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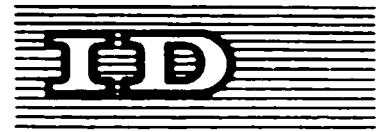
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Round Table Discussion of an
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DEMAND AND TRENDS OF

INDUSTRIAL AND TECHNOLOGICAL INFORMATION

IN DEVELOPED AND DEVELOPING COUNTRIES*

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C O N T E N T S

CHAPTER - I

INTRODUCTION

Mankind is now entering a period of transformation from an industrial society to an "information society". Information and knowledge have become the critical new factors in economic growth. While a number of vital resources are vanishing, thereby putting the very infrastructure required for running the basic industries in a precarious situation, we all know that there is one resource which is not only flourishing, but also gaining momentum each day - and that is information. It is now estimated that more than 50% of all information available today has been generated in the last twenty years. Five to ten times more information is available in any given subject area than thirty years ago. Five million scientific and technical articles are published annually in more than 100,000 journals. The world's output of new books is around 1,000 titles per day. It is this fact that has prompted everyone to talk of the information explosion.

One of the greatest challenges facing human society today and in the foreseeable future is the management of change. The chief instrument causing these changes has been advances in technology, backed by

scientific and technological research and develop-
ment and their applications to produce more goods
and services and their cumulative effect on economic
and social life of people. These changes have been
accelerating with awesome speed for the last few
decades with unprecedented advances in communication
and information technologies. Sociologists affirm
that an information age is being ushered in, in which
knowledge/information would be the axial force and
determining key factor for policy formulatioh and
material progress.

The needs-and the potential-of the rural and
semi-urban masses in the developing countries have
been the focus of the U.S. based organisation, viz.,
Volunteers in Technical Assistance (VITA), for more
than 20 years. VITA's staff and 4000 volunteer con-
sultants, many of them from leading businesses and
universities round the world have promoted research
and development and information exchange on the
whole range of technology applicable to small far-
mers and entrepreneurs in developing countries,
including small scale cement plants and improved
water wheels, automotive repairs, pedal-power presses
and so on. Recently VITA have been concentrating
on technology relating to renewable energy - tech-
nology that cuts down on the use of scarce firewood
and expensive kerosene, the chief energy sources in
rural areas of many of the developing countries as
well as on technology that uses sun, wind, water and
bio-mass. In most developing countries, these energy
sources are more competitive with, as well as, more
readily available, than imported fossil fuel.   But

very few developing countries including India, have any information on VITA's activities, due to lack of communication.

Large trans-national corporations are beginning to find that appropriate technology used in the industrial operations in developing countries can complement their overall turnover. Furthermore, many young, educated and experienced enterprising technocrat-entrepreneurs like Non-Resident-Indians (NRI) abroad, are anxious to integrate advanced technology with appropriate technologies, when it makes sense to do sc, and set up industrial units in their home countries to make a decent profit, in the process. They will, thus, be adding to entrepreneurial strength and general productivity which in turn enhances the country's ability to participate in the international economy. Incidentally, they could also help to spread technical awareness and dexterity through the population. But are there adequate and efficient channels for accelerating information to the transnational corporations and to these young entrepreneurs on industrial and technological demand and needs of both the developing and developed countries? The situation in this regard appears to be rather unsatisfactory and much needs to be done. Praiseworthy efforts are being made by the UNIDO in this regard and the Industrial and Technological Information Bank (INTIB) of UNIDO, has been carrying out action oriented activities to facilitate and accelerate greater flow of information to the INTIB users, during the past five years. Furthermore, INTIB has also been assisting in the technology-selection processes, providing information on alternative technologies and capabilities for choice among

alternatives. As for the developing countries them-
selves, the collection and dissemination of informa-
tion pertinent to the needs of their countries,
especially from the view point of priority within
the national strategy is becoming increasingly impor-
tant for their industrial and technological develop-
ment. In disseminating the required information,
besides the Government of the country, private non-
profit, national and regional organisations and
associations have to play their own roles. Facili-
tating information exchanges between scientists and
technologists, suppliers and users and between the
scientific community and policy makers, should yield
great advantage for limited additional resources.

CHAPTER - II

INFORMATION FOR DEVELOPMENT

Folloing the first industrial revolution,
economic developments in the advanced countries,
have been accompanied by a structural shift in
employment from the primary and secondary production
sectors to the tertiary or services sector. There
has grown a requirement for more and more speciali-
sation and professionalism in the services sector,
which has expanded accordingly. Now, information,
and the means and techniques of acquiring informa-
tion and control, are what this sector deals in.
Information is itself a "commodity" that provides
the basis for the livelihood of an ever increasing
proportion of the work-force. Perhaps the most
,significant contrast that can be drawn between the
industrialised countries and the developing countries
is between the information-rich and the information-
poor communities. Information as a commodity is
lacking in the developing countries.

The proposition can therefore be advanced that,
although in the course of industrial development in
the Third World, the services sector will in any case
expand as an automatic accompaniment, nevertheless
an accelerated rate of development could be achieved
by a primary concentration on the services, or infor-
mation sector; that is to say, by giving priority to
the informatization of this sector. It can be argued

that the services sector is critically important to
development and that the information technology
application that underpin activities in this sector
are appropriate for speeding up socio-economic deve-
lopment in the developing countries.

In recent years, there has been a growing aware-
ness of information as a crucial factor in the progress
of the industrialised nations, whatever their social
and economic policies and the degree of institutiona-
lisation of communication and information channels.
Information is increasingly seen as a major factor
for accelerating the development process of   coun-
tries which should make a relevant utilisation of both
the immense fund of already available knowledge and of
newly generated knowledge produced locally. The basic
problem in the successful application of information
towards development is the identification of appropri-
ate information requirements. This involves the identi-
fication of actual and potential information users, and
that of their specific information needs in the light
of the country's dev lopment goals and objectives.
Information users concerned with development fall into
three categories.

Policy makers, planners and managers requiring
information for decision-making or for determining
priority areas for national development. This type
of information is required at all levels of govern-
ment, in business and industry, in research organi-
sations and academic institutions.

Trained specialists involved in research, development and their application in all fields. They need information to sustain the innovative process which is required to transform decisions on priorities into productive reality.

Much of the rest of the population also requires information for development. For instance, in the developing countries, many of those living in the rural areas, are in need of information about available technologies yet unknown to them, but which could improve their daily lives. The provision of information to the active population will have a long-term effect on the educational level and consequently on the supply of skilled manpower in the developing countries.

It is necessary to determine what types of information and information services are needed for the various kinds of uses and users. Then investigation is needed on how far existing services, including universal services organised abroad, can meet these needs without significant extension or modification.

There should be an efficient information system by which the developing countries are able to identify sources for selecting and collaborating for acquiring the desired industrial technology and product process designs from the developed countries, with great ease and speed. The development of effective information systems in industrial technology has thus become a very important subject for the developing countries, which are endeavouring to modernise their industries, by up-dating the technologies. The importance of

technical information has become even more pro-
nounced with the rapid pace of technological in-
novations and developments in information proces-
sing and communication technologies, which provide
highly complex and efficient tools for information
analysis, storage, retrieval and communication.
There has also been rapid growth of a wide range
of information services and capability through
various devices and procedures for processing and
communicating complex technical data. These deve-
lopments have taken place and have been utilised
mostly in industrialised developed economies in
recent years and the continuing developments in
this regard are leading to significant transforma-
tion in the use and application of information in
various fields.

An information system essentially comprises of
a combination of various functions, including faci-
lities for collection, analysis of data, its storage
and retrieval and its dissemination to users. These
functions require institutional and other arrangements,
for collecting knowledge from various sources and
facilities for dissemination of such knowledge, in-
cluding document delivery, to various end users.
Such facilities can range from complex computerised
systems with satellite communications to various
media and audio-visual arrangements to libraries
and information institutions in metropolitan and
rural areas. The coverage of such system must be

open to include an enormous range of subjects,
including information on industrial technology,
research activities in particular fields, avail-
ability of specialised services, description of
institutional and technological capability in
different areas and the like.

CHAPTER - III

WORLD INFORMATION INDUSTRY

Technology offers a wide range of information and communicatio: resources than people have ever had. The resources are so pervasive and influential that it is now becoming clear that the developed countries are moving into a new era - the information age. One characteristic of the new age stands out among the welter of trends. This is, the increasing emphasis on the production, storage and distribution of information as its major activity.

The United States is the primary incubator of the changes, pushing the world towards an information age. The energies of most of the developing countries are still largely absorbed in farming or early indus-trialisation. Japan and the advanced nations of Europe are beginning the transition to a new communication and information environment, although they are not yet as deeply involved as the United States is.

The new technologies have profoundly affected governments, business, industry and the consumer. As a corollary and in fact, as the main support, the information industry has become global in scope. Domestic policies concerning computing and communi-cating have become intertwined with international happenings. Thus, worldwide, telecommunications has moved to the top of many national economic, commercial and political agendas.

The growing importance of telecommunications throughout the world is the result of three important forces. (i) Many nations have realised that they cannot compete in the development of the information industries without good telecommunications technology. (ii) The convergence of computer and communication technologies has created the possibility of growth of the information industry internationally, without regard for national boundaries. (iii) Multi-national corporate operations require worldwide round-the-clock communications and global networks for banking, air traffic control, travel reservations, news and trade. Oil producers for example, are highly dependent on communication systems to know where tankers are, when they are scheduled to arrive in port, and what special problems may exist, so that they can allocate their product most efficiently along international networks. In many cases, profits garnered by firms, depend on how effectively they use both communications and transportation.

We can with considerable assurance, forecast the nature of the communications and computer technologies into the 21st century. We can expect increasingly obiquitous information technology; transmission costs will fall considerably as we apply high speed computing to communications.

Two technologies can be singled out as the driving forces behind the information revolution: viz., the satellite and the semi-conductor "chip". A satellite receives radio signals at one frequency range, amplifies them, and retransmits them at another frequency range, using what is known as

a "transponder". While technological developments
in power sources and launch vehicles have contri-
buted greatly to the rapid development of communi-
cations satellites, transponder developments have
made possible reductions in the cost of transmission
over long distances, and today, the gradual encroach-
ment on even local communication costs.

Underlying the rapid worldwide thrust towards
digital communications and lower-cost computing, is
the dramatic and continuing decline in the cost and
price of semiconductor technology, which is based
on the silicon integrated circuit or "chip". The
number of functions on a chip is increasing by fac-
tor of 10, almost every five years. The speed at
which these functions perform their tasks is increas-
ing at least twentyfold every 10 years and the cost
of the hardware into which these chips go, appears
to be falling by at least 100 times every 10 years.

Semiconductors are used for various functions,
in processing, as in computers or stored programme
switches in the new digital telephone transmission
systems; for input/output devices such as terminals,
word processors, and telephones; and for memory
systems. They are used in small, low-cost consumer
products including pocket calculators, in video
games and in the "brains" of many new home appliances.
Semi-conductor chips are also important to the
fuel-efficient operation of the automobile.

In the future, chip technologies will provide
better human-machine interaction through improved

displays and better speech recognition and voice synthesis. They will simplify the processing of signals by reducing the number of bits transmitted and thereby lowering the cost of transmission. Finally, they will make the telephone useful and flexible - more "intelligent" - through the provision of new services, including call forwarding, speed dialing, call holding, multi-party conferencing, wake-up calling and alarm calling. Significant reductions in the cost of digital hardware as personal computers, intelligent typewriters, word processors and intelligent telephones are being achieved by producing general-purpose computer/ switching circuits and specialising their functions in the software. The significance of these developments to the computer/communications industry is that engineers will design new products under the assumption that the hardware of computer logic is essentially free. Software design costs will increasingly dominate the building of new computer and communication devices. There will be increasing demands for software designers, and more and more software will be prepackaged as firmware.

Telephone carriers throughout the developed world are rapidly moving twards an integrated services digital network, that will provide voice, data, image and video communications from a single terminal. The beginning of this revolution in the telephone service is the "intelligent" telephone. Coupled witn the digital private-branch exchanges in the office or stored programme digital switches in the carrier's central office, intelligent telephones are essentially computers with memories that can be programmed to offer a variety of communicating services.

Collectively, the services, products and information that are emerging as a result of the marriage of computers and telecommunications are known as network information services. Network information services can connect the needs and resources of users to the capabilities and services of producers and can facilitate transactions among them. All of the usual services of a marketplace can be offered within a large information network. Products and services can be advertised, buyers and sellers can be located, ordering, billing and delivery services can be facilitated and transactions - including wholesale, retail, brokering and mass distribution - can be consummated. Indeed, the entire range of products and services for business, industry, consumers and government can be perceived as a marketplace - a marketplace on a communication network, in which a single transaction on an intelligent telephone,sets in motion, concurrent and sequential activities (such as adjusting account balances and inventories and scheduling follow-on activities) that do not require human intervention.

Electronic mail networks are growing rapidly and will continue to do so as they become intertwined with private video, audio, and computer conferencing networks. The combination of electronic funds transfer, and electronic mail, makes possible far more efficient means for the management of cash. Firms in international business moving money around the world can monitor the flow of their money data continuously, keep track of payments and expected payments, and transfer money into more profitable channels, thereby ensuring much more efficient money management.

Providing these network services, requires a
production facility that can be on a network as
well. A large distributed network of computers,
software, terminals, and data bases (shopping cata-
logues, comparative analysis of insurance buys,
schedules of aircraft and trains and the like) pro-
vides an ideal production facility. New services
can be "manufactured" by adding value to existing
services; producers can pool resources to achieve
economies of scale and suppliers can specialise in
processes and products in which they have a compe-
titive edge. There is room for small producer to
custom-tailor services to an individual user's
specification.

Telecommunication costs are falling so rapidly
that it is estimated that by mid-1990s, for every
US dollar paid for transmission as much as US dollar
4 will be paid for terminals, software and the infor-
mation processing required to use that transmission.
While the growth of voice communications will continue
to increase at a relatively modest rate of about 4
per cent per year, the growth rate of network services
will be in the neighbourhood of 50 and even 100 per
cent per annum.

The internationalisation of the information
industries is inevitable. Trade in media products,
films, videos, books, magazines and newspapers has
often been the cause of considera le concern to
nations seeking to maintain, even establish cultural
identity. Data delivered via computer-communication

networks are more difficult to "read" and evaluate.
These are the transborder data-flows that transfer
technology, exchange money, co-ordinate and manage
the activities of foreign subsidiaries and organise
people. The volume of information is enormous and
its value is difficult to measure.

Computer communication networks know no national
boundaries. It is relatively easy to manufacture
information   on international network production
facilities and to market information products and
services in the international network marketplace.
Nations recognise the importance of this new inter-
national industry and are seeking ways to enter it.
Some seek tariff or non-tariff protections. The
international debate concerning transborder data
flow is, in essence, a debate about international
trade in telecommunications and information products
and services. How a nation develops its strategy
for dealing in this new international information
trade regime depends on how it views information
in its society and this depends on its legal and
cultural history.

Information   is now a major concern
to all advanced nations and of increasing concern
to developing countries. Information is necessary
for technological and economic growth and for the
efficient management of enterprises and even per-
sonal affairs. Information has value and is freely
and widely available for purchase. In the U.S.
view, information is a traded commodity that should
not be tariffed and that should be "free to flow"
in international markets.

The French see the development of their own
information products and services, as well as of
the equipment and systems required to produce and
distribute them, as being of prime importance to
their economic growth. A nation that cannot itself
provide the information products necessary for its
citizens and industries has lost a good measure of
its independence, according to this view.

Brazil takes a view that electronic technolo-
gies – communications and computers – provide the
industrialising nations with an opportunity to be-
come competitive on more secure, if not equal,
footing. Brazilian industrialisation policy seeks
the absorption of technology, not merely its trans-
fer. This approach calls for Brazilian businesses
to make the kinds of improvement in their new tech-
nologies as might be made by similar businesses in
industrialised countries.

Almost a decade ago, Japan took a momentous
step of making direct government investments in
research and development and has since made inroad
into the "citadel" of advanced technology viz.,
the United States.

Indonesia, Thailand, the Philippines, India
and the new nations of the Pacific Basin are
searching for the means to expand their communi-
cation and computing capabilities. India and
Indonesia have already launched their own satellites,
and Australia would have done so during 1985. The
scattered island nations of the Pacific are seeking

the means to communicate with each other as well as
with important metropolitan cities of the world
like New York, London and Paris.

Modern information technologies and the in-
creased generation and application of technological
information, including the development of national
primary and secondary services and data, is essential
to socio-economic development, together with increased
flow of such information from external sources and
the possibility of access to foreign sources. Since
technical information in industrialised countries
will increasingly be available in machine-readable
format, its effective utilisation in developing
countries may depend largely on the extent to which
such format is utilised and also on the selection
and preparation of suitable inputs and optimal usage
of the outputs from such facilities.

Information policies and strategies in develop-
ing countries should therefore take recent develop-
ments in information technologies into full account.
At the same time, these policies should lead to the
development of appropriate information systems, which
meet essential requirements for generation, dissemi-
nation and application of scientific, technological
and industrial information.

The scope of information systems dealing with
technical and industrial information varies consi-
derably with the wide range of requirements at
country level and in various fields and sectors.
Such systems and facilities extend from traditional
means of collecting and storing data in non-digital
form and disseminating such data through mail ser-
vices, field demonstrations and the like in most

developing countries, to highly specialised data
bases and services, using digital format and
satellite communications for high speed and high
volume data transfer across national boundaries,
mostly in developed countries.

Since the 1970s, the nature and potential of
information systems has changed significantly be-
cause of the major transformation in most aspects
of information technology. Comouters, and other
information machines are the motor power, pulling
us towards a transformed society faster than we
can understand where we are going .

CHAPTER - IV

INFORMATION NEEDS OF AN INDUSTRIAL SET-UP

Technical information available today is so
vast that the success of an industrial firm depends
first on its ability to receive the vital informa-
tion, in time. Information has come to be realised
as an important commodity in production along with
men, material, money, machinery and methods. Since
technological lead of an industry is a measure of
time employed for the proper utilisation of informa-
tion to remain ahead of others, technical information
holds the key to the continued prosperity of many
industrial units. The basic problem in the success-
ful application of information towards 'technovation'
- which is a creative process in financial and techni-
cal terms - is the identification of appropriate in-
formation requirements. The information needs of
entrepreneurs are crucial to the survival of the
business. The organisation of information into a
Management Information System (MIS) is equally impor-
tant to both big and small firms.

A well organised documentation and information
analysis service can help to improve the technovation
process in a Company, whether small or big. The advan-
tages that result from such a service are: shorter
innovation process, increased productivity, increased
competitiveness, better environment and higher profi-
tability. Especially in an engineering enterprise,

the vita. part played by technical information can
be assessed by the manner in which technical infor-
mation has catalysed the growth of the enterprise.
The information that led to acquisition of knowledge
and expertise in several areas of advanced technology
can afford an opportunity to disseminate this know-
ledge to others, outside the enterprise to enhance
their manufacturing operations.

A responsive and effective information service
requires adequate information for its own control,
growth and adjustment. This concept implies a culti-
vated understanding of the needs of the users to be
served and their reactions to the services provided.
It also implies continued monitoring of information
handling operations, technical alternatives, costs,
etc.,

In an ideal situation, the industrial informa-
tion system is composed of all information elements
required by every employee to accomplish his work.
Such an information system not only assures tech-
..^logical growth of the Company but also fosters
good industrial relations.

The activities of any industrial information
system greatly depend on the nature of information
flow in the organisation.

A generalised pattern of information flow to
support decision making at various levels in any
industry is shown in the flow chart on page 22.

Also Table I on pages 23 & 24, shows the
various information packages and the variety of
end users in a typical industrial organisation.
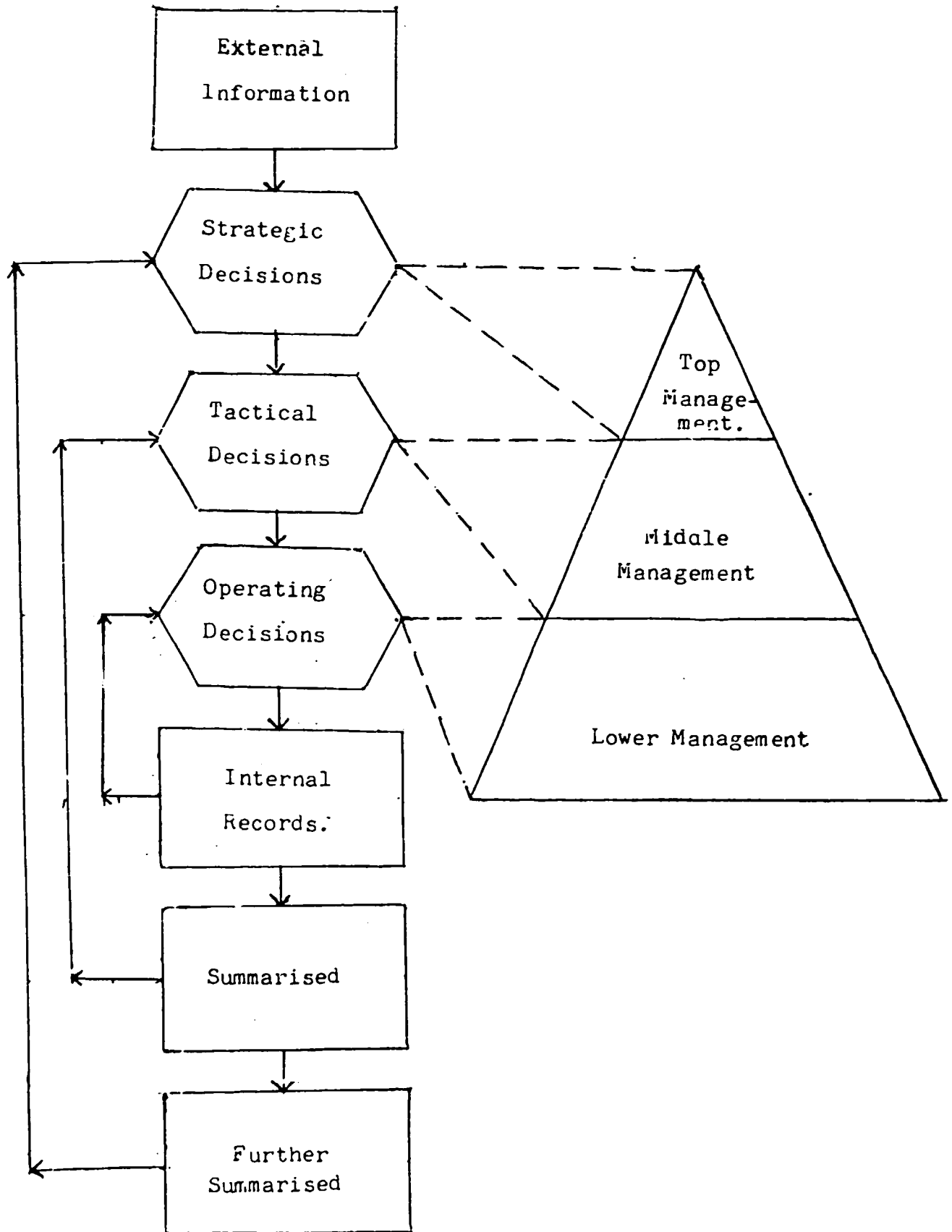
Information Flow in an Industrial Setup.

TABLE I : END USERS OF THE INFORMATION SERVICE/PACKAGE

Information Service/ Package	Contents	Department	Organisation	Ancillary Units	Industry	Society
1 Current Title Service	Bibliographical details of all articles of documents received in the Information Bank	x	x			
2 Bibliography	A comprehensive list of selected documents on a specific topic	x	x	x		
3. Statistical Information Service	Statistical data on the products or processes of interest to the user	x	x		x	
4 Technical notes	A brief account on the technical topic of interest	x	x	x	x	
5 Executive Brief	The information package highlithts topics of interest to the organisation	x	x	x	x	x
6 Topical Note	A comprehensive write-up on a specific topic or an event	x	x		x	
7 Management Abstracts	The various management techniques that have relevance to industry	x	x			
8 Product Information Brochure (PIB)	Provides exhaustive information on newly developed products of interest to the organisation	x	x	x	x	
9 Comparative Product Profile (COPP)	A comparative study of the salient features of products or processes of the competitors	x	x		x	
10 Country Profile	Social and techno-economical, political aspects of a country are analysed	x	x		x	x
11 Tech-Alert	Provides Information on emerging technologies by scanning current periodicals	x	x	x		

12	Technology Link	Latest trends in research & development of a specific technology are analysed	x	x		x	x	x
13	Product Focus	The salient features of products relevant to the industry	x	x		x	x
14	Nascent Information Service	An alert service for the top executive to keep abreast of the latest economic developments	x	x			
15	Transearch	The technological topics of interest to the organisation are identified by scanning French and German periodicals	x	x		x	x
16	Patent Information Service	Brings to the notice of the engineers the latest product/processes that are patented	x	x			
17	Write-ups	Information package on any technical or management topic. It is prepared on request or in anticipation	x	x		x	x
18	Oral and written translation, interpretation	Translations of technical texts from German, French to English. Interpretation service covering French, German and Italian to top management	x	x			
19	Reference Service	Involves answering technical query posed by the user	x	x			
20	Selective Dissemination of Information (SDI)	Matching users profile with the document profile to meet users' needs	x	x			
21	Referral Service	In the absence of the availability in India of information, directing the seeker of information to possible sources	x	x		x	x
22	Liaison	Establishing contacts with national and international technical institutions/associations for exchange of information	x	x			

Any industrial information system is likely
to be engaged in processing operations that have
one or more of the following characteristics :
(i) a large volume of input data; (ii) repetitive
tasks; (iii) the need for speed in processing and
retrieval; (iv) the need for a high degree of
accuracy;   (v) processing complexity i.e.,
complex manipulation of data; and (vi) information
exchange.

The above characteristics of industrial infor-
mation system encourage use of computers and micro-
processors. Computerised storage of information
saves time and increases productivity. Information
can be analysed and stored on any of the mass-storage
devices (like magnetic tape, magnetic disk) and the
same records in a file could be reorganised several
times according to the requirement. The computer
files can be easily accessible to several people
at nearly the same time. The network system will
connect two or more departments and they will be
able to quickly exchange information.

CHAPTER - V

CURRENT INFORMATION SYSTEMS AND
FACILITIES IN DEVELOPING COUNTRIES

The existing situation in developing countries
in regard to "information systems and facilities" is
varying in degrees, however, with underlying common
factors viz., most of them do not have any national
information policy and national network of informa-
tion service. The information institutions where-
ver these exist, are highly fragmented with very
little co-ordination between them. Of course, most
of them have national Libraries and Central Libraries
in towns and cities. Almost all their big cities are
endowed with university libraries and in some countries,
the U.S. Information Service and the British Council
Libraries. The latter two, keep titles emanating
mostly from their respective countries. Besides, in
some of the more advanced developing countries, faci-
lities exist in scientific & research institutions
and laboratories for collection and dissemination of
information on a particular discipline e.g., aero-
nautical research institutes maintain fairly up-to-
date literature, journals, articles and monographs
related to aeronautics for the use of their staff and
for individuals interested in the subject. Such
sources also serve the aircraft industry and educa-
tional institutions like science and engineering
colleges. Besides, industries in the large sector
- both in public and private sectors - maintain
libraries and documentation services for the use of
their own staff, mainly on subjects pertaining to the
technology of the products manufactured by individual
enterprise.

Broadly, most developing countries can be cate-
gorised under three different groups in terms of the
extent of information activities and facilities,
they possess. In the first group, which comprises of
relatively a few more advanced developing countries,
·   have well defined policies regarding information
on industrial and technological developments and pos-
ses satisfactory institutional and other facilities
for information processing, including documentation
and communications. However, institutional co-ordi-
nation even in these countries is generally inadequate
and although a collection of periodicals is maintained
in some institutions, the majority of such collections
are fragmentary. In some of these countries, list of
periodicals is maintained at national information
centres together with the documentary delivery system.
Public abstracts are generally available in some of
the institutions. However, they lack modern facili-
ties of collection, storing and retrieval of informa-
tion like computer facilities, and access to foreign
data basis is limited. Several other aspects of in-
formation systems require considerable strengthening
such as the need for a much large collection of books
and monographs, greater access to latest publications,
specialised training facilities for informational per-
sonnel, greater dissemination of information, documen-
tation deliveries to particularly non-metropolitan
users and greater co-ordination of information func-
tions and institutions. One important aspect which
needs to be strengthened in these countries is to
provide incentives and facilities for greater utili-
sation of industrial and technical information by
user groups including repackaging of such information
in suitable form and language in which it can be
effectively utilised.

The second group consists of those countries
where information systems and facilities exist
only in certain selected sectors of industry and
economy, apart from the existence of basic insti-
tutional facilities such as in university and
central libraries, in individual enterprises and
in documentation and research institutions, with
fairly satisfactory information, documentation
and dissemination mechanism. However, there is
no national network of information systems, neither
there exists any information policy at national
level. Well-defined collection and dissemination
of technical and industrial information are frag-
mentary and limited. The collection of books,
periodicals and monographs is generally poor and
these countries experience difficulties in acquir-
ing new titles. Computer facilities for acquiring
industrial, technological and scientific information
are poor and can rarely be used for on-line searches
of external data basis. Telecommunication systems
are inadequate for interlinking information systems
in different parts of the countries. In addition,
there is serious shortage of skilled personnel in
processing and for implementation of information
techniques. Facilities for research in science
and technology are lacking in most of these coun-
tries and if available, are restricted only to a
few sectors. Only a few periodicals are available
in complete collection and document delivery
systems are restricted to only a few areas.

In the third group of developing countries,
who, form unfortunately a large majority, there is

barely any information activities on science, tech-
nology and industry, or wherever these exist, are
at very low level in terms of capability and usage.
In these countries, there is very little awareness
of the importance at the users level of technical
information. Demand for and use of such information
has not developed and there appears to be very little
effort made in order to improve the situation. Col-
lection of books, periodicals and monographs is very
limited and generally out of date with hardly any
new titles in various fields. Computer facilities
for information processing do not exist and there
are only a few skilled personnel available for hand-
ling technical and industrial information. Generally,
in this group of developing countries, information
system and the required infrastructural facilities
are extremely inadequate.

CHAPTER - VI

GROWTH OF INFORMATION TECHNOLOGY IN INDIA

In order to assess the role of information services and the impact of information technology for the growth of industrial development, it is essential to make a very brief review of the birth and growth of industries in India. It was only after the Second World War, a concerted effort was made to transform an agrarian economy into an industrial economy. An organised creation of industrial activity in India is therefore hardly four decades old.

The industrial information service in India has adapted itself to provide useful information to serve the cause of industrial development of the country. The actual industrialisation can be deemed to have started after India attained independence in 1947. The initial post-independence years were characterised by the creation of industries with technical know-how obtained from abroad. Most of the information needs at this stage were provided by the collaborators whose products were introduced into the Indian market through licence manufacture. Hence the products, processes and even relevant industrial information were fully imported. The real change came about with the generation of indigenous know-how as a result of domestic R&D efforts. It was at this stage that the industrial

information service was recognised as an important constituent of industrial development of. the country. The birth of most of the enginering industries in India through foreign collaboration and their subsequent growth due to their own capacity to provide the required knowhow is the general pattern. The information needs have changed from the stage of collaboration to the stage of indigenous production.

Access to precise and reliable information - scientific, technological, commercial and managerial - at the right time in a form most conveniently usable can help to arrive at quick decisions, measure performance, take remedial action and plan for the future, in addition to minimising the wastage of resources due to unnecessary and unintended re-invention. Furhter, the availability of the right type of information can trigger new directions in research, development and managerial action.

Electronic computers were introduced in India just about two decades ago. Until recently, developments for the extensive use of sophisticated computer technology in data and information processing have been comparatively slow and sporadic.

The computer centre of the Indian Institute of Technology, Madras, is used for implementing the CAN/SDI experimental project, in operating the Police Information System for the Tamil Nadu

Government, and in other management information system development. An experimental terminal has been installed in Bangalore. The Tata Institute of Fundamental Research (TIFR), Bombay, has an active computer/information research group developed over the past two decades. The computer facility of the Delhi University has been used extensively by the Indian National Scientific Documentation Centre (INSDOC) in preparation of various data bases, indexes, directories etc.,

The Indian Statistical Institute, Calcutta, has been the pioneer in the use of computers and in computer science education. Its division, the Documentation Research and Training Centre, in Bangalore, has been developing programmes and pilot computer-based information storage and retrieval systems, indexing methods and offering courses in the subject as part of its programme of education in documentation and information science.

Some of the industrial information centres such as the Central Technical Information Centre of HMT and Technical Information Centre of BHEL have started using computers for information processing. HMT's Central Technical Information Centre is developing Computer based selective dissemination of information systems mainly for internal analysis.

The Data Bank and Information Division (DBID) of Information Planning and Analysis Group of the Electronics Commission has been maintaining an information base for dissemination of basic data pertaining to indigenous electronics industry. The information is being maintained in a computerised data bank called 'Electronics Industry Information System'. Data, such as directory information, licensing, approvals, production, export, import, foreign collaboration and other macro-level statistics regarding the electronics industry are available with the data bank. The information is being used mainly for internal analysis as well as policy formulation and is also being provided to the entrepreneurs, other Government agencies, and answering Parliament questions. The main functions of the Division are the following:

    (i) Acquisition of Data

   (ii) Organisation of Data

 (iii) Analysis and synthesis of data

  (iv) Updating of data

   (v) Data retrieval and dissemination

  (vi) Feedback and improvements

Bhabha Atomic Research Centre (BARC) at Bombay uses computer for its catalogue of technical reports and other documents. It now serves as the input centre to International Nuclear Information System (INIS) and has developed Information Retrieval System for INIS data base.

National Information System for Science &
Technology (NISSAT) - Among other things the
NISSAT plan envisages the development and use of
computer facilities in bibliographical information
processing, data base creation and information
transfer and services based on them, in information
storage and retrieval, in Selective Dissemination
of Services based on international tape services
etc., Considerable progress has been made in all
these areas.

Policy directions for generating and utilising
scientific, technological and social knowledge for
socio-economic development of India were succintly
enunciated by the first Prime Minister of India,
late Pandit Jawaharlal Nehru in the country's
Scientific Policy Resolution (SPR) in 1958. SPR
not only stresses the role of science and techno-
logy for socio-economic developmental approach, but
also places equal emphasis on systematic building
up of information/knowledge base and its use. This
far-sighted and enlightened policy has resulted in
the creation of number of R&D institutions in the
last four decades. Alongside these institutions,
the information support base has also been built
up. Good as these efforts are, as information has
now come to occupy the centre of the stage, its
care, harnessing and management assume great impor-
tance and the evolution of a national information
policy now seems to be imperative.

The information infrastructure that India has,
comprises mainly libraries, documentation and infor-
mation centres, a few information analysis centres,
centres for scientific data, centre for socio-

economic statistics etc., These institutions have
been established at various stages of the country's
development, offering library, documentation and
·information services in a conventional way. Now
these institutions have to be integrated to form
a national network, identifying their respective
individual and collective roles, functions, and
responsibilities, with proper linkage and inter-
connections, but without any administrative control,
and red tape from any one top organisation. With
the fast changing dimensions of information, new
types of information institutions are bound to be
designed and developed. These new types should
coalesce with the existing framework smoothly.

Information technology holds the key to the
success in establishing an integrated versatile
national system. At present, except for the National
Information Centre, which is attempting to provide
MIS to the Government and a few sporadic attempts
at local levels by some institutions, not even be-
ginning has been made to modernise information
systems and services at the national level. Bibli-
ographic information, factual and numeric data ser-
vices, are increasingly becoming computer-based and
are commonly available on-line, in most of the deve-
loped countries. In the meantime, these services may
be available only in the machine readable forms and
paper based services are likely to be prohibitively
expensive. As heavy importers of information.
India's information systems and services would be
seriously affected even to hold-on to conventional
services as they stand today. And the big problem
for the country, which is being tackled by the
Government of India on a top priority basis, is

the awfully inadequate tele-communication facili-
ties. Hence the country's National Information
Policy directions should include   ice or computer
hardware - main frame, macros and minis with all
supporting systems - development of software indi-
genously or import of software compatible with the
hardware, problems of netting linkages with inter-
national data bases etc.,

All these naturally imply that a continuous
stream of quality manpower should be made available
at all levels of information handling. This is one
of the serious lacune at present in India, needing
a great deal of attention.   The National Information
Policy should not only be for setting and offering
full-time education and training programmes on crash
basis, but also to organise continuing education
and training programmes to absorb the existing man-
power into the modern mainstream.

Above are only some of the salient issues. But
to create an effective mechanism and machinery for
providing accessibility and availability to recorded
public information, national information network is
a minimum requirement. For a fast developing country
like India the time is ripe for initiating appropriate
actions by all the shareholders, like the Government
of India, professional associations, educational
institutions, industry and trade etc., to evolve a
National Information Policy.

CHAPTER - VII

DEVELOPMENT OF NATIONAL AND GLOBAL
INFORMATION SYSTEMS FOR DEVELOPING COUNTRIES

In developing any information systems, one
should not think in terms of only supply of infor-
mation but place higher emphasis on the quality of
information stored and distributed by the system
and the information support with which the system
would be equipped. It is the final users of the
scientific and technological information, their
perceived and unexpressed wants and needs that
must be at the centre of attention of any infor-
mation systems. The differences between the re-
quirements of the users of scientific information
on one hand and the industrial and technological
information on the other, must also be recognised.
Information is not an alternative to action, but
on the contrary, an essential element in the deci-
sion making process and hence an instrument to
allow action with higher probability of success
to identify actions and select among them.

The inadequcies of the information institutions
and facilities in most developing countries call for
an urgent need to improve the prevailing situation
in those countries for developing effective and
efficient national information systems on industrial
and technological front.   No doubt any measures
for improvement of existing information systems
and for creating new facilities and institu-
tions for the purpose, will have to be so designed

that these meet the general and specific require-
ments in a country's situation. In the first
place, objectives of such information systems
should be clearly defined in the national infor-
mation policy. Thereafter, the promotion of
demand and usage of scientific and technological
information and identification of main user
groups in a country, are some of the important
aspects to be looked into. Other aspects which
need to be covered, include, assessment of the
kind of information required and determination
of inter-relationships and linkages necessary
with scientific and technological information
systems in other countries and at the regional
and international levels.

In formulating any national information
systems and information network, we must recog-
nise that without a close relationship between
the demand side representing both existing and
potential user requirements, and the supply of
scientific and technological information, it is
not possible to stimulate and promote increased
demand and greater popularisation of information
usage. An important function of the national
information system should therefore be, the
development of socio-economic environment in
which scientific, industrial and technological
information is required and is utilised to much
greater extent than at present.

Role of government in developing countries
for establishing and strengthening information

systems and **institutions** is very important and
indeed is pivotal unlike perhaps in the developed
countries. It therefore becomes necessary for
the governmental agencies in developing countries
to assess carefully users' needs and promote user
demand especially in the priority areas of special
national interest. The user groups include gov-
ernment departments and agencies, educational and
research institutions, industry and trade, engi-
neering and consultancy firms, trade and industry
associations, development banks, individual entre-
preneurs and professionals.

Bibliographical information and linkages with
regional and inter-regional networks constitute an
important aspect of information systems at the
national level. In most developing countries,
bibliographic information sources need to be greatly
strengthened and national bibliographies should be
prepared in each country.

Non-computerised information systems and faci-
lities will continue to be necessary in developing
countries, despite the gradual extension of latest
information technologies to the developing countries.
Books, periodicals, documents relating to science,
industry and technology will continue to play a very
important part and their acquisition and delivery to
end-users will remain an important function of infor-
mation systems in these countries.

It must be appreciated that no uniform model of
information policies or systems can be presented .

which could be suitable for all developing countries.
Hence there is need for considerable flexibility in
the development of information systems and institut-
ions and these should be capable of adjustment to
changes in country situations and the level of
development. A review of existing information ser-
vices and facilities in each developing country
should be undertaken and an assessment made of the
extent and manner in which existing information
services at national level are, in fact, being utilised.

The development of effective national information
systems on science and industrial technology in deve-
loping countries and the finanacial and the technolo-
gical constraints faced by most of these countries,
especially in the introduction and use of latest in-
formation technology, necessiates greater international
co-operation between developed and developing countries
and the implementation of programmes of multi· llateral
and bilateral technical assistance for this purpose.
Technical assistance programmes should cover selection
of equipment, development of software and implementa-
tion of specialised training programmes for local per-
sonnel, besides linkage arrangements at inter-country
and international levels.

The establishment of global network of information
is an evolutionary process requiring several years of
concerted efforts from the national governments, re-
gional inter-governmental organisations and the UN
system as well as the international scientific and
technological community at large. Considerable progress

has been achieved by the industrially advanced
countries in developing international information
systems over the last three decades and these have
different purposes in terms of subject and func-
tional coverage as well as information and commu-
nication structures, and management strategies.
Despite such vast volume and diversity of informa-
tion sources, developing countries find it diffi-
cult to make effective use of them. This situation
could be improved by adopting the following measures:

(1) First and foremost is to strengthen the
existing national information systems on scientific
and industrial technology in the developing countries.

(2) Activise the source referral function of
the network globally and using the existing services
facilities at the international level, expand the
coverage based on demand requirements and availability
of resources.

The development of global network of information
at the national and international levels, depends
essentially on the commitment of the respective gov-
ernments of the developing countries and subject to
this, following measures could perhaps assist the
countries to develop their information networks :

(i) Activise the scientific and technological
source - referral system, at the national, regional
and global levels;

(ii) Establish an effective method of co-opera-
tion among organisations and agencies to achieve
integration of different systems and networks from
the users point of view mainly through the develop-
ment of adequate software; and,

(iii) set up establishments and maintenance of
formal mechanisms for interaction among participants
of the network.

The emerging scene in the information tech-
nology in developing countries could be   data
networks - new type of infrastructure - being
ushered in by compelling forces of **economic** and
technological change. They are the product of
an exciting link-up between computers and tele-
communication.

For any industrial development programme to
be successful, it needs immediate and free access
to the latest techno-economic information in the
relevant fields of industry available in any part
of the world. An effective means of obtaining
such an access is through a well-organised modern
information and documentation system using compu-
ters, microprocessors and telecommunication net-
works.

In this emerging scene, the information system
can be visualised as a system of basically three
components, viz., information, user, and staff,
operating in a specific environment. Any infor-
mation system, to be effective, should be designed,
based on a study of the environment in which it
operates with respect to its impact on users, infor-
mation sources and professional manpower resources.

The system should be capable of constant re-
adjustment based on the changes in environmental
factors. The information system in the regions
concerned should include the *following elements
as shown in the flow chart on page 44 :

    * A profile of the information sources
      which feeds the system.

      A profile of different types of docu-
      ments that enter the system.

The operations of systematic scanning of information, selective acquisition of documents and their technical processing.

Data bank of information relating to actual facts and data relating to industry as well as indexes relating to document/institutional/personal sources containing specific data and information.

Document bank or library of documents relating to the relevant subject fields.

Information retrieval systems based on electronic data processing system which gives immediate access to information contained in either data bank or document bank.

Analysis and synthesis of information to suit specific needs or specific users according to their special requirement.

Selective dissemination of information.

Project oriented dissemination of information to specific project teams in industries or institutions.

Other dissemination services like documentation lists, state-of-the-art reports, bibliographies etc.,

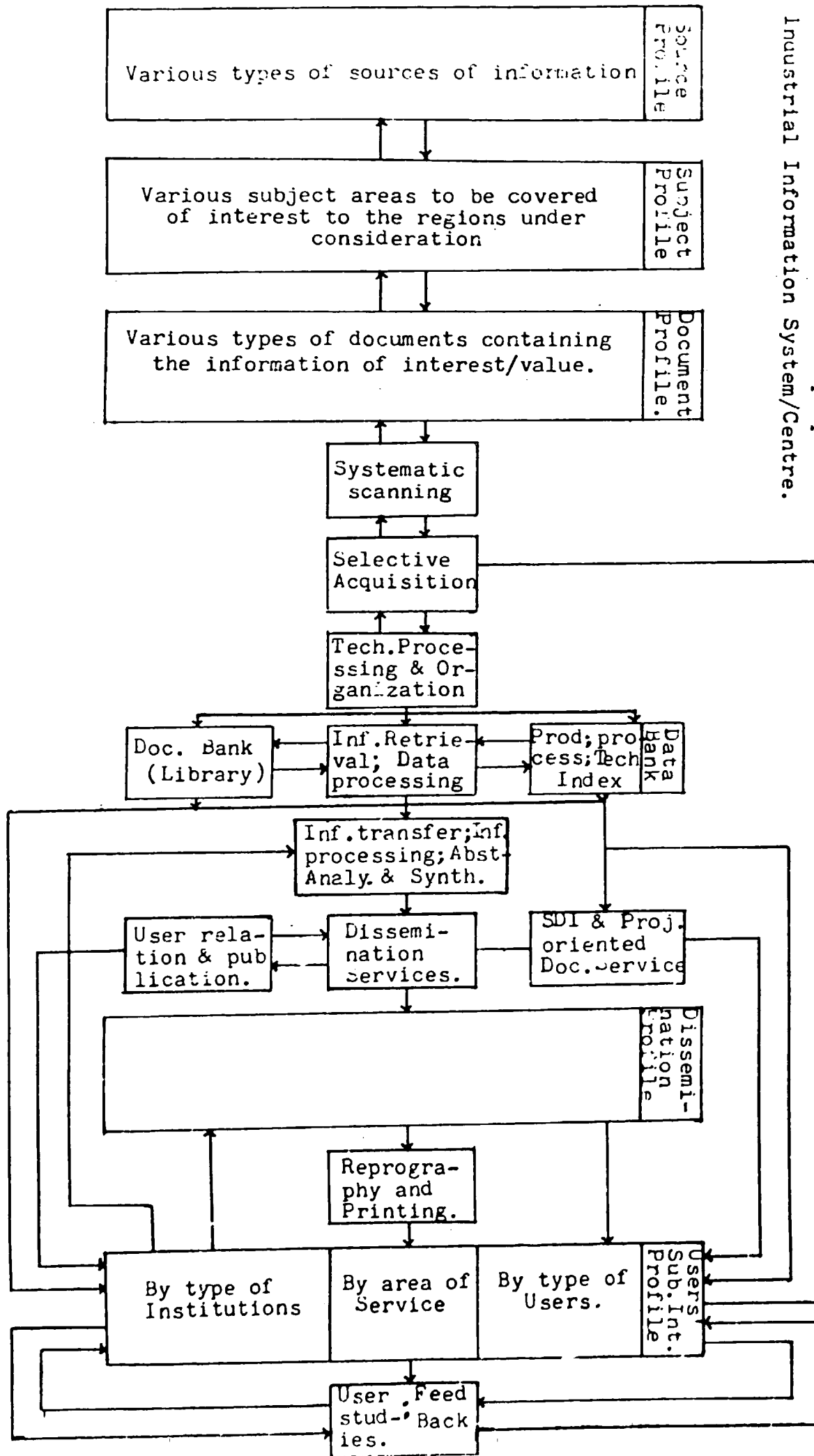Publication activity for dissemination of information.

Reprographic & printing services to produce various dissemination services including publications.

User profile according to type of institution and type of occupation in different areas/regions coming under the purview of the proposed system as a basis for the services.

Feedback mechanism from users to redesign and reorient the system for maximum use.

Flow Chart of activities of proposed Industrial Information System/Centre.

Various types of sources of information	Source Profile
Various subject areas to be covered of interest to the regions under consideration	Subject Profile
Various types of documents containing the information of interest/value.	Document Profile.

Systematic scanning

Selective Acquisition

Tech. Proce- ssing & Or- ganization

Doc. Bank (Library)	Inf. Retrie- val; Data processing	Prod; pro- cess; Tech Index	Data Bank

Inf. transfer; Inf. processing; Abst- Analy. & Synth.

User rela- tion & pub lication.	Dissemi- nation Services.	SDI & Proj. oriented Doc. Service

Dissemi- nation Profile

Reprogra- phy and Printing.

By type of Institutions	By area of Service	By type of Users.	Users Sub. Int. Profile

User Feed stud- Back ies.

An essential approach to science and tech-
nology information dissemination processes at
the national level is to enrich the information
resources and optimise their utilisation by all
those who need them. Information processing
should be co-ordinated to eliminate unnecessary
duplication of effort and at the same time, to
assure everyone of access to information.

Following are some salient suggestions which
could be implemented by developing countries on
priority basis :

Computer based information systems should
not be an ad hoc development. They should
be developed in a scientific way.

There should be a good compatibility be-
tween hardware and software development.

The specific areas of information to be
computerised should be identified taking
into view the techno-economic considerations.

Greater emphasis should be for information
analysis service and various types of
information packages.

There should be effective liaison between
industry and university in develpping
information technology.

There should be Technical Information Centres
at all medium and large industrial establish-
ments and industrial estates.

An agency should be established on a national
basis to train and develop personnel in the
area of computer based information systems
and information analysis.

Industrial Information Bank on modern lines
to cater to the needs of the industries and
entrepreneurs should be established.