Lack of connection being made between the marketing and promotion efforts and the recognition of the value of STI in development in general.

4. Inadequate attention paid in U.S. and other developed countries to development of marketing efforts and market research of specific use for STI in LDCs.

7.5.5 Evaluation

Problems/Obstacles:

1. Too few evaluation efforts -- despite numerous recommendations made for evaluation of national and international STI efforts.

2. Misdirected and inadequate efforts and mistakes continued for lack of evaluations; resources squandered.

3. Lack of valid and reliable methodologies for evaluations; trip reports and brief interviews are too shallow and even misleading as evaluation methods.

4. Low degree of U.S. involvement in evaluation of STI efforts, even where the U.S. was directly involved.

7.6 Education and Training of STI Professionals

This is another major area of concern. It is perceived that it is impossible to build STI systems and services (particularly in relation to utilization of modern information technology and international networks) without properly educated/trained professionals and that the major obstacle to all STI activities is the lack of such personnel.

7.6.1 Activities of International Organizations

On insistent requests by LDCs, international organizations are deeply involved in education and training efforts. Requests are for (i) assistance in building facilities for formal, systematic education of STI professionals and (ii) international support in training of managers and advanced specialists for national STI systems and for education of future educators.

Problems/Obstacles

1. Sporadic nature of these efforts; lack of long term financial resources to sustain these efforts.

2. Involvement of too many UN and international agencies without considerations of each others efforts; lack of coordination.

3. Lack of international educational planning.

4. Questionable quality of many educational training efforts.

5. Collapse of many efforts after international support was stopped.

7.6.2 University Education

Problem/Obstacles

1. Issue of whether preparation of STI professionals should be university (academically) based or should it involve short training of a specialist which already has a degree in other subjects still not fully settled, particularly not for industrial information systems.

2. Lack of qualified faculty in programs relevant to STI activities: librarianship, information science, computing.

3. Determination of level of university education.

4. Difficulties in determination of relevant curriculum to be taught.

5. Low degree of relationship between curricula as instituted and existing national STI systems plans and policies.

6. Teaching advanced methods of STI handling (e.g. computerization, on-line services) in relation to their relevance or irrelevance to domestic situation.

7. Orientation of programs to satisfy a whole range of information needs from most elementary to most sophisticated.

8. Lack of adequate educational resources and facilities, including textbooks in native languages, laboratories, library and course materials, access to computers etc.

9. Lack of positive career development opportunities and professional status of graduates of these programs in many LDCs; this does not work well for attracting best prospective students.

A large number of students from LDCs are being educated in subjects relevant to STI activities in the U.S. and other developed countries. Criticisms are voiced that often such students are 'over-educated' and without competencies needed for the country's environment and that students coming from different institutions or countries bring different philosophies and solutions, creating difficulties for working together. It is often perceived that the U.S. should provide more attention toward:

1. Increasing the opportunities for LDC students to study STI subjects in the U.S. and particularly for future faculty members.

2. Increasing the orientation of U.S. programs for LDC students toward problems of LDCs.

3. Initiating and sustaining direct and long term cooperation between similar schools in the U.S. and LDCs to develop faculty, curriculum, courses and to help in teaching.

7.6.3 Training and Continuing Education

Problems/Obstacles

1. Not enough opportunities, facilities and resources for practical training of future STI professionals during their academic training, particularly in relation to information technology.

2. Lack of opportunities for continuing education of already practicing professionals.

3. Sporadic nature of the efforts for continuing education. Great diversity in quality of such training courses.

The U.S. did not participate to any great extent in continuing education/training efforts; calls were made for intensification of such participation; also for creation of "educational packages" suitable for continuing education.

7.7 Major Themes and Expectations

The strongest and most often made recommendations made by LDCs pertain to:

1. Need for appropriate technology and related appropriate information

2. Need for policy-making and business information

3. Requests for more development of international STI systems and networks

4. Need for building necessary information infrastructure, particularly assistance in education/training of STI professionals

5. Strengthening of regional approaches to STI and developing - developing links

The major expectations of LDCs from the U.S. are surmized from general expectations from developed countries:

1. Easier access to U.S. based STI systems; more consideration by these systems of LDCs needs.

2. Greater involvement in and contribution to of U.S. STI systems and networks international systems and networks (such as AGRIS)

3. Easier access to information technology and telecommunication networks and assistance in their deployment in LDCs, particularly in relation to software and training

4. More opportunities for direct exchanges between scientists, engineers and STI professionals in LDCs and those in the U.S.

5. Assistance with costs of acquisition of S&T literature and STI in general

6. Easier access to hard-to-get information, particularly to policy making, business and negotiable information

7. Assistance in building of national STI systems, particularly in education/training of necessary STI professionals.

8. REFERENCES

1. Atherton, P. Handbook for Information Systems and Services. UNESCO.

2. Beverly, J. E. Summary Appraisal of Technical Information Situation in Latin America in relation to Possible International Networks. UN Economic and Social Council, CEPAL/MEX/77/14 (77-7-379-50). Mexico, July 1977.

3. Brewster, B. J. American Overseas Library Technical Assistance 1940-1970 Scarecrow Press, 1976.

4. Dextre, S. G. "Industrial Information in Latin America." Information Scientist. 10(4): 149-156. December 1976.

5. International Council of Scientific Unions/Committee on Science and Technology in Developing Countries (ICSU/COSTED). Impact of Information Services on National Development. (Report of a study on India and Malaysia) Bangalore, India, December 26, 1977.

6. International Federation for Documentation. Commission for Asia and Oceania. (FID/CAO) Proceeding of the Fifth General Assembly and Congress. Seoul, Korea, 18-20. October 1978.

7. International Institute for Applied Systems Analysis (IIASA) Study of the Potential Use of Informatics Technology on Problems of Scientific and Technological Cooperation. Prepared for UNESCO. Laxenburg, Austria. June 1977.

8. King, D. W. et al. Statistical Indicators of Scientific and Technical Communication (1960-1980). King Research Inc. Washington PB-254 060.

9. Lancaster, F. W. and Martyn, J. "Assessing the Benefits and Promise of an International Information Program (AGRIS)" Journal of the American Society for Information Science. 29(6): 283-288, November 1978.

10. Malugani, M. D. "Evolution of Latin America and Caribbean Regional Participation in AGRIS." Quart. Bull. Internat. Assoc. Agric. Libr. & Doc. 23(3-4): Fall - Winter 1978.

11. Menou, M. J. Strategic Issues Regarding Basic Education Programs in Information Science in Less Developed Countries. International Federation of Documentation. Seminar on Education in Information Science. FID/ET/II/1. Edinburgh, September 18-21, 1976.

12. Okwvovulu, A. O. "Biomedical Periodicals in Nigerian Medical Libraries: The Medical Librarian's Dilemma." Bull. Med. Libr. Assoc. 64(3): 305-308. July 1976.

13. Page, J. Information Systems and Networks for Technology Transfer. (Final Report for UNESCO, Contract SC551.5718) IATFIS/V/CRP.6 June 1978.

14. Poncelet, J. Principal Directions Relative to Implementation and Evaluation of STI and Automatic Documentation Services (In French) UNESCO/UNISIST PGI - 78/WS/ZZ. September 24, 1978.

15. Radhakrishna, S. and Iyenjar, T. K. S. ed. Technical Information Services for Developing Countries. International Council of Scientific Unions; Committee on Science and Technology in Developing Countries (ICSU/COSTED); Indian Institute of Science, Bangalore, India. 1977.

16. Robredo, J. "Problems Involved in Setting "p and Operating Information Networks in the Developing Countries". UNESCO Bull. Libr. 30(5): 251-254. September - October 1976.

17. Romerio, G. F. A Central American Information Retrieval Network. UNESCO/UNISIST PGI/78/WS/8, Paris, March 1978.

18. Samaha, H. A Study of the Application of Scientific and Technological Information in Development. Field Study in Tanzania. UNESCO/UNISIST PGI/78/WS/6, Paris, February 1978.

19. Schlie, T. et al. Report on a Conference on The Role of Scientific and Technical Information Services in the Transfer of Technology in Latin America. National Science Foundation, Washington, D. C. 16-18 February 1976.

20. Schlie, T. W. A UNIDO Industrial Information Bank: A Survey of Some Feasibility Issues. Report for the Internation Center for Industrial Studies, UNIDO, Denver, June 21, 1976.

21. Schlie, T. et al. Seminar on Industrial Information, 38th World Congress FID, Mexico, October 1-2, 1976.

22. Standing Conference of Eastern Central and Southern African Libraries. Libraries and Information Services as Instruments of Transition to the 21st Century in Africa. (Proceedings of SCECSAL 2) Zambia Library Assoc., Lusaka, 1978.

23. Steward, F. International Mechanisms for the Promotion of Appropriate Technology. Prepared for Expert Meeting on International Action for Appropriate Technology. Geneva, 5-9, December 1977.

24. Tome, M. "Advances in Preparation of Special Librarians and Information Specialists in Latin America: Analysis of Problems and Education Processes." (In Spanish). Quart. Bull. Internat. Assoc. Agric. Libr. & Doc. 23(3-4): Fall-Winter, 1978.

25. U.N. Economic Commission for Western Asia. A Study and Assessment of Information Resources in Selected Developing Countries (ECWA Region). E/ECWA/NR/2 Beirut, August 18, 1977.

26. UNESCO. World Guide to Library Schools and Training Courses in Documentation. ISBN 92-3-001024-3, Paris 1972.

27. UNESCO. World Guide to Technical Information and Documentation Services. 2nd ed, revised. ISBN 92-3-001228-9, Paris 1975.

28. UNESCO. Feasibility Study: Data Bank Services in Africa. SC-75/Conf. 501/Col. 3. Paris, March 3, 1975.

29. UNESCO. Guidelines for Planning of National Scientific and Technological Information Systems. SC/75/WS/39. Paris, 1975.

30. UNESCO. Second UNISIST Meeting of Experts on Regional Information Policy and Planning in South and Central Asia. ROSTSCA/UNISIST/II/17, New Delhi, May 15, 1976.

31. UNESCO. Information Policy for Development: National and International Responsibilities. (First UNISIST Meeting on the Planning and Implementing of National Information Activities in Science and Technology).

32. UNESCO/IFLA. Resolution of the Seminar on Resource Sharing in Libraries in Developing Countries. (Held at Autwerp University August 30 - September 4, 1977) D5/5 IFLA - P - 77 70905-HV/csa. 1977.

33. UNESCO. Bibliographical Services throughout the World, 1970-1975. Paris, 1977.

34. UNESCO. Management of Information Resources at the National Level. (Second UNIST Meeting on the Planning and Implementating of National Information Activities in Science and Technology). PGI/77/Conf. 605/Col. 3, Paris January, 1978.

35. UNESCO. First UNISIST Meeting of Experts on Regional Information Policy and Planning in Southeast Asia. PGI-77/WS/5. January 19, 1978.

36. UNESCO. Recommendations - 7th Regional Committee for the Development of Information Services in Eastern Africa. Nairobi, April 18-20, 1978.

37. UNESCO. First UNISIST Meeting on Regional Information Policy and Planning in West Africa. PGI/UNISIST/WA/I/3 Paris, June 27, 1978.

38. UNESCO. Cooperation in the Field of Computerized Documentation Techniques and SDI. Discussion paper prepared for the International Seminar on Selective Dissemination of Information. Ottawa, Canada. October 2-4, 1978.

39. UN General Assembly. UNCSTD: Draft Outline of the Program for Action. Note by the Secretary-General. A/33/303 and Add. 1. New York. October 20, 1978.

40. UN General Assembly. United Nations Conference on Science and Technology for Development. Report of the Secretary-General. A/33/298. New York, October 18, 1978.

UN Interagency Task Force on Information Exchange and the Transfer of Technology (IATFIS).
Reports:

41. Report on a Mission to Bangladesh and Thailand by V. Umbricht. IATFIS/V/CRP.2 September 12, 1977.

42. Report on a Mission to South America in Connection with Consideration of a Global Network for the Exchange of Technological Information by J. Longsdon. IATFIS/V/CRP.6, 1977.

43. Interagency Mission on the Establishment of an African Center for the Transfer, Adaptation and Development of Technology. IATFIS/V/CRP. 8, August 31, 1977.

44. Policy Issues and Criteria Relating to the Network for the Exchange of Technological Information. IATFIS/V/CRP. 9 August 31, 1977.

45. Establishment of a Network for the Exchange of Technological Information. Report of the Secretary-General. IATFIS/V/CRP.10, September 22, 1977.

46. Survey of African Needs and Facilities for Technology Information. IATFIS/V/CRP. 11, August 15, 1977.

47. Network for the Exchange of Technological Information: A Review of the Facilities in the ESCAP Region by L. C. Jain. IATFIS/V/GRP. 13, September 12, 1977.

48. UN Intergovernmental Bureau for Informatics (IBI). "The SPIN Conference." IBI Newsletter, no. 27, Fourth Quarter 1978.

49. UN Inter-Organization Board for Information Systems. Directory of UN Information Systems and Services. Geneva, March 1978.

50. UNIDO. A Review of the Work of the Industrial Inquiry Service from 1966-1973. UNIDO/ISID. 84, Vienna, April 4, 1974.

51. UNIDO. Industrial Information in Asia and the Pacific (ESCAP). UNIDO/ISID. 121, Vienna, April 8, 1975.

52. UNIDO. Establishment of an Industrial and Technological Information Bank. Report by the Executive Director. Vienna, March 21, 1977.

53. Valls, J. The Role of "Commodity" and "mission" Oriented Information Centers in Development. International Federation for documentation. Commission for Asia and Oceania. Fifth Congress. Seoul Korea. FID/CAO/V/06. October 18-20, 1978.

54. World Bank. Research Proposal on Transfer of Technology to Small and Medium Enterprises. Washington, D.C. March 28, 1978.

55. Wysocki, A. Education and Training of Information Specialists and Users: the UNISIST Experience. Report by the Director, UNESCO General Information Program at the Fifth Interamerican Conference of Agricultural Librians and Documentalists. Costa Rica. April 10-14, 1978.

56. Zahawi, F. Experiences in Regional Training Schemes for the Arab States with Particular Problems that Arise in these Schemes. International Federation for Documentation. Seminar on Education in Information Science. FID/ET/II/4. Edinburgh, September 18-21, 1978.

UNITED STATES INFORMATION RESOURCES AND SERVICES

Davis B. McCarn
Online Information International, Inc.
Rockville, Md. 20852

1. INTRODUCTION

It has almost become a cliche to note that the United States has become the first post-industrial society, that it has gone beyond the stage where the main source of employment is industrial production. In its brief history, the United States has moved from an agricultural economy to an industrial economy and now to an information economy. PARKER* has summarized the evidence for this transition in his background report for an Organization of European Cooperation and Development (OECD) conference. Information is defined in Dr. Parker's supporting analyses to cover a wide range of activities including education, advertising, television, publishing, telecommunications, computing, libraries, science, and much of management. Using this broad definition, the labor force involved in information has grown from 20% of all workers in 1955 to 50% in 1975; more than half of all the workers in the U.S. are now engaged in some kind of information generation, processing, or dissemination activities. This trend to information handling has been parallelled by the development of information technologies and services. The United States has nearly 30,000 libraries; 89,000 schools, colleges, and universities; and 61,000,000 students. U.S. indexing and abstracting services do over 80% of all the indexing and abstracting in the world. The annual investment in telecommunications and computers in the United States is more than ten times that of any other country.

Scientific and technical information activities are but a small part of this overall information system. In 1975, total U.S. expenditures on research and development were $35.2 billion, about 2.5% of the Gross National Product. The U.S. NATIONAL SCIENCE FOUNDATION has published an estimate that $10 billion of that amount involved the generation, processing, dissemination, and use of information. Approximately 52% of the costs were involved in authoring and use of information, functions that are usually considered outside the purview of information services, but the other 48% was spent on publishing (16%), processing and control (24%), and the creation of numeric data bases (8%). Periodicals account for most of the costs (61%), with books (24%) and other forms such as technical reports and numeric data bases making up the remainder (15%). Information services for U.S. science and technology are provided at the rate of $2400 per year per scientist/engineer. The cumulative advance of science and technology depends in large measure on these information services; they articulate the communications of the scientific community. Without access to such services, scientists and engineers are largely cut off from the fruits of the world's advances in science and technology.

* NOTE: Capitalized names refer to items in the Bibliography.

The scientific and technical communities of the lesser developed countries (LDCs) need access to the information services of the United States not merely to obtain answers to specific developmental problems, not merely to distill appropriate technology from the world's developments, not merely to conduct research in the areas most relevant to their own national problems, but most importantly, they need access to provide the information life-blood without which a community of researchers and engineers cannot be maintained. In this age of international science and technology, a viable program cannot be developed or maintained in isolation. Without adequate access to the world's community, scientists and engineers wither; or they may leave and become part of the "brain drain" from the LDCs. Thus, the provision of appropriate and adequate information access may be a sine qua non for successful development programs.

The United States is uniquely qualified to provide the information access required in the LDCs. It has the richest panoply of information services for science and technology of any nation in the world. Further it has the communications technologies and capabilities to make these services available anywhere in the world. The purpose of this paper is to describe, in a systematic fashion, the major information resources and services of the United States in order to provide a background for the development of the necessary services for the LDCs.

The scientific and technical information services of the United States are various and multitudinous as one would expect in our pluralistic society. They are provided by governmental, educational, professional, research, and commercial institutions. They have become so numerous that referral centers have come into existence to keep track of them and to allow users to find the information resources appropriate to their problems. At the apex of such referral centers is the National Referral Center in the Science and Technology Division of the Library of Congress.

Library of Congress
Science and Technology Division
National Referral Center
Washington, D.C. 20540
Telephone: (202) 426-5670

The National Referral Center assists those who have questions in scientific or technical fields by referring them to organizations that can answer their questions. It provides a single place to which anyone may turn for advice on where to obtain information on specific topics in the physical, biological, social, and engineering sciences, and the many technical areas relating thereto. The National Referral Center maintains a subject-indexed data base that is continually updated by a professional staff and that contains descriptions of some 13,000 organizations having specialized knowledge is some area of science or technology. Organizations covered include professional

societies, university research bureaus and institutes, federal and state agencies and units within them, industrial laboratories, museum specimen collections, testing stations, and individual experts. Also included are the more traditional sources of information, such as technical libraries, information and document centers, and abstracting and indexing services. The Center also publishes a variety of directories to information sources. This paper does not attempt to summarize the information on the 13,000 sources available through the National Referral Center, but rather it will attempt to provide a framework for categorizing the various sources of information and identify some of those of most potential utility to the LDCs.

In addition to referral centers generally and the National Referral Center in particular, the publishing and information industries in the United States devote substantial efforts toward providing information on sources of information in the U.S. One major source of such information is the Information Industry Association:

Information Industry Association
4720 Montgomery Lane, Suite 904
Bethesda, MD 20014
Telephone: (301) 654-4150
Cable: INFORMASSN WASHINGTON

Directories of information sources are produced by the following:

Gale Research Company
Book Tower
Detroit, MI 48226
Telephone: (313) 961-2242

R.R. Bowker Company
1180 Avenue of the Americas
New York, NY 10036
Telephone: (212) 764-5100

McGraw-Hill, Inc.
1221 Avenue of the Americas
New York, NY 10020
Telephone: (212) 977-1221

The first of these, Gale Research, has just begun publication of a Directory Information Service providing a guide to sources of information on information.

KRUZAS and SULLIVAN provide an Encyclopedia of Information Systems and Services which contains 2094 detailed entries on more than 2500 organizations, 400 of which are located in 56 non-U.S. countries. See the bibliography for other illustrative directories.

The information services relevant to the LDCs discussed in this paper will be categorized into three groups: 1) the first group includes those services which provide direct access to the scientific literature by either organizing it so that users can find what they need or by actually providing copies of materials identified as being needed; 2) the second group includes services that assemble information and data and provide actual information to requestors from data bases; 3) the third group includes organizations which provide expert advice and analyses in response to specific questions or problems. These will be referred to as primary, secondary, and tertiary scientific and technical information (STI) services, respectively. For each group a brief description of the characteristics of the group will be given followed by an identification of the major services in the United States relevant to the interests of the LDCs.

2. PRIMARY SCIENTIFIC AND TECHNICAL INFORMATION SERVICES (BIBLIOGRAPHIC)

The primary scientific and technical information services discussed here are those that provide access to the literature of science and technology. In order to provide such access it is necessary to collect and index or abstract the literature and to provide modalities for users to have access to the indexes and abstracts and to the original literature represented in the indexes. These functions are not usually combined in the United States; in most cases large organizations provide indexing and/or abstracting of a segment of the literature, while actual access to the documents is provided by scientific and technical libraries. This specialization of function is possible in the U.S. because of our wealth of large libraries; there are over 11,600 university, special, and medical libraries in the U.S. and these are relied on for most document delivery. Thus, the differentiation of function into 1) the abstracting and indexing services of the organization of information and 2) the libraries for delivery of documents is usually efficient for U.S. science and technology. This is clearly not the case for the LDCs which lack the library infrastructure of the U.S. Some services do exist in the United States for nation- and world-wide delivery of documents, however; and these will be described at the end of this secton.

The abstracting and indexing functions are the fundamental processes required for access to the scientific and technical literature. Indexing and abstracting result in the creation of indexes to the literature that allow users to find material relevant to their concerns. Such abstracting and indexing also, more recently, has resulted in indexes which can be searched on computers from remote terminals, thus, creating more powerful ways of finding needed scientific and technical information. In most cases the organizations

which provide indexes and abstracting services concentrate on specific disciplines and forms of literature. A particular service will cover the journal literature in biology or chemistry, another may cover all government-supported technical reports, and a third covers all doctoral theses. The major U.S. abstracting and indexing services are listed in Table 1. The Table also shows the number of information items processed by each organization in 1967 and 1977. Coverage by these services has been growing at a rate of 5.8% per year, doubling every 12 years.

Much of the information in Table 1 comes from the National Federation of Indexing and Abstracting Services (NFAIS). NFAIS is the organization which represents the interests of and provides communication channels for the major abstracting and indexing organizations of the United States. It also conducts research useful to the abstracting and indexing community and provides educational programs in information science. It publishes a bi-monthly newsletter and an NFAIS Member Services Directory containing a description of principal products and services and coverage for its 39 members. Further information can be obtained from:

National Federation of Abstracting
and Indexing Services
112 S. 16th Street
Philadelphia, PA 19102
Telephone: (215) 563-2406

Table 1 also indicates that U.S. abstracting and indexing activities are dominated by four major producers, who in combination account for 60% of the total items processed in 1977. These organizations are the Institute for Scientific Information, the Chemical Abstracts Services, the BioSciences Information Services, and the National Library of Medicine. Each of these is described further below:

INSTITUTE FOR SCIENTIFIC INFORMATION
325 Chestnut Street
Philadelphia, PA 19106
Telephone: (215) 923-3300
Cable: SCINFO
Telex: 84-5305

The Institute for Scientific Information (ISI) produces multidisciplinary indexes to both the sciences and the social sciences. ISI publishes Science Citation Index, Socl'l Science Citation Index, and Current Contents. The first two products are unique in that the journals indexed are carefully selected on the basis of several criteria, including citation analysis, resulting in the inclusion of 90% of the world's significant scientific and technical literature. Further, ISI uses citation indexing which allows retrieval of newly published articles through the subject relationships established

by an author's references to prior articles. The primary means of access to ISI's indexes is through the tracing of citations to one or more articles known to be relevant to a particular information requirement. ISI indexes cover about 3600 journals in science and technology.

CHEMICAL ABSTRACTS SERVICE
AMERICAN CHEMICAL SOCIETY
THE OHIO STATE UNIVERSITY
Columbus, OH 43210
Telephone: (614) 421-6940
Telex: 82-1608

The Chemical Abstracts Service (CAS) produces Chemical Abstracts, "Key to the World's Chemical Literature." This product and the related computer data base provides worldwide coverage of the chemical sciences literature from over 12,000 journals, patents from 26 countries, new books, conference proceedings, and government research reports. It includes 80 sections, covering biochemistry, organic chemistry, macromolecular chemistry, applied chemistry and chemical engineering, and physical and analytical chemistry.

BIOSCIENCES INFORMATION SERVICE
OF BIOLOGICAL ABSTRACTS
2100 Arch Street
Philadelphia, PA 19103
Telephone: (215) 568-4016
Telex: 83-1739

The BioSciences Information Services (BIOSIS) of Biological Abstracts produces Biological Abstracts and Bioresearch Index and a data base, BIOSIS PREVIEWS, which represents the contents of both of these publications. Biological Abstracts covers approximtely 140,000 accounts of original research yearly from 8,000 primary journal and monograph titles. Bioresearch Index includes an additional 100,000 citations a year from symposia, reviews, preliminary reports, research communications, and other secondary sources. These indexes cover the vast majority of the world's literature on biological research.

NATIONAL LIBRARY OF MEDICINE
8600 Rockville Pike
Bethesda, MD 20014
Telephone: (301) 496-6193

The National Library of Medicine (NLM) indexes the world's medical literature. NLM's primary printed products are Index Medicus, Current Catalog, The Index to the Dental Literature, The International Nursing Index, and The Hospital Literature Index. These products cover approximately 250,000 articles from over 3000 journals in medicine and 14,000 monographs each year. In addition, NLM

produces a variety of special bibliographies and literature searches. NLM also operates a large-scale online information retrieval service, the Medical Literature Analysis and Retrieval System -- Online (MEDLINE); it is the only large abstracting and indexing service that also provides such online service. NLM is an element of the United States Government under the National Institutes of Health.

In general, the organizations listed in Table 1 produce printed indexes to the literature in their areas of expertise or for the specific forms of information that they cover. They also usually produce machine-readable data bases of the same information as appears in their indexes. These data bases are leased or sold to several large organizations that provide online information retrieval services from these data bases and others. Such services are described in the next section.

2.1. Online Bibliographic Retrieval Services

According to WILLIAMS, in 1976 there were 33 million bibliographic references available in the United States for online searching; in 1977 this had grown to 52 million. Further, she estimates that 700,000 online searches were performed in 1974; 1,000,000 in 1975; 1,200,000 in 1976; and over 2,000,000 in 1977. Online search activities are growing at a rate of over 40% per year! These estimates exclude online cataloging. Monographs cataloged by participating libraries at OCLC, Inc., (formerly, the Ohio College Library Center) totaled 4.5 million from mid-1975 to mid-1976 and 6.4 million in 1976-77.

This growth rate is nearly matched by the rapidity of change in the number of data bases being provided. SUMMIT & FIRSCHEIN report that Lockheed provided service from 18 data bases in 197[illegible], 36 in 1976, and over 60 in 1977. Thus, almost anything specific written about this dynamic field is obsolete by the time it appears in print.

2.1.1 The Service Providers

In the United States there are five major providers of online bibliographic search services. They all provide access to a variety of bibliographic files; there is a clear-cut distinction between the producers of the many data bases referred to above and the relatively few major online search services. Each of these services has made arrangements with several or many data base producers to provide online search services for the producer's data bases. These major services are enumerated in Table 2 along with the number of data bases provided as of January 1978.

Table 1

MAJOR UNITED STATES ABSTRACTING
AND INDEXING SERVICES

NUMBER OF SCIENTIFIC AND TECHNICAL
INFORMATION ITEMS INDEXED

NON-GOVERNMENT ORGANIZATIONS	1967 (1000s)	1977 (1000s)
American Dental Association	7	8
American Geological Institute	11	49
American Institute of Physics	--	21
American Meteorological Society	9	7
American Petroleum Institute	29	66
American Psychological Association	17	27
American Society for Metals	24	33
American Theological Library Association Indexes	3	4
BioSciences Information Service	125	250
Chemical Abstracts Service	269	478
Documentation Abstracts, Inc.	1	5
Earthquake Engineering Research Center	--	1
Engineering Index, Inc.	52	97
The Foundation Center	9	44
Institute of Electrical and Electronics Engineers	--	12
Institute for Scientific Information	330	495
International Academy at Santa Barbara	--	24
International Repertory of the Literature of Art (RILA)	--	8
Medical Documentation Service	2	2
National Association of Social Workers	1	1
Philosophy Documentation Center	2	26
Primate Information Center (Seattle)	2	4
Sociological Abstracts, Inc.	9	14
University of Tulsa	16	17
SUB TOTAL	918	1,693
UNITED STATES GOVERNMENT ORGANIZATIONS		
Defense Documentation Center	53	28
Energy Research and Development Administration	47	160
Natioal Aeronautics & Space Administration	107	82
National Agricultural Library	102	126
National Institute of Education/DHEW	--	36
National Library of Medicine	165	260
National Oceanic and Atmospheric Administration	1	3
National Technical Information Service	30	81
Water Resources Scientific Information Center	--	13
SUB TOTAL	505	789
TOTAL	1,423	2,482

Table 2
Major U.S. Online Bibliographic Search Services

Research Service	Retrieval System	Number of Bibliographic Data Bases (Jan. 1978)
National Library of Medicine	ELHILL	18
Lockheed Information Systems	DIALOG	70
SDC Search Service	ORBIT	40
Bibliographic Retrieval Service	STAIRS	15
The New York Times Information Bank	--	1

These services are listed in the approximate order of total connect hour usage of the systems. The manuals provided by each service and of the overall search capabilities offered for each data base. These manuals are listed in the bibliography. An overview of the first four is provided in the Proceedings of the COMPCON 78. A useful summary of the commands for all systems can be found in LAWRENCE ET AL.

The full names and addresses of these services are as follows:

The National Library of Medicine
8600 Rockville Pike
Bethesda, MD 20014
Telephone: (301) 496-6193

DIALOG Service
Lockheed Missiles & Space Company
Code 5020/201
3251 Hanover Street
Palo Alto, CA 94304
Telephone: (415) 493-4411 x45412
Telex: 346-409

SDC Search Service
2500 Colorado Avenue
Santa Monica, CA 90406
Telephone: (213) 829-9463
Telex: 65-2358

Bibliographic Retrieval Services, Inc.
Corporation Park, Building 702
Scotia, NY 12302
Telephone: (518) 374-5011

The Information Bank
Mt. Pleasant Office Park
1719A Route 10
Parsippany, NJ 07054
Telephone: (201) 539-5850

2.1.2 Available Data Bases

The most comprehensive list of all data bases whether online or not is that compiled by WILLIAMS & ROUSE. These authors compiled data on 277 current bibliographic data bases that are commercially or publicly available and are designed or used primarily for bibliographic information retrieval. WILLIAMS summarizes the more recent statistics for such bases as shown in Table 3.

Table 3
Distribution of Machine-Readable
Bibliographic Data Bases

Source		Number of Data Bases		Number of Records (millions)	
		No.	(&)	No.	(%)
U.S.		208	(57)	58	(82)
Non-U.S.		154	(43)	13	(18)
	TOTAL	362	(100)	71	(100)

Some 23% of the records in U.S. data bases are produced by the government sector and 77% by the private sector. Of the 71 million references, 52 million are online as of the end of 1977.

The National Library of Medicine has published information on connect hours and number of searches for its data bases showing 650,000 searches on MEDLINE and its derivative files in 1977. Based on these clues, an educated guess would indicate that the following are the most searched data bases in the United States: (1) MEDLINE, (2) ERIC, (3) CA Condensates, (4) Psychological Abstracts, (5) BIOSIS Preview, (6) NTIS (National Technical Information Service), (7) New York Times Information Bank. The System Development Corp. reports that the most used data base on the ORBIT service is the World Patent Index from Derwent.

Not all of these bibliographic data bases are relevant to the needs of the LDCs; on the other hand, some are making an effort to select information items in accordance with formalized criteria of relevance to LDCs (for example, the NTIS data base). Those that are relevant and available from the major U.S. providers are listed in Table 4. See WILLIAMS and BRANDHORST for the detailed list of 108 data bases provided by six suppliers (Lockheed, BRS, SDC, Battelle, NLM, and New York Times) from which Table 4 is extracted.

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charge ($/Hr.)
AGRICULTURE & FOOD			
AGRICOLA	Cataloging and indexing (CAIN) data base providing worldwide coverage of agriculture; from National Agricultural Library. 1970+	1060	25
Aquatic Sciences and Fisheries Abstracts	Oceanography, pollution, freshwater biology and limnology as well as legal, political, and social topics related to sea and inland water studies; from FAO and UNESCO. 1975+	31	60
Commonwealth Agricultural Bureaux Abstracts	Comprehensive coverage of literature related to the agricultural sciences; from Commonwealth Agricultural Bureaux. January 1973+	690	65
Food Science and Technology Abstracts	International coverage of food science and related technologies; from International Food Information Service. 1969+	153	65
BUSINESS			
INFORM	Abstracted Business Information covering business, finance, and related fields; from ABI. Aug. 1971+	75	65

*As of June 1978

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charge ($/Hr.)
LABORDOC	Worldwide journal and monographic literature in the fields of labor relations, employment, working conditions, economic and social development, management, social security, training, demography, and labor legislation; from International Labor Organization, 1965+	75	75
Management Contents	Journal literature of business and management; from G.D. Searle. Sept. 1974+	43	55
CHEMISTRY			
Chemical Abstracts	Bibliographic data and keyword phrases for chemistry and chemical engineering; from Chemical Abstracts Service (CAS). 1970+	2870	35
Chemical Industry Notes	Extracted from business-oriented periodicals dealing with recent events in the chemical industry; from Predicasts, Inc. and CAS. Dec. 1974+	170	70
CHEMNAME	CAS Registry Numbers, CA Index Names, molecular formulas, and synonyms for chemical substances covered by CASIA; from CAS and Lockheed. 1972+	400	60
CLAIMS/CHEM	U.S. chemical and chemically related patents plus some foreign equivalents; from IFI/Plenum Data Company. 1950+	441	150

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charge ($/Hr.)
EDUCATION			
AIM/ARM	Abstracts of instructional and research materials in vocational and technical education; now updated with ERIC on Lockheed; from Center for Vocational Education. 1967-1976	19	25
ERIC	Complete data base on research and journals in the field of education, including Current Index to Journals in Education and Resources in Education; from the Educational Resources Information Center. 1966+	316	25
Exceptional Child Education Abstracts	Literature dealing with education of handicapped and gifted children; from Council for Exceptional Children. 1966+	27	25
National Information Center for Education Media (NICEM)	Nonprint educational media; from University of Southern California. 1964+	300	70
National Instructional Materials Information Service (NIMIS)	Instructional materials and media used in the education of handicapped children; from National Center on Educational Media and Materials for the Handicapped.	35	35

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charge ($/Hr.)
ENVIRONMENTAL SCIENCES			
Air Pollution Abstracts	Air quality and air pollution prevention and control; from Environmental Protection Agency. 1966+	86	35
Environmental Abstracts	Environmental literature from interdisciplinary perspective: science, technology, politics, sociology, commerce, law; from Environmental Information Center, Inc. 1971+	72	90
Environmental	Wide range of environmental issues including: air transportation, defense programs, energy, hazardous substances, parks and forests, roads and railroads, urban and social programs, wastes and water; from Information Resources Press. 1977+	1	25
Maritime Research Information Service Abstracts	Maritime research including cold-weather regions, cargo, ships, materials, navigation, safety, and harbors; from Maritime Research Information Service of the National Research Council. 1970+	13	45
Meteorological and Geoastrophysical Abstracts	Meteorological and geoastrophysical literature from both U.S. and foreign sources; from American Meteorological Society and NOAA. 1972+	56	50

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charge ($/Hr.)
Oceanic Abstracts	Worldwide coverage of oceanography and marine-related literature; from Data Courier, Inc. 1964+	99	55
PESTDOC	Literature of pesticides and allied data; restricted availability; from Derwent Publications.	83	100
Pollution Abstracts	All types of literature on pollution, its sources, and its controls; from Data Courier, Inc. 1970+	53	65
GEOLOGY AND PETROLEUM			
APILIT	Petroleum literature; restricted availability; from American Petroleum Institute. 1974+	238	65
APIPAT	Petroleum patents; restricted availability; from American Petroleum Institute. 1964+	107	65
GEO-REF	Geosciences; from American Geological Institute. 1961+	477	75
GeoArchive	International coverage of the geo-sciences literature and data; from Geosystems. 1969+	200	70

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charge ($/Hr.)
Petroleum Abstracts	Exploration and production of gas and oil, geology, geophysics, and geochemistry, restricted availability; from University of Tulsa. 1965+	195	125
Petroleum/Energy News	Business news in petroleum and energy; from American Petroleum Institute. 1975+	92	115
HEALTH, MEDICINE, AND BIOLOGY			
Biological Abstracts	Worldwide coverage of the life sciences; from BioSciences Information Service. 1969+	2210	45
CANCERLIT	Abstacts of articles, proceedings of meetings, government reports, symposia reports, selected monographs, books, and theses relating to all aspects of cancer; from National Cancer Institute. 1963+	125	15
CANCERPROJ	Summaries of on-going research projects provided by cancer scientists from many countries; from National Cancer Institute. 1976+	18	15
CATLINE	CATalog-on LINE representing all serials and monographs cataloged by NLM and appearing in its Current Catalog; from NLM. 1965+	176	15

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charge ($/Hr.)
Epilepsy	Citations of articles on epilepsy that have been abstracted by Excerpta Medica; from Excepta Medica. 1945+	22	15
Excerpta Medica	Worldwide coverage of medical literature from Excerpta Medica Foundation.	600	655
International Pharmaceutical Abstracts	World literature in pharmaceuticals related to medicine, nursing, dentistry, and health care; from American Society of Hopital Pharmacists. 1970+	45	50
MEDLINE	Worldwide coverage of biomedical journal literature; from NLM. 1966+	45	50
Pharmaceutical News	Indexing records for seven major drug industry newsletters; from Data Courier, Inc. 1974+	29	65
RINGDOC	Pharmaceutical literature; restricted availability; from Derwent Publications. July 1964+	555	100
TOXLINE/TOXBACK	Human and animal toxicity studies, effects of environmental chemicals and pollutants, adverse drug reactions, and analytical methodology; from NLM. 1940+	834	15

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charge ($/Hr.)
PHYSICAL SCIENCES			
SPIN	More than 90% of the American journal literature on physics as well as all AIP journals and conference proceeding. 1975+	71	35
SOCIAL SCIENCES			
Psychological Abstracts	World literature in psychology and other behavioral sciences; from American Psychological Association. 1967+	263	50
Social Science Citation Index	Multidisciplinary index covering the world's most important social science journals; from Institute for Scientific Information. 1974+	599	70
Sociological Abstracts	In-depth coverage of sociology and related social science areas; from Sociological Abstracts, Inc. 1963+	85	55
TECHNOLOGY AND ENGINEERING			
CLAIMS/CLASS	Classification code and title dictionary covering all classes and selected subclasses of the U.S. patent classification system; from IFI/Plenum Data Company. 1950+	15	90

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charge ($/Hr.)
CLAIMS/GEM	U.S. general, electrical, and mechanical patents; from IFI/Plenum Data Company. 1971-1977	350	90
COMPENDEX	The COMPuterized ENgineering InDEX data base covering engineering literature; from Engineering Index, Inc. 1970+	648	65
INSPEC	Worldwide coverage of physics, electrical engineering, computer science, and control engineering with on-line thesaurus, from Institution of Electrical Engineers. 1969+	1326	45
ISMEC	Information Service in MEChanical Engineering plus engineering management, including an on-line thesaurus; from Data Courier, Inc. 1973+	78	65
Metals Abstracts	Worldwide metallurgical literature including Metals Abstracts Index and Alloys Index; an on-line Thesaurus is provided; from American Society for Metals. 1966+	326	80
Patent Concordance	Correlates patents issued by different countries for the same basic invention; from CAS. 1972+	396	45
Pira	Scientific, technical, marketing, and management literature of the paper, printing, and packaging industries; from Paper and Board, Printing and Packaging Industries Research Association. 1975+	31	55

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charg ($/Hr.)
SAE Abstracts	Papers concerned with self-propelled vehicles and applicable to the aeospace, transportation, and automobile industries; from Society of Automotive Engineers, Inc., (SAE). 1965+	10	80
TITUS	Literature of textiles and related industries, materials structure, and properties; from Institut Textile de France. 1967+	86	75
World Aluminum Abstracts	Technical literature on aluminum, ranging from ore processing (exclusive of mining) through end uses; from American Society for Metals. 1968+	61	50
GENERAL AND MISCELLANEOUS			
Abstract Bulletin of the Institute of Paper Chemistry	Principles, technologies, raw materials, products; practices of manufacturing and utilizing industries from Institute of Paper Chemistry. July 1969+	107	80
Comprehensive Dissertation Index	Doctoral dissertations from accredited universities (predominantly U.S.); from Xerox University Microfilms. 1861+	611	40
Energy Information Abstracts	Energy economics, U.S. policy and planning, research and development, resources and reserves, environmental impact, transmission and storage of electric power and fuel; from Environmental Information Center, Inc. 1971+	23	90

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charge ($/Hr.)
Government Reports Announcements	Broad range of disciplines of more than 240 governmental agencies; from National Technical Information Service. 1964+	451	35
Information Bank	Abstracts of articles appearing in more than 70 major general interest publications, including The New York Times, Washington Post, Wall Street Journal, Time, Scientific American; from the New York Times Information Company. 1969+	1360	90
Language and Language Behavior Abstracts	World literature on speech and language pathology; from Sociological Abstracts, Inc. 1963+		
LIBCON/E, LIBCON/F (MARC)	Cataloging of English-language and foreign-language books; from Library of Congress and various participating libraries. 1965+		
LISA	Library and information science; from Library Association. 1969+	27	50
Magazine Index	More than 350 popular American magazines in fields of current affairs, sports and recreation, business, environment, science and technology; from IAC. 1977+	70	45
PAIS	International coverage of public affairs literature; from Public Affairs Information Service. 1972+	63	60

Table 4
Major Bibliographic Data Bases Online in the United States

Data Base Name	Subject and Scope	Records (Thousands)	Approximate Connect Charge ($/Hr.)
Science Citation Index	Multidisciplinary index to the literature of science and technology; from Institute for Scientific Information. 1974+	2004	70
TRIS-ON-LINE	Resumes of ongoing or recently completed transportation research projects and abstracts of the transportatoin research literature; from Transportation Research Board. Current 5 years.	93	45
World Patents Index	Worldwide patents information; restricted availability; from Derwent Publications. 1963+	1377	120
TOTAL		27,180	

2.2. Document Delivery

As mentioned above, most of the document delivery, the actual provision of copies of the literature identified through the use of an index or online service, is provided by the many large and small university, special, and medical libraries in the United States. This has in many cases not been completely adequate for the user of online services who are remote from such libraries. To provide an alternative for such users, and for users who do not have access to a research collection, two services, the SDC Search Service and BRS, provide online ordering capabilities. A user from his terminal, can input an order for a document to a selected group on institutions. Such orders are then sent to the specified organization, a copy of the information is prepared (usually in either paper or microfiche), and the copy mailed to the requestor. Online ordering is now possible from the following organizations (addresses for each are included):

1. The Congressional Information Service for U.S. government documents.

   Congressional Information Service, Inc.
   7101 Wisconsin Avenue
   Washington, DC 20014

2. The Institute for Scientific Information through its Original Article Tear Sheet (OATS) service for articles from over 5200 scientific and technical journals.

   Institute for Scientific Information
   325 Chestnut Street
   Philadelphia, PA 19106
   Telephone: (215) 923-3300

3. The National Technical Information Service (NTIS) for government sponsored research reports contained in the NTIS data base.

   National Technical Information Service
   The U.S. Department of Commerce
   Suite 620
   425-13th Street, NW
   Washington, DC 20004

4. The Society of Automotive Engineers (SAE) for SAE published papers.

   Society of Automotive Engineers
   400 Commonwealth Avenue
   Warrendale, PA 15096
   Telephone: (412) 776-4841

5. The ERIC Document Reproduction Service for documents indexed in Research in Education (RIE).

   ERIC Documentation Reproduction Service (EDRS)
   P.O. Box 190, A
   Arlington, VA 22210

6. University Microfilms International (UMI) for dissertations from the Comprehensive Dissertation Index and from articles indexed in Current Index to Journals in Education in the ERIC data base.

   University Microfilms International
   300 N. Zeeb Road
   Ann Arbor, MI 48106
   Telephone: (313) 761-4700

7. FIND/SVP for articles in the Management Contents data base.

   FIND/SVP
   500 Fifth Avenue
   New York, NY 10036
   Telephone: (212) 354-2424

In most cases special arrangements must be made, usually a deposit account, with the organization from which documents will be ordered.

These services are important to LDCs because they offer the potential of access without the need for the creation of a large library as proposed by BOURNE. One other commercial service, Lockheed, plans to offer comparable services by early 1979.

A variety of libraries offer document delivery services on an international basis. A directory of U.S. libraries providing reprographic services is available by NITECKI. One of the largest such services is provided by the Crerar Library:

The John Crerar Library
35 West 33rd Street
Chicago, IL 60616
Telephone: (312) 225-2526

This library has two departments which have participated in information projects relating to foreign/developing countries. These two departments are Research Information Service (RIS) and Photoduplication Service (Photo).

RIS was founded in 1947 to provide capability for extensive, in-depth literature research and current awareness services. Its full-time professional staff have scientific degrees and extensive experience in dealing with nearly all scientific and technical disciplines.

Retrospective searches utilize both manual methods and online data bases. Current awareness reports are derived from scanning of all publications received by Crerar, selection by client profiles and reporting via reference cards, abstracts, photocopies, microfilm, punch cards, etc., in whatever frequency desired, including monthly or weekly bulleting.

Photo has handled requests from all over the world. Presently, some 2,000 deposit accounts are maintained. Requests are accepted by TWX, TELEX, telephone, and mail. The Crerar collection includes the basic sciences, engineering, all fields of medicine, and branches of agriculture of special interest. Currently, 7,500 participants are collected.

Most of the services mentioned above provide access to journal, report, or special literatures. The best sources for locating information on the availability of monographic literature are the United States Library of Congress' National Union List and List of Supplemental Locations and the files of OCLC, Inc. (formerly the Ohio College Library Center). The latter deserves special mention because it is the largest online library service in the world.

OCLC, Inc.
1125 Kinnear Road
Columbus, OH 43212
Telephone: (614) 486-3661
TWX: 810-482-1658

OCLC, Inc., provides online cataloging services to over 1650 libraries in the United States. As a byproduct of this online cataloging activity, the files of OCLC contain information on the location of all books cataloged indicating which of the libraries hold a given volume. The files of OCLC now contain information on over four million items: monographs, serials, films, recordings, and maps. Access to OCLC is available through TYMNET, and therefore the location in the United States of any of this material could be obtained online from almost anywhere in the world. If the LDCs were using OCLC or a similar service as an aid to cataloging the materials in their libraries, the resulting information on the holdings of their libraries could be the basis for a network for sharing materials between them. The BALLOTS Service offers a similar facility for a small group of academic libraries through ARLIN (Academic Research Library Network).

2.3. Current Awareness Services

The batch retrieval services of Europe (and Canada) have long been dominated by current awareness services, SDI (Selective

Dissemination of Information), rather than retrospective searches. Such services provide for the running of searches against only the new material being input to a bibliographic data base. Their popularity is not surprising because such searches are much less expensive than the larger retrospective search. Recently, the major online bibliographic search services and some of the data base producers have begun marketing the SDI services in the U.S., and the literature reflects an increasing interest in this form of service. All the major U.S. online services offer such SDI services against the many data bases they cover, and such SDI service could be viable, low-cost means of providing information to the LDCs in subjects particularly germane to a specific country.

3. SECONDARY SCIENTIFIC AND TECHNICAL INFORMATION SERVICES (FACTUAL)

The primary information services described above concentrate on the provision of information about where information can be found; they provide users with an indication of where they should look for answers to their questions. The secondary services, on the other hand, are concerned with actually providing answers to questions rather than just locations of answers. Such services actually assemble information on specific subjects and may produce handbooks or computer data bases covering some specific subject area. These compilations of information or data may cover a set of products in a specific area, such as characteristics of electronic equipment: they may cover manufacturing processes and methods, such as the machinability of metals; and some cover standards and norms, such as government or professional society specifications and standards. The largest group of such services provides statistical data on markets, sales, prices, etc., on products or firms or for whole economic sectors of both U.S. and other nations. Finally, another group of services provides compilations of data, i.e., physical properties, activities, and effects of chemicals, ceramics, alloys, etc. The fastest growing sources of information from such services are online data banks described further below. The data banks are produced by a wide range of organizations including trade, industrial, professional and scientific organizations, information centers of government agencies, and independent research and development organizations. Many of the data banks produced throughout the world are available from U.S. information services.

3.1. Data Banks

While bibliographic data bases continue to be the major resource of retrieval service, there is a rapidly rising interest in actual information files, numeric data bases, or data banks as they are variously called. These files are seen as a next step in the online revolution, providing answers to questions rather than references to the literature where such answers may be found. LUEDKE ET AL. have covered this field well, and I will not cover it

in detail here except to provide some indication of the momentum being achieved.

For potential users, the inventory published in ON-LINE REVIEW provides an itemized list of these data bases now available from online service organizations. Table 5 contains a subset of these which are available from U.S. Systems and are potentially relevant to the LDCs. A new column in ONLINE by FRIED ET AL. has started to provide continuing coverage of this subject. An introduction and a count of available data bases can be found in LUEDKE, and BOYLE ET AL. have also provided an insight into why these files are of such great interest concluding "that this ability to use the intelligence of the computer for manipulation of numerical data will make such data systems much more effective than online reference systems." This view is echoed by TOMBERG who compares the use, availability, and effectiveness of data banks with those of bibliographic files.

One symptom of the increasing interest in such files is a spate of articles on the Economic Information Systems [file on] Industrial Plants which provides detailed information on the production of products by U.S. industrial organizations. BURYLO has written on this file. The interest in this specific file results from its clear value in marketing planning, and the most widely used data bases are in financial and economic data. The largest provider of such services is Data Resources Incorporated which combines many files of economics and census data with economic forecasting and computer manipulation capabilities. (The use of this service by the French government for the projection of France's economy offended French sensibilities and fueled, in part, the international trend to computer isolationism, called the "transborder data flow problem.")

Chemistry is moving rapidly also in the direction of numeric data files. NLM and Lockheed Information Systems have both placed online the Registry of the Toxic Effects of Chemical Substances (from the National Institute for Occupational Safety and Health) and the Toxic Substances Control Act (TSCA) Candidate List (from the Environmental Protection Agency). The Candidate List is a file of all chemicals known to be in production in the U.S., and it is being used to assist chemical firms in the massive effort to register all chemicals for the TSCA. There are many numeric data files in the field of chemistry.

The following are names and addresses and abbreviations for selected U.S. Data Bank Producers/Suppliers:

Automatic Data Processing, Inc. (ADP)
175 Jackson Plaza
Ann Arbor, MI 48106
Telephone: (313) 769-6800

Control Data Corporation (CDC)
P.O. Box 0
8100-34th Avenue S.
Minneapolis, MN 55440
Telephone: (612) 853-4892

Chase Econometric Associates, Inc. (CEA)
555 City Line Avenue
Bala Cynwyd, PA 19004
Telephone: (215) 667-7350
Telex: 831609

Data Resources, Inc. (DRI)
29 Hartwell Avenue
Lexington, MA 02173
Telephone: (617) 861-0165

Environmental Protection Agency (EPA)
401 M Street, SW
Washington, DC 20460
Telephone: (202) 245-3000

General Electric Co. (GE)
Information Services Business Division
401 N. Washington Street
Rockville, MD 20850
Telephone: (301) 340-5167

International Monetary Fund (IMF)
700-19th Street, NW
Washington, DC 20431
Telephone: (202) 393-6362
Telex: ITT 440040

Lockheed Information Systems (LIS)
3251 Hanover Street
Palo Alto, CA 94304
Telephone: (415) 493-4411
Telex: 346409

National Bureau of Standards (NBS)
Washington, DC 20234
Telephone: (301) 921-2917

National Library of Medicine (NLM)
8600 Rockville Pike
Bethesda, MD 20014
Telephone: (301) 496-6193

System Development Corporation (SDC)
2500 Colorado Avenue
Santa Monica, CA 90406
Telephone: (213) 829-7511
Telex: 652358

Table 5 summarizes data banks available from U.S. suppliers.

3.2. Full Text Services

While numeric data bases are growing in number and availability, full text files have yet to appear in science and tehcnology. Though out of the path of most libraries, full text data bases are increasingly being used in law libraries and law firms. In the future scientific literature may begin to become available in full text form as more journals convert to computerized photocomposition. Both the American Chemical Society and the American Institute of Physics are making this conversion now, but at the moment the field of law remains the leader in full text retrieval. The two large services in full-text automated legal research are as follows:

Mead Data Central, Inc.
200 Park Avenue
New York, NY 10017
Telephone: (212) 883-9710

West Publishing Company
50 Kellogg Boulevard
Saint Paul, MN 55102
Telephone: (812) 228-2500

Table 5

MAJOR INFORMATION DATA BANKS ONLINE IN THE UNITED STATES
RELEVANT TO LESSER DEVELOPED NATIONS

Name of Data Bank	Data Bank Producer	Subject	Online Vendor
Agriculture -- major livestock groups, 15 crops	DRI	Agriculture	DRI
Agriculture/Weather	USDA	Agriculture, meterology	Data Resources, Inc.
Business International Corporation (BIC) -- national accounts, marketing	BIC	Business, economics	GE
Carbon-13 Nuclear Magnetic Resonance (CNMR)	EUSIDIC, NIC, EPA, NIH	Chemistry	Tymshare
Center for Energy Systems (CFES) -- USA	GE	Energy	GE
Chase Econometrics Agricultural Data Base	CEA	Agriculture, business & economics	ADP
Chase Econometrics Agricultural Forecast	CEA	Agriculture, business & economics	ADP
Chase Econometrics Short-term Industry Forecast -- 110 industries	CEA	Business, economics	ADP
Chemical Information System	EPA/NIH	Chemistry	Tymshare
ChemShare -- physical properties of pure compounds and mixtures	ChemShare Corp.	Chemistry	Tymshare
Commodity Data Information System (CDIS) -- 33 commodities	MJK Associates	Business, economics	MJK Associates

Table 5

MAJOR INFORMATION DATA BANKS ONLINE IN THE UNITED STATES RELEVANT TO LESSER DEVELOPED NATIONS

Name of Data Bank	Data Bank Producer	Subject	Online Vendor
Commodity Futures Database	Ciscom	Business, economics	GE
ContiCurrency Data Base -- 33 currencies, interest rates, main economic and political developments	Conti-Currency	Business, economics	ADP
Copper Development Association -- industry	Copper Development Association	Metals	ADP
Crystal Data Type	NBS	Chemistry	Tymshare
Crystallographic Data Centre Connectivity File	GB	Chemistry	ADP
Currency Exchange Database over 40 currencies	GE	Business, economics	GE
Current Research Information System (CRIS)	USDA	Agriculture	LIS
Dr. Dvorkovitz and Associates -- licensable technology	Dvorkovitz, Dr. and Associates	General	Dr. Dvorkovitz and Associates
Energy Data Base -- International consumption	CEA	Energy	ADP
EROICA Thermodynamic Data	University of Tokyo, Japan	Chemistry	Tymshare
Fertilizer forecast	CEA	Agriculture	ADP
Foundation Directory	The Foundation Center	General	LIS
Foundation Grants Index	The Foundation Center	General	LIS
Gas-Phase Proton Affinities	NBS	Chemistry	Tymshare

Table 5 (Continued)

MAJOR INFORMATION DATA BANKS ONLINE IN THE UNITED STATES
RELEVANT TO LESSER DEVELOPED NATIONS

Name of Data Bank	Data Bank Producer	Subject	Online Vendor
Grant Information System	Oryx Press	General	SDC
Hazardous Chemicals	National Fire Protection Association	Chemistry, environment	Tymshare
Heats of Formation of Gaseous Ions	NBS	Chemistry	Tymshare
Helps -- resources	Division of Special Education, State of Ohio	Education	Battelle Columbus Labs
Infrared Information System (IRIS)	Sadtler Research Laboratories, Inc.	Chemistry	University Computing Company
International Annual Time Series	PREDICASTS	Business, economics	LIS
International Data Base currencies, financial institutions, interest rates, national income	CEA	Business, economics	ADP
International Financial Statistics	IMF	Business, economics	DRI, Rapidata
International Marine Banking -- currency	International Marine Banking Co., Ltd.	Business, economics	GE
International Statistical Abstracts	PREDICASTS	Business, economics	LIS

Table 5 (Continued)

MAJOR INFORMATION DATA BANKS ONLINE IN THE UNITED STATES RELEVANT TO LESSER DEVELOPED NATIONS

Name of Data Bank	Data Bank Producer	Subject	Online Vendor
International Trade Commission -- production and sales of synthetic organic compounds	International Trade Commission	Chemistry	Tymshare
Laboratory Animal Data Base	NLM	Medicine	Battelle Columbus, Laboratories
List 149 of Carcinogens	Stanford Research Institute	Medicine	Tymshare
Marine Information System (MIS) -- merchant ships of over 4000 GRT, ships on order, tanker casualties, charter fixtures	Marine Managment Systems, Inc,	Shipping	GE
Mass Spectral Search System (MSSS)	NIH, AWRE UKAEA, EPA	Chemistry	ADP, Tymshare
MASTERSPEC -- specifications	American Institute of Architects	Civil Engineering	Alphatext, Bowne Time Sharing
Metals Forecast -- non-ferrous metals, international demand and supply	CEA	Metals	ADP
Metals Week Price Data Base	McGraw-Hill Publishing Company	Metals	ADP
National Electrical Manufacturers Association (NEMA)	NEMA	Business, economics, & electrical engineering	GE
Oil and Gas Journal Data Bank	DRI	Petroleum	DRI

Table 5 (Continued)

MAJOR INFORMATION DATA BANKS ONLINE IN THE UNITED STATES
RELEVANT TO LESSER DEVELOPED NATIONS

Name of Data Bank	Data Bank Producer	Subject	Online Vendor
Oil and Hazardous Material Technical Assistance Data System (OHMTADS)	EPA	Environment	Informatics, Tymshare, test
Oilmarket -- oil industry	API	Petroleum	Computer Co.
Pesticides Active Ingredients	EPA	Agriculture	Tymshare
Pesticides Analytical Reference Standards	EPA	Agriculture	Tymshare
Pesticide Reference Standards	FDS	Agriculture	Tymshare
Petroleum Products Exchange Data Clearinghouse	GE	Petroleum	GE
Physical Property Data Service	Institute of Chemical Engineers	Chemistry	GE
Platt's Data Bank -- Prices internationally	DRI	Petroleum	DRI
Predicasts Basebook historical economics internationally	Predicasts	Business, economics	LIS
Predicasts Composites historical economics internationally	Predicasts	Business, economics	LIS
Psychotropic Drugs	NIH	Medicine	Tymshare
RANN Pollutant File	NSF	Environment	Tymshare
Registry of Toxic Effects of Chemical Substances	NIOSH	Medicine	NLM, Tymshare
Smithsonian Science Information Exchange (SSIE)	Smithsonian Science Information Exchange, Inc.	General	LIS, SDC

Table 5 (Continued)

MAJOR INFORMATION DATA BANKS ONLINE IN THE UNITED STATES RELEVANT TO LESSER DEVELOPED NATIONS

Name of Data Bank	Data Bank Producer	Subject	Online Vendor
Statsid -- oil and gas statistics	Compagnie Francaise des Petroles	Petroleum	GE
Steel -- industry	American Iron and Steel Institute	Metals	DRI
Steel -- shipments by market	DRI	Metals	DRI
Storage and Retrieval for Water Quality Data -- waterways, USA	EPA	Environment	Tymshare
Technotec -- licenceable technology	Control Data Technotec, Inc.	General	CDC
TECSPEC Div. 15 -- specification	AEP Associates	Mechanical engineering	Bowne Time Sharing
TECSPEC Div. 16 -- specification	AEP Associates	Electrical engineering	Bowne Time Sharing
Toxicology Data Bank	NLM	Toxic Chemicals	NLM
Wood Products	Pulp and Paper Institute	Forestry/ Wood Products	DRI
World Fertilizer Market Information Service -- Production, consumption and trade	Tennesse Valley Authority	Agriculture	GE

4. TERTIARY SCIENTIFIC AND TECHNICAL INFORMATION SERVICES (INFORMATION EXPERTS)

Not all problems are simple enough to be solved through the provision of a bibliographic reference, an article, or a single answer or piece of data. Many problems are ill-defined or complex and require analysis by experts to define the question as well as provide a useful answer. Some problems may even require the development of training programs or individual courses because they involve a continuing activity rather than a one-shot "solution." At an even more general level the solution of a development problem may involve the design and development of an information system or a whole information infrastructure for installation in a less developed nation to support developmental activity or a program of related activities. For example, at its broadest level the National Science Foundation is directing the development of a total scientific and technical information system for the Kingdom of Saudi Arabia designed to provide access to the world's scientific and technical information, to specifically control and provide access to the results of scientific and technical research in the Kingdom, and to provide management support for the coordination of research activities in Saudi Arabia. Such a development effort requires access to and utilization of the information systems development expertise of the information industry of the United States.

Finding the appropriate expertise may be difficult. A myriad of sources exists, but matching them to a need may be a complex problem. The simplest initial method may be to use the salesmen of the multinational corporations operating in a given country since they should be expert on what is really available in the country. Access to appropriate expertise in the United States may best be identified through the National Referral Center in the Library of Congress. That Center can identify those information sources in the U.S. most likely to be of assistance with regard to a particular developmental area.

The two key agencies in the U.S. Government's program to provide appropriate technology for developing nations are the Agency for International Development (AID) and the National Technical Information Service (NTIS). AID has entered into an agreement with NTIS to provide technology for nations seeking development. A technical information network with 18 developing nations has been established. The technology transfer projects are based on local cooperating agencies trained in technical information handling. NTIS provides training which emphasizes the strengthening and growth of the cooperating agency's own institutional and user capabilities. A monthly newsletter, Application of Modern Technology to International Development is available. For further information contact:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: (202)724-3382

Another AID program called ADDS (A.I.D. Document Distribution System) is a means to provide On-Demand Document Delivery of AID-generated materials on request to AID personnel and to LDCs. These materials are free to AID personnel, partially subsidized to LDCs and prepared at cost to other requesters. Of interest to LDCs are the AID-produced Catalogue of Research Literature for Development and the A.I.D. Research and Development Abstracts (ARDA).

Beginning in 1978, AID, through its Indefinite Quantity Contracts (IQCS) program, provides short-term assistance in activities involving information technology transfer in all subject disciplines. Included is support in information project design, implementation, and evaluation. Technical support to AID and USAID Missions is provided in the following areas:

1. Reference Services
2. Current Awareness Service
3. Technical Processing (including cataloging)
4. Management Services (this includes development of requirements and design, implementation, and evaluation of information projects).

The American Council of Voluntary Agencies for Foreign Service, Inc. (ACVAFS) operates the Technical Assistance Information Clearinghouse (TAICH) under a grant from AID. TAICH serves as an information center specializing in the socio-economic development program abroad of U.S. Voluntary agencies, missions, foundations, and other non-profit organizations. TAICH provides files containing information on various U.S. voluntary agencies. TAICH also provides a quarterly newsletter, TAICH News, which provides current information on development assistance. Several directories which list U.S. voluntary and non-profit agencies involved in providing development assistance abroad are provided including a one-volume directory, U.S. Non-Profit Organizations in Development Assistance Abroad - 1971. Four regional directories, Far East 1966, Latin America 1967, Near East-South Asia 1969, and Africa 1969, are provided also. Inquiries about service should be addressed to:

The Technical Assistance Information Clearinghouse
American Council of Voluntary
Agencies for Foreign Services, Inc.
200 Park Avenue South
New York, NY 10003
Telephone: (212) 777-8210

For information regarding other AID-provided services, contact:

Division of Documentation and Information
Bureau of Development Support
U.S. Agency for International Development
Washington, DC 20523
Telephone: (713) 235-8936

Of interest is the "Federal International Development Offices Directory" prepared for AID and published in June 1975. This directory includes U.S. Government units involved in foreign development or technical assistance activities. AID units are excluded from this directory. For further information contact:

FIDO Coordinator
Technical Assistance Bureau
Agency for International Development
Washington, DC 20523

A unique service of the private information sector provides a worldwide technology exchange. Using a telex, TWX, or telephone terminal, a user can search through approximately 13,000 descriptions of new technological developments to find any relevant to his problem and then negotiate directly with the seller for use of the invention or process. The TECHNOTEC service is available from:

Control Data Corporation
P.O. Box 0
8100 - 34th Avenue, S.
Minneapolis, Minnesota 55440

The Membership Directory of the Information Industry Association contains a list of the individual and company members plus a description of services and products offered by the companies. Names and addresses are also provided. Below is a sample of selected information brokers and other providers of scientific and technical information which illustrates the broad array of information sources available. (Some of the sources have been cited in other parts of this paper but are repeated here for illustrative purposes.)

1. Micro Photo Division of
   the Bell & Howell Company
   Old Mansfield Road
   Wooster, OH 44691
   Telephone: (800) 321-9881

Provides microform information and storage and retrieval equipment.

2. Capital Systems Group, Inc.
   6110 Executive Boulevard
   Rockville, MD 20852
   Telephone: (301) 881-9080

Provides management and information services and program support.

3. Chase Econometric Associates, Inc.
555 City Line Avenue
Bala Cynwyd, PA 19004
Telephone: (215) 667-7350

Provides economic forecasting and detailed economic information and analysis.

4. Chemical Data Center, Inc.
3620 North High Street
Columbus, OH 43214
Telephone: (614) 261-7101

Provides consulting services and online and manual literature searches.

5. Data Courier, Inc.
620 South Fifth Street
Louisville, KY 40202
Telephone: (502) 582-4466

Provides publications which cover scientific and business management subjects.

6. Documentation Associates
Information Services, Inc.
11716 West Pico Boulevard
Los Angeles, CA 90064
Telephone: (213) 477-5081

Provides comprehensive information services.

7. Editec, Inc.
53 West Jackson Boulevard
Chicago, IL 60604
Telephone: (312) 427-6760

8. Herner and Company
2100 M Street, NW
Washington, DC 20037
Telephone: (202) 293-2600

Provides consulting services in all aspects of library and information systems, literature searches and publishes abstracting and indexing publications and information source directions.

9. Information & Publishing Systems, Inc.
7101 Wisconsin Avenue
Bethesda, MD 20014
Telephone: (301) 642-5424

Provides computer software products and consulting services.

10. Information Unlimited
2510 Channing Way #3
P.O. Box 4185
Berkeley, CA 94704
Telephone: (415) 841-5861

Provides indexing services, information gathering, and document delivery.

11. LINK
24 Gramercy Park
New York, NY 10003
Telephone: (212) 228-0753

Provides assistance in developing and marketing information products, services, and systems.

12. Science Associates International, Inc.
1841 Broadway
New York, NY 10023
Telephone: (212) 265-4995

Provides current awareness reporting news service in all fields and a Directory of Data Bases.

The most fruitful sources of information in ill-defined areas are probably the information analysis centers of the United States if an appropriate one exists. These centers collect and review all the information in a specific scientific or technical subject area and provide analyses, state-of-the-art studies, and specialized information services. The Federal Government supports the costs of 108 such specialized information analysis centers (IACs). A directory of these centers is being produced by the U.S. LIBRARY OF CONGRESS; Table 6 provides a listing of those of relevance to LDCs.

Table 6. Selected Federally Supported Information Analysis Centers Relevant to the Needs of Developing Countries

1. Biomedical Computing Technology Center
Oak Ridge National Laboratories
P.O. Box X
Oak Ridge, Tenn. 37830

2. Bureau of Mines
Associate Director - Mineral and Materials Supply/Demand Analysis
Columbia Plaza
2401 E Street, NW, Room 1038
Washington, D.C. 20241

Table 6 Cont'd.

3. Center for Climatic and Environmental Assessment (CCEA)
   Environmental Data Service, NOAA
   Federal Building; Room 116
   600 East Cherry Street
   Columbia, Missouri 65201

4. ERIC Clearinghouse on Information Resources
   School of Education
   Syracuse University
   Syracuse, New York 13210

5. International Demographic Statistics
   Population Division
   Bureau of the Census
   Washington, D.C. 20233

6. National Center for Analysis of Energy Systems
   Department of Energy and Environment
   Brookhaven National Laboratory
   Building 475
   Upton, Long Island, New York 11973

7. National Clearinghouse for Mental Health Information
   Division of Scientific and Public Information
   National Institute of Mental Health
   5600 Fishers Lane
   Rockville, Maryland 20857

8. National Climatic Center (NCC)
   Federal Building
   Asheville, North Carolina 28801

9. National Environmental Satellite Service
   National Oceanic and Atmospheric Administration
   Washington, D.C. 20233

10. National Geophysical and Solar-Terrestrial Data Center
    Environmental Data Service, NOAA
    Boulder, Colorado 80302

11. National Health Planning Information Center
    P.O. Box 1600
    Prince Georges Plaza Branch
    Hyattsville, Maryland 20788

12. Toxicology Information Response Center (TIRC)
    Oak Ridge National Laboratory
    P.O. Box X
    Building 2024, Room 53
    Oak Ridge, Tennessee 37830

Among the nongovernmental organizations, virtually every scientific and professional socity in the United States has an "international" program, and of recent years these international programs have been increasingly oriented toward the needs of colleagues in developing countries. The totality of this activity, however organized, represents a major resource of information for development. These organizations are too numerous to be included in this paper but sources such as the Encyclopedia of Associations, volume 1, which contains the National Organizations of the U.S. may be helpful. The Directory of Information Services is also a good source of providers of scientific and technical information, including academic and professional organizations. These publications are available from Gale Research Company. Knowledge Industry Publications, Inc., has issued recently the tenth edition of its Library and Information Facilities in the Area of the District of Columbia - a comprehensive listing of information resources and services in the Nation's Capitol.

Following are names and addresses of selected professional societies:

1. Association of Research Libraries
   1527 New Hampshire Avenue, NW
   Washington, DC 20036
   Telephone: (202) 232-2466

2. American Society for Information Science
   1155-16th Street, NW
   Washington, DC 20036
   Telephone: (202) 659-8686

3. American Library Association
   50 E. Huron Street
   Chicago, IL 60611
   Telephone: (312) 944-6780

4. National Association for
   State Information Systems
   Iron Works Pike
   Lexington, KY 40511
   Telephone: (606) 252-2291

Finally, in addition to the professional societies, many commercial and academic organizations specialize in information services to the lesser developed countries. For example, the university-based

International Development Data Center
Economic Development Laboratory
Engineering Experiment Station
Georgia Institute of Technology
Atlanta, GA 30332

maintains information on all aspects of LDCs and the technology available to assist them and publishes a monthly newsletter, The International Informer, describing recent acquisitions and projects.

Program on Policies for Science and
Technologies in Developing Nations
180 Uris Hall
Cornell University
Ithaca, New York 14853

has a staff of personnel involved in technology transfer and has published a selected list of information sources in the United States with a bibliography of selected materials.

Dr. Dvorkovitz & Associates
P.O. Box 1748
Ormond Beach, FL 32074

published UNIT, a magazine about licensing, new product development, joint ventures, and acquisitions; and sponsors an annual "World Fair for Technology Exchange," TechEx.

Institute for Invention and Innovation, Inc.
85 Irving Street, P.O. Box 436
Arlington, MA 02174
Telephone: (617) 646-0093

publishes Invention Management and Technology Exchange Bulletin.

5. SELECTED BIBLIOGRAPHY

ATTAR, R; Fraenkel, A.S. 1977. Local Feedback in Full-Text Retrieval Systems. Journal of the Association for Computing Machinery. 1977 July; 24(3): 397-417. ISSN: 0004-5411.

AVRAM, HENRIETTE D. 1975. MARC: Its History and Implications. Washington, D.C.: Library of Congress; 1975. 49p. (Superintendent of Documents no. LC 1.2:M18/16). ISBN: 0-8444-0176-5. LC: 76-608015.

BAYER, MARK. 1978. DIALOG TM - An Online Retrieval System for Bibliographic Information. COMPCON 78. Proceedings Computer Communications Networks. IEEE, New York, N.Y. 54-58. Available from IEEE Computer Society, 585 Naples Plaza, Suite 301, Long Beach, CA 90803.

BIBLIOGRAPHIC RETRIEVAL SERVICES, INC. (BRS). 1977. The BRS System Reference Manual and Database Search Guide. Schenectady, NY: BRS; 1977 September. 1 volume (discontinuous paging). (Loose-leaf for updating). Available from: BRS, Building 702, Corporation Park, Scotia, NY 12302.

BLACK, DONALD V. 1978. System Development Corporation's Search Service. COMPCON 78. Proceedings Computer Communications Networks. IEEE, New York, N.Y. 59-64. Available from IEEE Computer Society, 5855 Naples Plaza, Suite 301, Long Beach, CA 90803.

BOURNE, CHARLES P. 1977. Computer-based Reference Services as an Alternative Means to Improve Resource-Poor Local Libraries in Developing Countries. International Library Review. 1977; 9: 43-50. ISSN: 0020-7837.

BOYLE, J.; MCDONOUGH, W.R.; O'HARA, H.; SMITH, F.J. 1977. An On-Line Numerical Data System. Program: News of Computers in Libraries (England). 1977 April; 11(2): 35-46. ISSN: 0033-0337.

BURYLO, MICHELLE A. 1977. Database Review: EIS Plants. Online. 1977 July; 1(3): 53-58. ISSN: 0146-5422.

CONGRESSIONAL INFORMATION SERVICE. 1978 Directory of Government Documentation Collections and Librarians. 2nd ed. 1978. 7101 Wisconsin Ave., Wash., D.C. 20014. 544 p.

DIRECTORY OF FEE-BASED INFORMATION SERVICES. 1977. Information Alternative, Box 647, Woodstock, NY 12498. 71 p. $3.00.

DIRECTORY OF ONLINE INFORMATION RESOURCES. 2nd ed. 1978. 50p. $10.00. Capital Systems Group, Inc, 6110 Executive Blvd., Rockville, MD 20852.

EUSIDIC DATABASE GUIDE. TOMBERG, ALEX ed. Learned Information. Oxford, New York. ISBN 0 904933 13X 130 p.

FEDERAL INTERNATIONAL DEVELOPMENT OFFICES DIRECTORY. Agency for International Development. Wash., D.C. 20523. June 1975. DN-R2A-084 ARC #309.223025 F991 AID/273.

FRIED, JOHN B.; LUEDKE, JAMES A.: RUBIN. STEPHEN A. 1977. Online Numberic Database Systems. Online. 1977 July: 1(3): 70-72. ISSN: 0146-5422.

GRABOWSKI, HENRY G. and MUELLNER, DENNIS C. 1978. Industrial Research and Development Intangible Capital Stocks, and Firm Profit Rates. The Bell Journal of Economics August 1978, 9(2) 328-343.

INFORMATION INDUSTRY ASSOCIATION. 1977. Information Sources. The Membership Directory of the Information Industry Association. Available from Information Industry Association, 4720 Montgomery Lane, Suite904, Bethesda, Maryland 20014. 204 p.

INFORMATION MARKET PLACE 1978-1979. See SANDERS, JAMES.

KRUZAS, ANTHONY T. ed. SULLIVAN, LINDA V. Assoc. ed. Encyclopedia of Information Systems and Services. 1978. Gale Research Co. Detroit, MI. 1030 p.

LAWRENCE, BARBARA; PREWITT, BARBARA G., comps. BEARMAN, TONI CARBO, revisor, 1977. Online Commands. A User's Quick Guide for Bibliographic Retrieval Systems. Available from NYFAIS, 3401 Market, Philadelphia, PA 19104. 2 p. card format.

LOCKHEED INFORMATION SYSTEMS. 1976. A Brief Guide to DIALOG Searching. Palo Alto, CA: Lockheed Information Systems; 1976 September. 121p. (Loose-Leaf for updating). Available from: Lockheed Information Systems, Code 5208/201, 3251 Hanover, Palo Alto, CA 94304.

LUEDKE, JAMES A., JR. 1977. Numeric Data Bases On-Line. On-Line Review (England). 1977 September; 1(3): 207-215. ISSN: 0309-314X.

LUEDKE, JAMES A., JR.; KOVACS, GABOR J.; FRIED, JOHN B. 1977. Numeric Data Bases and Systems. In: Williams, Martha E., ed. Annual Review of Information Science and Technology. Volume 12. White Plains, NY: Knowledge Industry Publications, Inc.; 1977. 119-181. ISSN: 0066-4200; ISBN; 0-914236-11-3; LC: 66-25096.

MCCARN, DAVIS B. 1978. Online Services of the National Library of Medicine. COMPCON 78; Proceedings Computer Communications Networks. IEEE, New York, N.Y. 48-53. Available from IEEE Computer Society, 5855 Naples Plaza, Suite 301, Long Beadh, CA 90803.

MCCARN, DAVIS B. 1978. Online Systems-Techniques and Services. In Williams, Martha E. ed. Annual review of Information Science and Technology. Knowledge Industry Pub. Inc. 1978, Vol. 13... 85-124 ISSN: 0066-4200; ISBN 0-914236-21-0

MCCARN, DAVIS B.; LEITER, JOSEPH. 1973. On-Line Services in Medicine and Beyond. Science. 1973 July 27; 181 (4097): 312-324. ISSN: 0036-8075.

NATIONAL TECHNICAL INFORMATION SERVICE. NTIS Information Services. General Catalog No. 6. Springfield, VA, NTIS, Jan. 1979.

NITECKI, JOSEPH Z., editor and compiler. Directory of Library Reprographic Services (in U.S. and Canada). 5th edition, Weston, CT. Microform Review, Inc., 1973, 104 p.

PARKER, EDWIN B. 1975. Background Report. p. 87-140. Proceedings of the OECD Conference, February 4-6, 1975. OECD Informatics Studies. 11 Conference on Computer/Telecommunications Policy. Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave., N.W. Washington, D.C.

POOL, ITHIEL DE SOLA. 1976. Background Report. p. 281-308. Proceedings of the OECD Conference, February 4-6, 1975. OECD Informatics Studies 11. Conference on Computer/Telecommunications Policy. Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave., N.W. Washington, D.C.

QUAKE, RONALD and EGELAND, JANET. 1978. Bibliographic Retrieval Services, Inc. (BRS): A New Company with New Ideas in the Online Information Industry. COMPCON 78: Proceedings Computer Communications Networks. IEEE New York, N.Y. 65-69. Available from IEEE Computer Society, 5855 Naples Plaza, Suite 301, Long Beach, CA 90803.

SUMMIT, ROGER K.; FIRSCHEIN, O. 1977. Final Report: Investigation of the Public Library as a Linking Agent to Major Scientific, Educational, Social, and Environmental Data Bases. Palo Alto, CA: Lockheed Missiles & Space Company, Inc., Palo Alto Research Laboratory, Information Systems Programs; 1977 October 1. 1 volume (discontinuous paging). (LMSC-D560986). Available from: Lockheed Missiles & Space Company, Inc., Palo Alto Research Laboratory, Information Systems Programs, Palo Alto, CA 94304

SANDERS, JAMES. Information Market Place: A Directory of Products and Services R.R. Bowker Co. New York, New York 245 pp. $21.50 paper. ISBN: 0 8352 10790

SYSTEM DEVELOPMENT CORPORATION (SDC). EDUCATION AND LIBRARY SYSTEMS DEPARTMENT. ON-LINE BIBLIOGRAPHIC SEARCH SERVICES. 1976. SDC Search Service ORBIT User Manual. Revised Edition. Santa Monica, CA: SDC; 1976 March. 1 Volume (discontinuous paging)... SDC no. TM-5511/000/01; Loose-leaf for updating). Available from: SDC, 2500 Colorado Avenue, Santa Monica, CA 90406

TOMBERG, A. 1977. Data Banks: A Survey. In: On-Line Information: Proceedings of the 1st International On-Line Information Meeting; 1977 December 13-15; London, England. Oxford, England: Learned Information (Europe) Ltd.; 1977. 159-168. ISBN: 0-904933--10-5.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE. PUBLIC HEALTH SERVICE. NATIONAL INSTITUTES OF HEALTH. NATIONAL LIBRARY OF MEDICINE. 1978. On-Line Services Reference Manual. Bethesda, MD: National Library of Medicine; 1978 January. 1 volume (unpaged). (Loosefeaf for updating; Paragraph numbering; supercedes NTIS PB no. 253-577). NTIS: PB 277-167.

U.S. LIBRARY OF CONGRESS. 1979. Directory of Federally Supported Information Analysis Center. Forth Edition. Compiled by the National Referral Center. To be available from NTIS, U.S. Department of Commerce, Springfield, Va. 22151.

U.S. NATIONAL SCIENCE FOUNDATION. 1977. Science Indicators 1976. Report of the National Science Board 1977. (GPO Stock No. 038-000-00341-1). 304 p. Available from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

U.S. NATIONAL SCIENCE FOUNDATION. December 1977. A Chart Book of Indicators of Scientific and Technical Communication in the United States. Prepared by King Research Inc., Rockville, Md., 23p. (GPO Stock No. 038-000-000-00360-7). Available from Superintendent of Documents, Government Printing Office, Washington D.C. 20402.

WILLIAMS, MARTHA E. 1977. Data Base and Online Statistics--1977. Bulletin of the American Society for Information Science. 1977 December; 4(2): 21-23. ISSN: 0095-4403.

WILLIAMS, MARTHA and BRANDHORST, TED. Data Base Online in 1978. Bulletin of the American Society for Information Science. 1978 August; 4(6): 20-26. ISSN: 0095-4403.

WILLIAMS, MARTHA E., ROUSE, SANDRA A. comp./eds. 1976. Computer-Readable Bibliographic Data Bases: A Directory and Sourcebook. Washington, D.C. American Society for Information Science. 1976 Oct. 1 vol. ISBN: 0-87715-114-8; LC: 76-46249.

INFORMATION FOR DEVELOPING COUNTRIES:

SUGGESTIONS FOR A U.S. POSITION

Vladimir Slamecka
School of Information and Computer Science
Georgia Institute of Technology
Atlanta, Ga. 30332

1. DIMENSIONS OF THE PROBLEM OF INFORMATION TRANSFER

On the surface, the proposition is simple. There exist in some societies vast pools of knowledge which have demonstrably contributed to the high standard of living attained by these societies. Clearly, there must be cost-effective ways of acquiring and using this knowledge without delay by those who seek to better their standard of living through accelerated socio-economic development.

The simplicity of the proposition is very deceiving. In reality, the transfer and use of knowledge is one of the more trying challenges of our times. Its complexity is principally due to the following factors:

1. In industrialized countries, knowledge vendors--that is, information systems and services--cater to a highly information-conscious clientele, accustomed to an information-rich environment characterized by multiple channels for information transfer and high volumes of its use. In these countries information services serve advanced science and technology; morever, information is inventoried and made available in raw form which presumes the ability on the part of the problem solving recipient to adapt it to his/her specific problem or problem domain.

The information environment is most developing countries is fundamentally different; it approximates the industrialized countries' information milieu only infrequently (for example, in the instance of academic research or high-technology industry). In countries at the basic and intermediate level of development, problem solvers are not only less adept at mapping raw information the specific problems; the information obtained from knowledge repositories of the industrialized countries may itself be inappropriate to their problems. The consequences of this dichotomy are considerable. To wit:

- At the operational level, information needed most in the less developed countries is of the technological, experiential kind. Such information exists largely as idiosyncratic experience of human experts, mostly in proprietary circles of industrialized countries; little of it is systematically recorded in public-domain media.

- At the policy and planning level, information needed most rarely exists in the predigested, synthesized form which LDC decision makers would find most helpful. To boot, technical data for evaluation of "low" technologies is available in developed countries only infrequently, and its sources (such as professional societies, industrial development boards, chambers of commerce, etc.) are generally unknown to LDCs. Data evaluating more advanced technologies is frequently proprietary.

Thus despite the vast pools of knowledge that exist in the industrialized countries and are freely available to be initiated, information needed most by problem solvers in the less and least developed countries is frequently non-existent, in usable forms, or inaccessible. In general, the larger the difference in the degree of socio-economic development between the industrial and the developing countries, the less appropriate are the content and form of the advanced countries' information systems to the needs of the LDCs.

2. In industrialized countries, information and knowledge are the very lifeblood of social and economic existence. Their societies are not only information consumers; even more so they are knowledge producers. Information, a significant product of these societies, has given rise to dynamic markets of huge proportions, with many redundant channels connecting inputs and outputs. These are characteristics of the postindustrial "knowledge society."

In comparison, the propensity to use information is weaker in most developing countries. They exhibit less strongly the social traits that characterize information societies--the pursuit of the production of knowledge as a major industry, the demand for information as a problem-solving resource, and the expectancy or tolerance of redundant information channels, both formal and informal. In the developing countries this lack of a propensity for information use is exemplified by:

- Low motivation to use information for improvement;
- Difficulty in correctly diagnosing needs for information in problem-solving situations;
- Difficulty in interpreting and adapting information that is not presented in directly digestible forms;
- Infrequent sharing of indigenous experience generated by LDCs.

The cultivation of information awareness is partly a matter of cultural and social factors; it is very slow to develop, and the means through which it can be fostered are poorly understood and laborious.

3. The information economy of industrialized countries is supported by a complex of organizations having a relatively vast range of functions and responsibilities. This "infrastructure" has evolved in a natural manner over several centuries, principally in response to the need for a balance (often attained through redundancy of function and activity) between the information supply and demand forces. At this time the infrastructure is industrialized countries is so complex that it defies the usual designation of "information system."

To all appearances the existence of an information infrastructure is essential for sustaining information flows of even the most rudimentary type.

In the developing countries, the organizational structure and mechanisms for information flow are in most cases being designed de novo, as so-called national information systems. These artificial structures essentially mirror the basic features of information infrastructures of the industrialized countries. The latter, however, presuppose the existence of certain conditions at least some of which appear to be lacking in most developing countries. Among such conditions are:

- The recognition by government and industry executives of the value of information;
- A propensity toward information use by problem solvers;
- A level of technology supportive of modern information transmission (electrification, computing and telecommunications). This technology is absent in rural, and inadequate in virtually all other LDCs, preventing the consideration of efficient mechanisms for information transfer such as those characterizing the infrastructures of industrialized countries;
- A rudimentary level of development of informal communication channels and habits.

The difficulty of conceiving effective ways of information transfer from industrialized to developing countries, due to the considerable differences between their respective information infrastructures, or by their absence in many developing countries, is further aggravated by a general lack of understanding as regards the form and function of minimal infrastructures commensurate with the level of socio-economic development of the LDCs.

These three sets of factors compound the problems of knowledge transfer between and among nations and societies. In general, we may conclude that the conditions for effective transfer of scientific and technical information for socio-economic development include, as a minimum, 1) a propensity on the part of problem solvers to use scientific and technical information; and 2) a level of information infrastructure commensurate with the level of socio-economic development.

Where the two preconditions exist, the key problems and challenges are:

1) Organizing information resources that are more appropriate and relevant to socio-economic development of LDCs, and presenting them in predigested, problem-oriented form; and

2) Organizing or enhancing mechanisms for more effective information access by and delivery to problem solvers, employing information technologies appropriate to their circumstances.

In developing countries in which the above preconditions do not exist, the key problems and challenges are more difficult by an order of magnitude. They are:

1) Gradually sensitizing problem solvers to a propensity toward the use of information and toward relative dependence on information; and

2) Developing and implementing, in the initial environment of highly idiosyncratic information needs and generally low demand, appropriate means, institutions, support, and policies necessary to begin the evolution of an indigenous information sector.

2. PROPOSITIONS AND RECOMMENDATIONS

Without doubt the environment for consumption and use of scientific and technical information in countries of the developing world is highly variable and non-uniform. It must follow that any one activity by the United States in this area intended to serve all LDCs will necessarily be effective only in some environments; in others it will inevitably prove inappropriate and possibly counter-productive, at least to the interests of one of the parties.

The alternative of favoring one group of LDCs over others is not quite tenable, except perhaps on a very short-term basis, not only for reasons of political realities but also on account of the intrinsic role of knowledge in socio-economic development. Thus, while certain sentiments might lead the U.S. to emphasize initiatives that bear on problems of the least developed countries whose people struggle for their bare existence and survival, problem solvers in the more advanced LDCs who already perceive the indispensability of information for sustaining the pace of development will press for accelerating its flow.

The realistic and prudent option for the United States is to formulate and adopt a long-term position toward information activities vis-a-vis the developing world, the overall objectives and program of which are sufficiently robust to embrace the broad range of developmental conditions and needs of the world's people. In doing so, the United States will have also demonstrated its perceptive understanding of the role of knowledge in global socio-economic development.

The following is a set of suggestions which, in aggregate, aspire to define such a long-term position in operational terms. They are predicated on the premise that the body of mankind's knowledge--the totality of data, information, expertise and experience generated

and gathered by man in the course of millenia of purposive activities--is an essential ingredient for further advancing the developing of society. It is therefore most appropriate that in our own era, with its bent for reducing the imbalance in the standard of living on the earth, the United States be heavily preoccupied with the role of knowledge in socioeconomic development of the world's people and nations.

Toward this stand we advance the following position and propositions for consideration by the United States government.

1. One of the basic social goals is for knowledge to become a desideratum whose worth is recognized by each individual. The benefits that the possession of knowledge promises and makes possible do not occur as an automatic consequence of gaining access to the knowledge of other societies, nations, and individuals. Knowledge must be wanted and cultivated, in a manner similar to that by which men cultivate other indispensables such as food, materials for shelter, and means for barter; it must also be accepted as a socio-economic resource. An essential condition for socioeconomic progress is for people to want knowledge, and to want to cultivate it.

The first and possibly most important proposition is thus to create an atmosphere in the society of man that induces the people in all nations to want knowledge, that prompts them to actively seek it, and that encourages them to husband it conscientiously as an indispensable personal and social resource. Such an objective is clearly a long-term one; it is also one that demands utmost sensitivity to and respect for other cultures.

Of the means which foster such an environment, the most effective ones are education, the uninhibited flow of abundant information, and demonstration of the pervasive effects of knowledge seeking and husbanding on the community of man. Considerate U.S. support of these means is desirable, partly because of their secondary effects such as the impact on democratization of society.

The United States has of course been a perennial advocate and leader in activities and programs that support this objective directly and indirectly. What is propitious is a conscious focusing of these activities at the goal of stimulating problem solvers in LDCs to desire information. In addition to continued encouragement of programs for the education of students from less developed nations in U.S. schools, and of personal contacts at the people-to-people level among Americans and LDC nationals, other activities that might be considered are: the revitalization of the "Peace Corps" in more knowledge-oriented formats; the development and sensitive dissemination of programs demonstrating the effect of knowledge-seeking on the standard of living and socio-economic development; and efforts to better understand the efficacy of existing and new techniques for inducing and fostering knowledge-seeking habits in economically less developed societies. Many in the U.S. are

highly knowledgeable about mechanisms of information diffusion in indigenous environments of LDCs; this knowledge, gathered through research, needs to be put to use.

2. As regards nations which are at the threshold of their socioeconomic development, the United States should be prepared to advise and assist them in the setting up of minimal organizational and functional capabilities for absorbing and using appropriate information. The genesis of these nations' desire for knowledge must go hand in hand with the build-up of such minimal facilities. As part of the build-up, the players and roles of current and potential information user communities of these nations, and their institutional and organizational relationships, should be identified; principles for a gradual development of incipient sectoral and national information systems and services specified; and, in general, foundations need to be laid for the development of indigenous information sectors.

Some international organizations, particularly UNESCO and the International Bureau for Informatics (IBI), entertain related objectives and have established a record of activities in this area. They are concerned, however, almost exclusively with the establishment of broad and generic guidelines, and are unable to provide the level of assistance necessary to register a discrete impact on individual countries. In contrast, the United States has begun to address systematically the full issue of providing for a minimal indigenous information capability in several countries (e.g., Egypt and Saudi Arabia). Other developed countries following this strategy are Canada and West Germany.

Under the suggested program of advice and assistance, the United States would be prepared to provide, upon request, initial guidance and training to incumbents in charge of the incipient national information functions, and to assist them with basic materials (such as referral tools, core collections, survey tools, and possibly equipment for beginning efficient communication within and without their countries).

It must be noted that the building of basic infrastructures for information use is a limitless ocean of need, and that U.S. actions need to be based on thoughtful analyses of many unanswered questions regarding priority of needs, forms of assistance, demonstrability of intention of LDCs to support indigenous information sectors and many other. However, a program of this type is needed to afford the necessary first concrete step, one which many of the beginning level LDCs have found so far too difficult to take.

3. A concomitant attention is needed to strengthen the flow of information already being transferred from the United States to the developing world. Current information input for socioeconomic development in LDCs is highly volatile, ranging from intensely coherent to random and occasional. The United States has an excellent opportunity to impact these information flows, by incorporating

information functions as a standard component of international and bilateral problem-oriented activities it sponsors in and among LDCs. The proposition is to interconnect, via information flows, problem solvers in LDCs with their counterparts in industrialized countries, thus effectively building and strengthening networks of individuals and institutions clustered around common problems and interests.

Elements of the suggestion to tightly couple information with problem solving at the international level are evident in some of the efforts of the Agency for International Development, NTIS, and other agencies. They should be strengthened and made more explicit and formal through devices such as the following establishment of problem oriented information transfer practices and channels; development of information carriers (conferences and meetings, bulletins for exchange of experience); training of information personnel and of users; provision of information processing technology; and interfacing with existing U.S. information sources and services appropriate to the problem domain.

The complementary of the preceding suggestion (No. 2) with this one (No. 3) should be clear: while the former provides the necessary backbone of national information infrastructures in LDCs, the latter focuses on the concurrent nurturing and servicing of enclaves of problem solving users.

4. The probability of success of the two preceding suggestions shall increase substantially if the United States simultaneously undertakes a program to mobilize its own information resources and services, so as to provide scientific and technical information of a kind and in a form more appropriate to the needs and environments of LDC problem-solvers.

The mobilization of U.S. information resources and services would take the following forms:

- Accelerating the expansion of existing U.S. information services and institutions (such as NTIS and AID) toward acquiring, announcing and providing "LDC-appropriate" information that is in the public domain and within their sphere of responsibility.

- Encouraging the judicious development, by the private U.S. information sector, of LDC-oriented information services for providing, in semi-processed form, information oriented toward the decision-making and problem-solving activities of different categories of LDC users, and for mediating access to proprietary information resources.

- Formalizing a U.S. referral service for creating and maintaining an inventory of U.S. resources and services and for query switching (a component of such service exists in the National Referral Center of the Library of Congress), and

adapting this service for international access. A switching/referral center or centers in the United States will have two-fold benefits: it will provide a much simplified and more efficient access to U.S. information sources, while simultaneously and effortlessly providing customers for U.S. information and its industry.

- Establishing and promoting, in both LDCs and the United States, more efficient communication protocols for LDC access to U.S. information resources, and for the delivery of information to the LDCs. These protocols might encourage use of "appropriate" communications facilities, ranging from telephone and telex to the imminent capabilities for point-to-point transmission via satellite; the provision to LDCs of appropriate information directories; and similar means.

It stands to reason that the U.S. information sector should benefit from such a broadening of its current perception of information systems and services, in terms of opportunities for developing new information products and by serving previously dormant information markets.

5. The final suggestion recommended for the U.S. position is active U.S. support of the international organization of global networks for problem-solving information. As a result of a U.S. initiative (by former Secretary of State Kissinger in 1976), the United Nations is examining alternate formats of a "global network for technological information," the principal objective of which is to facilitate the coupling between problem solvers and knowledge resources. The network idea, although at relatively initial stages of formulation, is rendered even more plausible by the direction of development of the information and communication technologies, one of the primary areas of U.S. technological leadership. There is little doubt that versatile, global communications facilities are on the horizon. There is also little doubt that other nations, developed and less developed, shall insist on a multilateral approach to the design, operation and management of these facilities. By maintaining strong interest in and support of the network concept and movement, and by influencing its formulation, the United States and other countries can derive multiple benefits from U.S. technological leadership in this field.

3. EPILOGUE

The five suggestions described in the preceding section are intended to be complementary, in the sense that they sustain synergistically this country's long-term position toward information activities vis-a-vis the developing world. They emanate from a judicious assessment of the role of scientific and technical information in socioeconomic development, especially as seen by the developing countries themselves, and from an analysis of our own information resources and potential.

Perhaps the strongest impression that emerges from this assessment and suggested positions is one of an unavoidable need for a major transfiguration of the traditional concept of "scientific and technical information" and "STI services." The less developed countries come clearly through in stating that their primary and urgent need is to have served the information needs of individuals responsible for guiding and implementing the planned economic and social development of their nations. One way in which this new user community differs from that of science and engineering is that its members are less accustomed to relying on and working with raw data and information that characterizes STI repositories; another difference is in the nature of their problems -- problems which often require other types and forms of information than those deposited in traditional STI stores.

To serve these new communities, therefore, a modified concept of information services appears necessary, one which incorporates, as one of the service functions, elements of the problem solving processes specific to the community of developmental decision makers and problem solvers, and which affords them access to experiential informationm that exists outside the STI repositories -- often as a form of human expertise, and hence "proprietary." These desiderata are a major departure from existing information services in developed countries, whose design is based on the premise that in these countries the decision maker and the problem solver have the inclination to operate on raw data and information, and the ability to access the necessary expertise through informal channels.

The upshot of this situation is as follows:

1. Information services aimed at the LDC, development-oriented user clientele are expected to possess analytical and problem solving capabilities that are not now available in existing STI systems regardless of their degree of sophistication and mechanization. These capabilities require rather massive injection of human talent with both knowledge of information resources, the ability to operate on raw data and information, and to do so in the substantive domains of developmental problems. At this time it is not clear which problem solving functions should be incorporated in the new concept of information services or where is the dividing line between the services and the users as regards their respective responsibilities and capabilities for problem solving.

2. Despite the contention of some in the LDC user community that the traditional information resource of science and engineering is not essential to their interests, the new information services will continue drawing on both its bibliographic and (particularly) factual components. The new resource element that these services will be in substantial demand of is the body of experiential knowledge that is widely distributed in the problem solving and decision making communities of the developed countries, relatively unstructured, sometimes withheld from the public domain, and primarily accessible through informal communication channels and networks confined to these specific communities.

3. Because of these new characteristics the services are likely to be relatively costly to whoever foots the bill. The cost of searching the formal repositories of data and information is minor compared to the cost of additional human services. The cost (and value) of the additional knowledge resources needed (experiential, proprietary) is not easily estimated at this time.

A U.S. decision to provide information services oriented toward the needs of socioeconomic development of other countries thus has numerous aspects, the more obvious of which are the vast differences in scope, complexity, demand on personal and proprietary knowledge, and cost. The less obvious but equally important aspects are the implications that will fall out from these differences. The inevitable conceptual reorientation of the time-honored STI "syndrome" may possibly affect the very structure of the present-day information sector and industry.

The challenge posed by information needs in socioeconomic development is one which, when fully understood and taken up, offers a potential for another dramatic evolution of the U.S. information sector. A condition mandatory to our succeeding in this challenge is that we study and understand the nature and modus operandi of this new user community, and that we give every thoughtful consideration to its extended effects on our own national goals.

APPENDICES

The appendices of this paper are intended to support the above discussion and suggestions in several ways.

- Appendix A explicates the nature and factors of information transfer as a demand/supply process.

- Appendix B summarizes the major strategies typical for international information markets. The suggestions made earlier support the U.S. position that scientific and technical information, a product made possible by the investment of individual nations and countries, is an economic resource whose value is -- as a minimum -- commensurate with its cost of production and investment. While the latter may not yet be easily determined, the cost/benefit considerations associated with information transfer are not unlike those in international commerce dealing with other commodities. It is important to keep this in mind, particularly in view of sentiments that call for a "free exchange of knowledge and experience" (UN Conference on Science and Technology for Development. Preliminary Draft Programme of Action. December 1978).

- Finally, a reminder is in place that the United States has a distinguished record of public and private initiatives (Appendix 3) and proposals (Appendix 4) which exemplify not only this country's perception of the importance of scientific and technical information for socioeconomic development, but particularly its determination to prompt others to access and share the knowledge resources resident in the U.S. The suggestions in this document are made in the context of these long-standing sentiments.

Appendix A.

FACTORS IN THE INFORMATION TRANSFER PROCESS

To attempt to deal with the problems and prospects of optimizing information transfer for purposes of socioeconomic development by making all-encompassing propositions is bound to be futile. Information, information needs, information uses and users, and information services are not precise categorical concepts, just as the notions of "socioeconomic development" and "less developed countries" are not precise concepts. They represent ranges of meanings, each meaning being characterized by somewhat different parameters.

As a process, information transfer involves a demand side and a supply side, often negotiated and executed by an information broker (Figure 1). At each major node of this process there exist more than one alternative. The effectiveness of the information transfer process depends heavily on selecting relevant couplings among compatible alternatives.

The following notes are intended to expand briefly on the terminology used in Figure 1.

The distinction of types of economy acknowledges the considerable differences among the less developed countries as information generators and consumers. At the basic level of development, characterized by an agricultural, pre-industrial economy, the amounts of scientific and technical information generated and processed are restricted in terms of both volume and subject interest. The intermediate level economy, which characterizes countries beginning the process of industrialization, shows rudiments of an information infrastructure, on the one hand organizing the record of indigenous research and experience, on the other appreciating the need for information procurement and use. Countries with relatively industrialized economies, said to be at an advanced level of development, are anxious to join the global information economy as both suppliers and consumers. Their perception of the functions of information and of information technology in socioeconomic development is quite sophisticated.

The categorization of user types reflects the functions of information in problem solving situations. The four categories are present in all of the three types of LDCs. The policy maker category comprises decision makers at the level of ministries, planning agencies, and other higher echelons of administration and management. The technical management category is made up of individuals responsible for the direction and management of organizational entities such as corporations, firms, institutes, in both the public and private sectors. The operations category is comprised of the problem solving worker: farmer, technician, factory worker, housewife, etc. The university/research category identifies with the community of science, and

Information Demand Flow

1. Type of LDC Economy
   a. Basic level
   b. Intermediate level
   c. Advanced level

2. User Category
   a. Policy level
   b. Technical management level
   c. Production/operations level

3. Broker Type
   a. Diagnostician
   b. Synthesizer

4. Information Type
   a. Management/policy information
   b. Technical information
   c. Technological information
   d. Scientific information

5. Source Type
   a. Recorded
      1. Primary
      2. Secondary
   b. Human subject expert

Information Supply Flow

Figure 1. Elements in the Information Transfer Process
(Adapted from L. White)

research and education; it is shown as a separate group because its information related characteristics differ from those of other problem solvers.

In numerous instances the services of an information broker, or intermediary, are essential. Such services are provided by a variety of individuals: reference librarians, bibliographic search specialists, consultants, and companies specializing in information work. Two principal types of information brokering may be distinguished: in one, the intermediary diagnoses the user's need and provides the raw information that may meet the need. The second type of intermediary goes beyond this diagnostic function, by evaluating and interpreting the raw data for the user; this synthetic function has a higher probability of effectively answering the user's information need.

Information itself can be usefully categorized in many ways. One such categorization is that which corresponds to the categorization of user types. Accordingly, we may distinguish between policy information, serving managerial analyses (e.g., of alternate technologies), economic issues, extended effects of science and technology, and financial and legal aspects; technical information, comprising results of applied research, engineering and development, such as analysis and design of processes; technological information, a designation for trade information, descriptions of know-how, show-how, the bench-level secrets of the trade--generally, expertise; and scientific information, being results of scientific research.

It would be most propitious if the categorization of information sources also reflected the categorizations of users and information. Unfortunately, this is not the case; information pertinent to a given user category is deposited in many different types of information sources. For our purposes we may distinguish between primary sources, comprising the formal media of communication such as scientific journals, books, technical reports, patents, and theses; and secondary sources, in which data and information is extracted from the primary sources and rearranged in (usually) the format of classified directories such as handbooks, numeric and bibliographic data banks, and varied other compilations. The primary and secondary sources contain "recorded" information--in contrast to information stored in human memories. Recorded information tends to be organized in an encyclopedic manner; that possessed by human experts is distinct in that it represents, typically, the result of the experience of humans (hence its designation as "experiential" information).

Appendix B

S&T INFORMATION TRANSFER STRATEGIES

Normally, information is a component of technology export or transfer. The private sector acts as an agent of information transfer in a broad range of commercial transactions and enterprises, often going much beyond information related to the product in question. The role of multinational companies is potentially significant.

Beyond this natural mechanism, five main strategies are used by U.S. government and private organizations to facilitate the transfer of S&T information to potential users in developing countries. These are discussed briefly in the paragraphs which follow.

1. "Sale". This means it is used not only by commercial firms, but also by not-for-profit organizations such as professional societies, and by the U.S. government's chief S&T marketing arms--National Technical Information Service of the Department of Commerce and the Superintendent of Documents of the Government Printing Office.

2. "Barter". Under this approach U.S. and foreign publishing bodies and information services exchange goods and services. For example, the National Library of Medicine, DHEW, receives standardized input covering the medical literature in certain countries. In return, these countries receive MEDLARS computer tapes and other products based on the U.S. and world-wide biomedical literature. The Chemical Abstracts service of the American Chemical Society, and the American Institute of Physics have similar arrangements with several countries and foreign consortia.

3. Participation in international decentralized information systems. In this mode of cooperation, each country provides standardized abstracts and indexes for its own literature in a given subject field to a central, internaional clearinghouse and, in return, receives indexes and computer tapes for the entire literature submitted by all participating countries. Examples of U.S. government participation in such international networks include contributions of the Department of Energy to the International Nuclear Information System (INIS) and the Department of Agriculture to the Agriculture Information System (AGRIS).

4. "Answer and Referral" assistance. Another mode of cooperation consists of "answer and referral" services provided by virtually all government agencies. In this case, the agencies either provide the information requested or, in the case of detailed or highly technical requests, refer inquirers to the organization most able to answer the inquiry. Examples are the U.S. participation in the world-wide UN Environmental Program (UNEP); and, through the EPA, the National Referral Center of the Library of Congress, which answers thousands of inquiries per year.

5. "Person-to-Person" information transfer. Interpersonal communication, the most effective form of information transfer, is carried out in many ways as part of numerous cooperative programs between U.S. and foreign countries. Examples include assistance programs of AID; scientific and technical programs under bilateral agreements and joint commissions; the Scientists and Engineers for Development (SEED) program, funded by AID and administered by the National Science Foundation, and, more generally, the educational institutions in the U.S. which welcome foreign students.

Appendix C

HIGHLIGHTS OF U.S. GOVERNMENT ACTIONS

1948 Establishment with Government support of the U.S. Book Exchange (USBE) as a national center for the international exchange of publications.

1949 Government Technical Assistance agencies start continuing programs for the export and translation of technical literature (Marshall Plan; International Cooperation Agency; Agency for International Development, etc.); Regional Technical Assistance Centers (RTACs) established to assist local technical publishing. Assistance given to technical libraries in developing countries.

1949 The Berkner Report, "Science and Foreign Relations: International Flow of Science and Technical Information" reaffirmed the international exchange of scientific and technical information as a principle of U.S. foreign policy.

1955 U.S. proposals at the Atoms for Peace Conference led to the creation of the International Nuclear Information System (INIS) as a function of the International Nuclear Energy Agency (INEA).

1958 U.S. sponsored the (first) International Conference on Science Information (ICSI).

1967 U.S. GOvernment supported the "internationalization" of the computerized Chemical Abstracts Service and MEDLARS through the Organization for Economic Cooperation and Development.

1975 Secretary Kissinger proposed to the U.N. the creation of an international network for the international exchange of technological information relevant to development. This became an important component of the current efforts of the United Nations to explore a U.N.-wide information network supportive of technology transfer, and it motivated expansion of USAID/NTIS activities in this area.

Appendix D

SUMMARY OF PREVIOUS RECOMMENDATIONS

The U.S. information sector, both public and private, has a remarkable record of sincere concern with bringing scientific and technical information to bear on the socioeconomic advancement of development people and their countries. A part of this concern, a plethora of recommendations have been made for the U.S. to engage in programs, projects, actions and initiatives that would place this country's reservoir of scientific and technical knowledge and experience at a more facile disposal of the LDCs.

The following is a summary of a non-exhaustive survey of such proposals made in recent years (after 1970). In an attempt to give this material some structure, the ideas are arranged into three clusters: 1) recommendations intended for implementation within the U.S. information sector; 2) rcommendations intended for implementation in the information sectors of individual LDCs; and 3) internationally oriented recommendations.

The attempt to assess the present status of these recommendations exceeds the level of affordable effort; the inclusion of references (when available) at the end of the section may assist the reader to follow up on any ideas of interest.

1. <u>Recommendations oriented at the U.S. information sector</u>

   a. <u>General</u>

      - Recognize need for U.S. central point for dealing with international aspects of information (Pikus, Zablocki)
      - Establish U.S. national STI center (Werdel/NRC)
      - Establish an International Institute for Technology Transfer as a "data bank to supply information" (Hanna)

   b. <u>Access to and provision of existing U.S. STI</u>

      - Establish a central point in U.S. for channeling queries and transfer of STI (Keren)
      - Establish national referral center or centers
      - Establish a permanent demonstration of U.S. information services, including directories, in Washington (S. Adams)
      - Establish adequate directory and referral service (NRC)

- Fully develop the technology referral service of the world Data Bank (Stewart)
- Use U.S. commercial attaches as access nodes (DRI, Zablocki)
- Establish U.S. counterparts of the British Lending Library (Page)
- Finance experimental use by LDCs of U.S. STI systems

c. New Information resources for LDCs

- Collect information on "new disciplines" such as family planning, urban development, appropriate technology (Vogelsang)
- Collect scarce or rarely available information--e.g., for small farmer needs, rural health delivery, tropical agriculture (Vogelsang)
- Provide support for documentation for LDC-generated materials and ephemeral papers
- Define and collect data and information for incipient nations
- Gather and disseminate LDC-generated experience
- Support people-to-people contact (Stewart)

d. New information services

- Establish an International Center for the Exchange of Technological Information (Kissinger)
- Develop services for experimental information (Schlie)
- Develop service for LDC-generated patent information (Georgia Tech)
- Develop services on alternate technologies (Bhalla)
- Re-establish regional technical centers (until recently operated by USAID) to arrange for rights to U.S. technical publications, as means for subsidizing copyright fees (S. Adams)
- Organize extension services of information specialists to visit industry (Schlie)

- Have U.S. government encourage development of corps of consultants and firms as bridges between LDC users and information services (DRI)

- Support the development of intermediaries (Vogelsang), LDC gatekeepers (NAS '72)

- Support the development of "translator" services such as VITA (Rudel)

- Synthesize, repackage and improve dissemination of existing knowledge on techniques and technologies relevant to technology problems such as appropriate energy sources; cultural factors influencing health dietary behavior; technology for agricultural residues for chemicals; forest species identification; wood properties and potential users; coal conversion technology; food preservation, packaging and handling, storage; urban and intercity transportation experiences; farm irrigation technology; etc. (NRC/UNCSTD)

- Develop specialized "location" systems (registries, directories, rosters and referral services for people, institutions, research in progress) such as consultants and training institutions in water system/treatment, etc. (NRC/UNCSTD)

- Develop specialized management information and data systems in support of priority development areas such as census data, vital statistics, housefold sampling; energy supply, conversion and consumption; water management; land use planning; soil resources; market systems; etc. (NAS/UNCSTD)

- Develop and disseminate improved techniques for data collection, manipulation, display and storage in support of management functions and techniques for forecasting, planning, policy making, finance, evaluation and assessment, administration, management by objective and by exception, etc. (NAS/UNCSTD)

- Develop appropriate software and training programs to expand use of minicomputers in LDCs (NRC/UNCSTD)

e. <u>Internationalization of U.S. systems/services</u>

- Make available to LDCs U.S. systems/services/institutions such as NLM, NTIS, SSE, etc. (Kissinger)

- Amplify selected U.S. specialized information systems a la VITA, LIFE, NTIS, IFDC (FITC)

- Expand AID's DIS system to provide direct information services to the field

- Extend systems like ERIC to offer services to Africa (Mncube)

f. Research

- Study "appropriate infrastructure" concepts--i.e., optimal policies, institutions, and means for information transfer at various levels of socioeconomic development

- Study the role of information transfer in socioeconomic development

- Develop measures of information development of societies a la GNP, economic indicators (Menou/Saracevic)

- Study better ways of converting information into knowledge in LDCs (Piganiol)

2. Recommendations oriented toward LDC information sectors

a. Organizational infrastructure

- Assist in the development of proper structures for transfer of information with LDCs, by sector, especially for small and medium scale industry

- Assist in the development of infrastructures, institutions, information generation, and in overall information sector development

- Establish national referral centers in LDCs (Beverly)

- Support studies and surveys of information needs in and by LDCs (Saracevic)

- Support bilateral analysis, design and development of national information systems

- Assist one country to provide pilot model for information services (Mncube, Beverly)

b. Development of services

- Assist in the development of extension services in LDCs

- Establish "sister-institution" relationship with LDC information centers (NAS '72)

- Initiate or further develop extension services for the rural practitioner--e.g., for farmers (pesticide applications, forestry, post-harvest loss reduction and prevention, food preservation, crops and weather information), for small industries and enterprises, health care delivery, etc. (NRC/UNCSTD)

- Provide LDCs with core collections of information

c. Manpower development

- Support education and training of information specialists, in cooperation with regional and national organizations in LDCs

- Develop LDC-based capability centers to provide training to the establishment and operation of technology transfer (Beverly)

- Develop "definite" packaged programs in: development of national information structures, information handling, how to establish local training centers (Vogelsang)

- Contract with U.S. research institutes to develop prototype programs for LDC research institutes (Vogelsang)

- Assist LDCs in training software specialists to take advantage of information technology (Mncube, NRC/UNCSTD)

- Assist LDCs in user sensitizing

- Fund supplementary training in information for LDC students in the U.S. (DRI)

- Support training of personnel in areas of management information and data systems, systems analysis, technological choice, satellite and communications, information and computer technologies (NRC/UNCSTD)

- Train information users (FITC)

- Train specialists in most basic information services and highest priority areas (FITC)

3. Internationally oriented recommendations

a. Inter-linking mechanisms

- Develop problem solving networks in which U.S. institutions play the role of information brokers

- Embody STI activities and awareness in international professional organizations (NRC/UNCSTD)

- Develop or extend institutional capabilities for analysis, synthesis, and dissemination of information via organizations such as those embodied in the Internation Council for Research for Agroforestry; Postharvest Institute (proposed); NRC's Transportation Research Board; etc. (NRC/UNCSTD)

- Support the establishment of specialized research networks (NRC/UNCSTD)

- Create specialized professional organizations for sharing experience, such as industrial research managers in LDCs (NRC/UNCSTD)

- Promote "advisory services" of industry based organizations such as those in the U.K. (Page)

- Take advantage of the WAITRO (World Association of Industrial and Technological Research Organizations) for information dissemination (Schlie)

- Support people-to-people contacts (Stewart)

- Establish "Socially Appropriate Technology System" (SATIS) to systematize ISR activities of technology group (Groupe de Recherchers sur les Techniques Burales)

- Develop regional mechanisms for U.S. aid in information activities (Bernstein)

- Foster "international systems of technical collaboration among problem solving organizations all over the world who are working in the same area" (FITC)

b. <u>Communications facilities</u>

- Facilitate use of communication facilities in LDCs, especially telephone (DRI)

- Develop low-cost, appropriate communications systems in LDCs such as the international agriculture centers telephone polling systems (Vogelsang)

- Establish communication mechanisms (newsletters, meetings) on information requirements

- Increase the utilization of satellite communications and related technology--e.g., for remote sensing of resource mapping and assessment, global weather data systems, rural development, engineering education, information retrieval, urban and transportation planning, electronic mail and information exchange among research networks and other specialized development communities, in support of delivery systems for primary health care, tropical disease control and research, etc. (NRC/UNCSTD)

- Experimental program in satellite communication with a select number of countries in 1981 (FITC)

c. <u>International systems and services</u>

- Support existing and international specialized data information centers, services and systems--e.g., weather and crop information systems; germ plasm materials; prevention and reduction of post-harvest losses; WHO information system on water treatment, supply and disposal; methodologies for information and data management, etc. (NRC/UNCSTD)

- Support input of U.S. agricultural information into AGRIS (Lancaster)

- Develop a "network for the exchange of technological information (consisting of) a large number of individual nodes and links between them . . ." (UN/ECOSOC, E/6002)

- Establish "Technology Referral Service" aimed at improving technology choice and involving a clearinghouse (World Bank)

- Establish an "International Centre for Appropriate Technology" for very poor rural areas, to be located in an LDC; to do research (Khan)