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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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THE INDUSTRIAL AND TECHNOLOGICAL INFORMATION BANK'S (INTIB) FUTURE WORK

The need for an international industrial information programme

Prepared by

Adam Wysocki**

UNIDO Consultant

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** Chairman, Institute for Scientific, Technical and Economic Information (ISTEI). Warsaw, Poland.

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INTRODUCTION

The paper has been prepared as a contribution to the discussion organized by UNIDO on the present and future work of the Industrial and Technological Information Bank (INTIB).

Its purpose is to propose a framework for the establishment in the future of a world-wide industrial information programme, which could stimulate and assess the transfer of industrial information within and among the member states of UNIDO.

The paper, in its first part, provides short background information and reviews the main factors which might determine the development of UNIDO's industrial information activity in the not so distant future, namely:

- world-wide context of economic development
- United Nations information policy
- development of new information technology
- role of industrial information in technology transfer.

In the second part, some possible solutions for future development of INTIB are outlined.

At the very beginning definitions should be given for the basic concepts and terms used in this paper, in order to avoid any misinterpretation.

The "information programme" is usually not involved directly in an operational activity, but comprises activities aimed at establishment, development or improvement of information systems networks or services.

The main function of a "programme" is to encourage, stimulate, assist or promote such action as: formulation of national or international policy, establishment of an information infrastructure, providing information handling tools, training and education.

An "information system" is an operational activity comprising facilities for collection and analysis of data, their storage and retrieval and their dissemination to users.

An "information service" refers to those activities that provide access to recorded information resources and its delivery, usually in the form of documents, and to those that provide assistance

in applying information in the solution of problems.

An "information network" can be described as a mechanism for interlinking services and systems to give information to users at any given point. It covers physical networks, including tools for transmission of information and human networks providing interlinkage of human resources for information transfer.

Another item which also needs some explanation is the term "future". In this paper it is used to describe the period from now to the end of the century (1985 - 2000).

PART I

1.1 Background

INTIB was established within UNIDO as a follow-up of the Lima Declaration and the Plan of Action on Industrial Development and Cooperation, and was described as one of the means whereby developing countries should gain access to technological know-how and advanced technology.

Initially INTIB work was based on the industrial and technological knowledge accumulated within UNIDO and stored in Industrial Development Abstracts, Roster of Consultants, Guides to Information Sources, Industrial Inquiry Service and technical publications.

The activities of INTIB took many forms, including the preparation of document lists, technological profiles and special documentation on areas such as choice of equipment, licenses and patents and on specific industrial sectors or products (8).

INTIB now contributes a service to the technology collection process. It brings a new dimension to the ongoing industrial information activities of UNIDO by strengthening the technological capabilities of developing countries. Capacity to deal with technological acquisition, capacity to adapt or develop indigenous technologies and to transfer these among developing countries, capacity to choose among technological alternatives, capacity to obtain and assess information on these (9).

INTIB is also considered an information bank, which is "chiefly concerned with the selective processing and assessment of tech-

nological information, in order to provide a basis for making decisions; the information service of the bank will be complemented by advisory and extension services" (1).

In another definition (2) the Industrial and Technological Information Bank is to: "select, process and assess technological information in order to provide decision-makers in developing countries with a reliable and comprehensive basis for making appropriate technology selection at the planning stage of new investments in industrial development".

From the above it is quite evident that INTIB's main function is to collect and provide industrial and technological information - and that this function is to be extended by advisory and extension services.

INTIB's present and future activity should also be considered together with other UNIDO information activity such as:

- the UNIDO Newsletter, a monthly publication reporting on major UNIDO events, development and publications, industrial opportunities, expert post vacancies, information on resources sought by entrepreneurs in developing countries and resources available from throughout the world and reports on industrial inquiries.
- The Industrial Inquiry Service, providing a major link of communication and transfer of information and know-how between developing and industrialized countries through the intermediary of UNIDO.
- Industrial Development Abstract, a product of INDIS (Industrial Information System), providing information on documents, reports and studies, both in machine-readable form and in printed publications.
- UNIDO Documents List, which reviews all official documents prepared by UNIDO.
- The Roster of Consultants - containing information on consultants and consulting bureaus in developing and developed countries, and which indicates not only names and addresses but also provides information on previous activities and experiences especially in developing countries.
- Library Service, which is not only a depository for library material, but also an integral part of UNIDO Information Service - and provides Selective Dissemination of Information (SDI Service) on the basis of Country and Subject Files.
- UNIDO publications, which provide information, instruction and advice for developing countries.

This background information shows that UNIDO industrial information activity could be grouped in three main sections:

a) provision of bibliographic and factual information and documents supply,

b) industrial information advisory service providing assistance in applying information to the solution of the problem,

c) publication activity comprising both primary and secondary publications.

UNIDO's information activity is supplemented by supporting activities consisting of training courses, workshops and seminars. UNIDO has not at present developed an overall industrial information programme directed towards Member States or, more especially, towards the developing countries, and comprising activities which would enable them to develop or improve endogenous industrial information capabilities.

The future of INTIB cannot be discussed "in abstracto". It should be placed within the wide international context of industrial and economic development, which could influence INTIB's future organization and functions.

I.2 World-wide context of economic development

Current perspectives on economic development are not too optimistic. The Advisory Committee on Science and Technology for Development at its fifth session held at UN Headquarters from 4 - 13 February 1985 (3), when considering the global application of science and technology to development, stated inter alia, that the world has been going through economic, social and political upheavals of considerable magnitude and pervasiveness, which are expected to continue into the 1990s.

There has been a slow-down in the rate of economic growth, particularly in developing countries, and the prevailing view is that the modest recovery being experienced by a few Industrialized States is unlikely to spread to most of the Third World. The developing countries are facing an exteremely heavy international debt and debt service burden, which has led to a net transfer of resources from developing countries, and which has serious consequences for the process of capital cumulation.

International trade has slowed down, accompanied by growing protectionism and a sharp deterioration of the terms of trade for the developing countries. This has made it almost impossible for most developing countries to sustain export levels and to earn the foreign exchange necessary for their essential imports, let alone to service their foreign debts.

In some parts of the world, there is the added tragedy of famine triggered by a complex array of ecological problems, of which drought and soil degradation are the two most evident.

At the same time, and in strong contrast, there have been impressive scientific advances which are heralding the transition of knowledge, intensive, productive and service activities in industrialized countries. These advances emcompass such fields as: micro-electronics, telecommunications, automation and robotics, computer science and technology, new and renewable energy sources, biotechnology and genetic engineering. Their combined impact is going to bring about profound changes in the structure of industry and other sectors of productive and service activities, both for developed and developing countries. Examples of structural changes in the economics of the developed countries brought about by recent technological changes are already becoming evident.

This scientific and technological progress brought new development options and new possibilities for many developing countries. For example:

- The fields of micro-electronics and biotechnology offer advances that could lead to decentralized patterns of development by making it possible to carry out productive and service activities efficiently on a small scale - and telecommunication technologies may reinforce this pattern.
- Satellite broadcasting can be useful for distance teaching in huge rural areas.

Scientific and technological advances are also generating new options for agriculture, for biomass and for conventional and renewable energy resources for industrial purposes.

Faced with this situation and considering the enormous social demands that will fully emerge before the turn of the century, developing countries must devise new strategies for mobilizing their scarce resources in the most effective way. Of paramount importance will be the need to develop each country's own potential to the fullest possible extent, promoting a process of endogenous development, in which

science and technology and scientific and technological information must play a leading role.

The general overview of the world economic situation, and especially that of developing countries, leads to the conclusion, that it will be difficult, if not impossible, for decision-makers to find solutions for the improvement of national economies without appropriate industrial information.

Local and international industrial information services could substantially contribute to the self-reliance of developing countries by providing input to the organization and management of their industrial and agricultural production. This could also stimulate their export and facilitate their financial situation.

Such information activity cannot be achieved centrally. It requires development of local industrial information capabilities connected with other centres, both in the developed and developing world.

I.3 UNIDO-INTIB and UN information policy

The UNIDO industrial information activity should be considered as an essential element of the Global Information Network recommended by the Vienna Programme of Action.

The future of INTIB is also closely linked with the overall UN effort in the field of scientific and technological information transfer and the recommendations of appropriate UN bodies cannot be ignored in the solution of INTIB development plans.

What are the principal recent policy recommendations approved by UN bodies?

The Advisory Committee on Science and Technology for Development discussed, at its fifth session, questions relating to the Global Information Network. Its conclusions could be summarized as follows (3):

1) Adequate national efforts in the area of scientific and technological information represent the essential base upon which any network might be built. Without this, the users, whose needs such a network should serve, would be isolated from the network.
2) Each developing country needs to have a basic minimum of

information available in primary form to allow it to sustain scientific and technological activities related to its own development. Urgent, special efforts are needed to ensure that this becomes reality.

3) At the international level, efforts should first be devoted to developing a global referral service, which would enable national systems to find relevant information sources wherever they are located.
4) Such an international referral network should avoid duplication with existing services, but rather seek to ensure that adequate linkages are provided among existing systems and services.

The Advisory Committee also recognized that global trend will inevitably make new and advanced technologies, like computers and telecommunication, essential elements of any science and technology information system, and that is necessary for all developing countries to acquire the capabilities and to initiate the infrastructure for these new technologies, in order to ensure linkage with international systems and to prepare for the time when much scientific and technological information will be available only through these means.

The Advisory Committee rightly put an accent on national information capabilities as a prerequisite of any future action aiming at the establishment of a Global Information Network.

Similarly, an Ad Hoc Panel of Specialists on Information Systems and Technology for Development (Rome, 21-25 January 1985) (6) considered that the development of national information systems, and increased capability for handling, processing and disseminating scientific and technological information, constituted an essential prerequisite for rapid technological growth in developing countries, and what is necessary to develop more comprehensive information systems at national level, composed of various elements, data bases and sub-systems, geared to meet the requirements of the main users group in various fields.

The Panel also stressed that developing countries comprised a very diverse and heterogenous group, of various levels of socio-economic development and with varying priorities.

Consequently, their information needs would also be very diverse and varied and the provision of technological information to meet such requirements was a complex task and would necessarily need to be geared to national requirements in different countries.

These statements were supplemented by recommendations concerning "international linkages" of the future network, which should

be viewed essentially as means of strengthening the existing information systems or networks.

Finally, the UNCSTD Intergovernmental Committee (IC) took several decisions at its seventh session (7) relating to the Global Information Network.

The IC decided that the setting up and strengthening of national information systems and networks should form the major activity in the process of the development of a global information network.

The Committee decided further, that the efforts of developing countries in setting up and strengthening their own national information systems and networks should be encouraged on a priority basis by seeking international assistance through all possible means.

The Intergovernmental Committee requests the organizations and bodies of the UN System to consider ways and means of enhancing their cooperation in the effort to establish national information networks and systems for science and technology in developing countries, taking into account methods and standards developed by UNISIST and ISO.

The IC further requests the Secretary General of the United Nations through the organs, organizations and bodies of the UN system to take, within their mandate, the necessary measures to provide support to the developing countries for the establishment or strengthening of their national systems and networks of scientific and technological information through the provision of consultancy services, technical assistance, specialized training programmes and other appropriate means.

The message of these three UN bodies is unanimous and clear:

- the priority and the prerequisite of any international network is the national information capability;
- the Global Information Network should be built on the existing national or international facilities;
- the UN bodies, organs and organizations should support, first of all, the national information efforts.

I.4 New information technology

UNIDO's industrial information activity must take into account the rapid changes in information technology which will influence, if not determine, its future development. Computerized data bases, tele-

communication and networks, are the essential elements in modern information system development.

The major impact of new information technology is at present observed in the "hard information" areas characterized by well-defined professional and specialized markets - to which industrial information belongs.

The revolutionary changes with respect to information processing and its dissemination will have serious implications and impact on industrial information systems and services, especially in developing countries.

The rapid growth of computerized bibliographical, factual and full-text data bases and the development of transborder data flow, which is shown in developed countries, will widen the gap between them and the developing countries, which in general still use the conventional methods of information collection, storage and retrieval.

In a few developing countries an effort is already observed towards the development of endogenous capabilities for manufacture of computers and micro processors, and for the use of computerized processing and satellite communication.

Another factor linked with new information technology is that more and more technological information sources are available only in computer-readable form. Therefore, facilities for receiving and processing such information should be available in developing countries to ensure their access to industrial and technological information sources.

The UN Ad Hoc Panel (6) expressed the views that computers and telecommunication were increasingly emerging as the lingua franca of scientific and technological information - and developing countries should use these facilities in their information systems and networks together with traditional systems of information collection and dissemination.

While comprehensive abstracts and registers could be, and, indeed, have been prepared in certain countries without the use of such facilities, computers and modern telecommunications provide basic and efficient tools which should be utilized in information systems in the countries which could identify the necessary resources, in conjunction with existing systems and facilities.

The increased use of computer facilities in industrial information processing and transfer would require the provision for de-

veloping countries of an advisory service on the choice of hardware and software and their adaptation, exploitation and maintenance.

There is a danger of becoming locked into particular systems of hardware, software or telecommunication, which are incompatible with, or deny access to others, and/or may rapidly become obsolescent. Not much is yet known about the life-expectancy of these systems, but for a satellite, for example, this has been estimated at seven years, and for a personal computer at two or three.

It should also be underlined that for many areas touching the new media categories and boundaries are overlapping or blurred. This ambiguity is found, for example, between extended abstract and shortened articles, between primary and secondary publications, between formal and informal communication; between public and private sector interest. It is difficult to predict which aspect will dominate in the future, which seems likely to be increasingly multifaceted. Hybrid solutions in information transfer and processing are the most probable.

In this changing information environment, UNIDO's role in the immediate future could be:

- to encourage its Member States and provide assistance and advice in first-stage infrastructure development, international standardization and compatibility of hardware and software;
- to foster the identification of governmental and international funding, and help to establish and maintain the technology needed to provide access within each country to industrial information sources stored both locally and elsewhere, and to endeavour to make such access as widely available as possible;
- to contribute to the development of national industrial information policies by providing guidelines and support.

I.5 Information and technology transfer

The primary function of scientific and technological information is to support the objectives of national scientific and technological development and to enable the conversion of national resources, both material and human, to meet the developmental goals and the production of goods and services.

The objective of information systems and services is not only to develop technological capabilities in various fields, but to assist in the effective acquisition and transfer of technology from local and external sources.

Industrial information has its well-defined place in

the technology transfer process, which involves three elements: information, "know-how" and "hardware". Each element has different properties, and is transferred using distinct methodologies (4).

The three elements are interrelated, and form a logical chain - and all three are necessary for technology design, manufacture, installation, use, maintenance or transfer.

Information is the written, verbal or graphic description of designs, specifications, procedures and methods about all aspects of making, using, maintaining, operating, financing and administering technology.

Know-how is the skilled use of information and interpersonal relations to identify and solve problems. Know-how combines hardware and information to produce the desired technical solution.

Hardware is the physical embodiment of a tool, device, material, part or system that is used to accomplish work or to provide a service.

The weakness of industrial information is mainly that it is transferred out of the technology transfer context - and not followed by know-how and hardware transfer.

The INTIB objectives defined by UNIDO are chiefly concerned with the selective processing and assessment of technological information to provide a basis for making decisions.

Decisions in industry, as well as in all fields of human activity, are reached by a problem solving process which includes five action steps: diagnosis of problem, design of problem solution strategy, acquisition of information, analysis of information, adaptation and application of information (5).

The sequence of action from diagnosis to adaptation and application of information to resolve a given problem situation requires different skills and involves different types of information in each step.

The correct diagnosis of a problem is the key element in the sequence. At each level, and for each problem, the diagnostician brings a distinct store of information to bear upon the situation. It should be noted that the kind of information needed to properly diagnose a problem situation may be quite different from the kind of information needed for step 2: the design of a problem solution strategy.

This step generates alternative approaches to information acquisition and to solving the problem consistent with the overall problem situation- objectives, resource availabilities, constraints, times-frames, assumptions, etc.

The person who designs the problem solution strategy may or may not be the same one who did the diagnosis, and may or may not be inside the organization having the problem, and he depends on a different set of skills and information than the diagnostician. He must know how to solve the problem, and determine what solutions are relevant, feasible and appropriate, what specific information is required, where to go for it and how to get it.

Acquisition of information is the next step in the problem solving chain. Large organizations often have the information required to solve a specific problem, available from their own files, records, drawings, catalogues, data banks, patents, libraries or information centres. Smaller organizations may have directories or abstract journals. They may provide an indication as to where, at national or international levels, such information may be found, what form it is in, who has it,and who could be contacted to acquire it. The best solution is to find such information at local or national levels.

INTIB may play an important role in helping to establish national industrial information facilities or in directing the user to the appropriate active source of information.

In the analysis of the information acquired two principles should be preserved: avoiding over-loading the analytical capacities of the individuals and organizations concerned, and analyzing only the information which has direct links with the problem solving process.

The last step is the adaptation and application of information to resolve the problem situation. It is a pragmatic exercise requiring a special set of skills. It consists of putting information to work, in the face of a specific problem. In the application of information, we relate and connect information with reality. The quality, relevance and completeness of the solution cannot be better than the information supplied and the skills of persons who use it. This last step must be implemented within the problem situation or the organizational context that generated the problem.

The information flows involved in the problem solving sequence present very real dangers of sub-optimization within the information systems. It is now relatively easy to"drown"people in a flow of information. More information can be acquired than can be properly analyzed and effectively applied.

The effective and proper use of information is neither simple nor obvious nor widely practiced. Information is necessary for sound decision-making. But, if the decision-making process itself is not well-organized, even the best information will not be able to play

its vital problem solving role.

The purpose of the discussion presented above is two-fold; first, to show that information plays an important role in the technology transfer process and that different kinds of information ai needed for solving problems; and secondly, to demonstrate that it is not an easy task to provide appropriate information from outside sources for the solution of local problems, and that local information facilities and experts are needed for adaptation and application of information to concrete problem situations.

PART II

II.1 INTIB - future work

It is not easy to outline a scheme for the future work of INTIB. Lack of a recent evaluation of this information service as to its coverage, recall, precision and novelty, as well as to the evaluation of document delivery provides an additional obstacle to a more precise INTIB development plan.

Therefore, proposals for INTIB's future work must remain general, and be based mainly on literature concerning INTIB and UNIDO information activity, the existing trends and tendencies (described in Part I), general knowledge of industrial information needs of developing countries, and the personal experience of the consultant.

The scheme should be a realistic one, for stimulating development of industrial information activity in Member States and at UNIDO HQ.

The future information work of UNIDO might be oriented in two directions: operational, for the development of an INTIB network, and conceptual, for the establishment of an international world-wide industrial information programme.

II.2 INTIB as a network

The initial concept of INTIB as a kind of central "clearinghouse" or "information bank" for storing information within UNIDO and linking it informally with internal and external information sources, ought to be reconsidered in the light of existing trends in information activity.

The future of INTIB is linked, without any doubt, with

the networking concept, which pre-supposes the existence of "nodes" and a central coordinating unit.

The future of INTIB also depends on information resource sharing, because of the volume of industrial information and the financial constraints of UNIDO. Networking is an essential requirement for resource sharing.

An INTIB network must consist of a formal agreement with participating organizations, under which the materials, information and services provided by network participants are made available to all potential users.

A formal network agreement will ensure the proper input to the INTIB system and improve the coverage and representativencss of information.

Such a network might consist of INTIB national focal points (nodes), responsible for the input, processing, storage, output, control and use of industrial information.

The network concept will also stimulate the establishment of local industrial information capabilities and be a step towards improvement of the information infrastructure in developing countries.

The network link (conventional or modern) will bridge all nodes and allow information to pass from node to node. It will make possible the physical sharing and transfer of resources through the network, and increase the availability of information to all users.

The INTIB network might, and probably should facilitate the introduction of new information technology - computers and telecommunication - to the organizations participating in the network.

The network protocols, which will include rules, standards, agreement and contract rights relating to use of the network will also contribute to the compatibility of information handling procedures and to the improvement of the quality of services.

The INTIB network operation will require introduction of some basic rules, such as:

- acceptance of common responsibilities for all network participants;
- acceptance of network rules of procedure;
- acceptance of the network manager, which could be an INTIB central unit at UNIDO HQ.

With the installation of computer and telecommunication facilities as network links the INTIB network could further evolve

as an online network which could consist of:

- data base providers or producers
- data base vendors or operators (hosts)
- data base carriers, and
- data base users.

It is not the purpose of this paper to design or even to outline an INTIB network, but to provide a general framework for the future INTIB work, and therefore we should restrict our discussion to these general remarks.

II.3 UNIDO - world-wide industrial information programme

It is hard to envisage that industrial information facilities could be developed in developing countries without conceptual and financial assistance from outside. The same might be said for the establishment of a future INTIB network's nodes.

On the other hand, the international information activities in the different subject fields grouped within the UN family such as agriculture, atomic energy, science and technology, are already backed by comprehensive information programmes which encourage, stimulate and assist national and international efforts in these fields.

Furthermore, international and national sponsors, who provide funds for information activity, tend to be less and less interested in small projects, the effects of which cannot be measured and properly evaluated. They are, however, willing to participate in programmes, the impact of which can contribute to national economic and social development.

The UN plans to establish a Global Information Network also call for reinforcement of national, regional and international information capabilities in given subject fields, which could be properly represented only by UN organizations embracing within a programme all aspects of information infrastructure broadly conceived.

The information activity is a complex one, and comprises among other things policy formulation, standardization, research, education and training, information handling, establishment and development of information infrastructure and so on. These activities are interrelated and interdependent and it is impossible to imagine that an organization which claims to be responsible for industrial information can restrict its interest to one or a few elements of this complex issue.

It is therefore desirable and even indispensable for UNIDO to develop an overall international industrial information programme.

Such a programme should be a strong industrial information component of UNIDO's activity as the UN Agency responsible for industrial development.

The programme should clearly define UNIDO's place and functions within the information environment of the UN System and describe the role UNIDO could play in the establishment and development of industrial information in Member States as a tool for meeting their essential industrial needs.

It is evident that such a programme should also take into account ongoing international efforts and especially those linked with the establishment of a Global Information Network.

The content of such a programme could cover the following subjects:

a) Industrial Information Policy (at national and international levels).
This area comprises action aiming at:
- formulation of industrial information policies
- establishment of industrial information policy-making mechanisms
- implementation of such a policy/planning, programming, budgeting/
- international coordination
- involvement of Member States and international organizations
- standardization of handling procedures.

b) Development of Industrial Information Capabilities, mainly in developing countries through:
- stimulation and promotion of the establishment and development of national industrial information infrastructure
- implementation of new information technology
- training and education of information specialists and users
- promotion of innovative methods for industrial information services
- advisory and assistance activity.

c) Development of INTIB Network (see Chapter II.2)
- re-orientation of INTIB's scope and coverage towards a network concept embracing UNIDO units and national input centres
- establishment of INTIB national focal points (nodes)
- development of information links (including computer and telecommunication links)
- development and application of protocols and coordinating mechanisms
- interconnection with other networks
- development of evaluation mechanisms.

The proposed UNIDO international industrial information programme and INTIB network will undoubtedly be a pragmatic step to meet the challenge that developing countries pose to the industrialized countries and international organizations when they demand a more equal partnership in information transfer.

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