

## SCIENTIFIC AND TECHNICAL INFORMATION EXPERIENCES AND ACTIVITIES IN INDIA: PROBLEMS AND FUTURE PROSPECTS\*

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### I. PLANNING FOR SCIENTIFIC AND TECHNICAL INFORMATION SYSTEM

Having recognised the important role the information sector plays in the application of science and technology for development, the fifth Five Year Plan (1974–79) gave considerable emphasis on the need for a national science information system. In planning and evolving the national information system relating to science and technology, the pre-requisites were also clearly identified and listed as follows:

- (i) good communication facilities linking the users to the network of information centres and interlinking within the network;
- (ii) more effective use of existing telecommunication facilities and developing new communication facilities for efficient operation of the system;
- (iii) support for scientific publication activities, including the establishment of a national science press;
- (iv) information resources (libraries, documentation centres etc) with adequate collection of all types of documents;
- (v) facilities for training in library and information sciences and communication;
- (vi) good organisational system using modern management techniques and financial procedures;
- (vii) standardisation in materials, techniques and patterns of service.

Having outlined the broad issues and identified the pre-requisites, the Government of India proceeded with the concept of the establishment of a national information system which would embrace the following objectives:

- (i) provision of a national information service relevant to present needs and capable of development to meet the future needs of the generators,

processors, disseminators and users of information;

- (ii) optimum utilisation of existing information services and systems and the development of new ones;
- (iii) promotion of national and international cooperation and liaison for exchange of information;
- (iv) support and active encouragement for the development of facilities for education and training in information science and technology, and in communication, to provide qualified manpower for the implementation of the national science information policy;
- (v) support of, and active participation in research, development and innovation in information science, and communication, to enhance both the efficiency of information services and the quality of information provided by these services; and
- (vi) support and promotion of research, development and innovation in information technology.

### II. NATIONAL ACTIVITIES IN INFORMATION SYSTEMS IN SCIENCE AND TECHNOLOGY

The growth of information infrastructures in the country has been very closely related to the growth of science and technology institutions in the country. Ever since 1947, a number of specialised scientific departments have been set up from time to time based on the requirements of each sector of science and technology and its relevance to national development. Out of each of these structures, as well as through mechanisms of setting up autonomous structures, we have now in the country 138 universities, 320 national institutes and laboratories, over 900 industrial research and development units etc. There are scientific departments under the Government structure (Atomic Energy, Space, Electronics, Science and Technology, Scientific and Industrial Research, Non-conventional Energy Sources, Defence Research) as well as major organisations for agricultural and medical research and under these establishments scientists and engineers are carrying out research and development

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activities which need very strong information base in the form of libraries containing journals, current literature etc. These organisations have therefore independently developed major information systems on their own. In addition to the scientific departments, there are other S&T related sectors such as Industry, Steel, Irrigation, Mines, Textiles which have also developed their own information centres satisfying their limited requirements. An illustrative list of the existing information infrastructures in various Government and other organisations is given in table 1.

While formulating the overall framework for National Information System in Science and Technology, the Fifth Five Year Plan had taken note of the growth of the individual scientific departments and their information infrastructures. It was felt that these infrastructures could be integrated properly in a configuration called the National Information System for Science and Technology (NISSAT). Under the framework of NISSAT, to start with, a few sectoral information centres have been set up over the last five years or so. These have been in the field of Food, Leather, Machine Tools and Drugs. These information centres are expected to provide scientific and technical information to specialists working in these centres all over the country. It has not yet been possible to ensure fuller and wider utilisation of these sectoral centres while the host institutions specialised in these areas have been able to benefit from them extensively. Greater effort is needed to extensively develop the sectoral information systems and their wide utilisation.

In addition to building up the information infrastructures in scientific departments/institutions as well as the building up of the sectoral information centres, there has been an increasing awareness of utilisation of international information systems which have been set up by specialised agencies under the aegis of the United Nations system. In order to effectively utilise international information systems, national focal points have been identified within the country. These are all based on a sectoral approach and have not necessarily been inter-linked for the purposes of taking an overall developmental approach. A list of national focal points for international information system is given in table 2. Most of the international information systems subsist on national inputs from these identified focal points. Though in several cases the supply of inputs has been maintained effectively, information dissemination activities from these global data bases for the potential national users community

are to be stimulated. In view of this situation and with the proliferation of focal points as well as with the recognition of the inter-dependent science and technology activities in relation to development, it is felt that there is a need for coordinating these activities at the national level.

Based on the expertise available with individual infrastructures in various Government departments, several attempts have also been made in experimenting with new techniques of acquiring global data as well as communicating and inter-linking various information centres. These experiments have used the hardware and sophisticated techniques provided through international efforts. Such experiments have given rise to a certain amount of confidence in attempting major exercises in global networking. However these experiments have not been transferred to real life operational systems.

In recent years, the activities of the National Informatics Centre (NIC) set up in March, 1977 under the Electronics Commission/Deptt. of Electronics, Govt. of India have played a very important promotional role in creating appropriate information systems. The centre has been charged with the total responsibility for providing informatic services to Government Ministries/Departments to catalyse decision making in Government. The centre has assisted in designing, developing and implementing advance computer based methodologies and promoting the adoption of computer based data management techniques. It has helped in generating specialised manpower in the field of informatics and has been able to initiate activities connected with several intra-city and inter-city computer networks. The centre is also responsible for developing information system required for various sectors such as finance, trade, agriculture, industries, construction, transport, education, manpower etc. In many of these fields it has already made sufficient advances. The National Informatics Centre network located in New Delhi is based on a large computer system CYBER CDC 170/730 which was acquired in May, 1980 with the assistance of UNDP and has adequate peripherals required for the comprehensive role this centre is expected to perform.

Another major information centre which caters to the requirement of scientific community is the Indian National Scientific Documentation Centre (INSDOC) established in 1952 under the Council of Scientific and Industrial Research (CSIR). The INSDOC provides services such as procuring documents, photo copying services, bibliography, reference information and

**Table 1** List of Existing Information Systems/Centres in Various Govt. Organisations in the Country  
(List not Exhaustive)

Sl No.	Organisation Agency	Information System/Centres	Related Sectoral Activities
1.	Deptt. of Electronics/ Electronics Commission	(i) National Informatics Centre and NICNET  (ii) Regional Computer Centres and INDONET	Computer networking with other government departments to provide techno-economic information. Computer facilities to be used in different parts of the country giving information about various sectors.
2.	Ministry of Science & Technology (a) Deptt. of Science & Technology  (b) Deptt. of Scientific & Industrial Research (DSIR) Council of Scientific and Industrial Research (CSIR)	(i) Management Information System (MIS) being evolved  (ii) National Resources Data Management System (NRDMS) (iii) National Council for Science and Technology Communication (iv) National Information System for Science and Technology (NISSAT)  (v) Indian National Scientific Documentation Centre (INSDOC)  (vi) Publications Information Directorate (PID)	Providing necessary information to Science Advisory Committee to the Cabinet and developing information System for various R&D activities in different agencies dealing with Science and Technology. Pilot scale Computer based data bases on natural resources for micro-level planning. Promotion of new areas of Science and Technology and Science popularisation. Development of sectoral data bases for Science and Technology. Promoting Industrial and Bibliographical Information Services. Access to global information resources and control of documents on scientific and industrial research
3.	Department of Space	National Natural Resources Management System (NNRMS)	Being evolved to promote utilisation of Indian Remote Sensing Satellite
4.	Department of Atomic Energy	Bhabha Atomic Research Centre	Providing information relating to Research in Atomic Energy and Physics.
5.	Deptt. of Agricultural Research & Education (DARE), Indian Council of Agricultural Research (ICAR)	(i) Indian Agricultural Statistics Res. Instt.  (ii) Indian Agricultural Res. Institute	To create data base for Agriculture research
6.	Defence Research & Development Organisation (DRDO)	Defence Scientific Information & Documentation Centre (DESIDOC)	Documentation and information on science and technology related to defence research
7.	Department of Environment (DOEn)	Environmental Information System (ENVIS)	Establishing network for creation of data base on different aspects of Environment.
8.	Department of Ocean Development (DOD)	National Oceanographic Data Centre	Marine research and development resources surveys.
9.	Director General of Health Services (DGHS)	National Medical Library	Documentation and bibliographical Information on Health.
10.	Ministry of Education, University Grants Commission	(i) All Indian Institutes of Technology  (ii) Few Universities	Creating Information Support on Science and Technology

Table 1 (Continued)

Sl. No.	Organisation/Agency	Information System/Centres	Related Sectoral Activities
11.	Ministry of Industries	(i) NISSAT Sectoral Centre at Central Machine Tools Institute. (ii) The Small Entrepreneurs National Documentation Centre (SENDOC)/The Small Industries Extension Training Centre (SIET).	Development of Data Base relating to Industry and Research. SENDOC gives special emphasis on Small Scale Industries.
12.	Deptt. of Textiles	National Centres on Textiles & allied Industries contemplated at Association of Textile Industries Research Association (ATIRA)	Information relevant to Textile Industry.
13.	Department of Mines	(i) Geodata bank at Geological Survey of India (GSI) (ii) Geodata bank at Indian Bureau of Mines	Data banks on Geology and Minerals
14.	Department of Steel/ Steel Authority of India	Information Centre	Iron and Steel
15.	Department of Irrigation	Central Water Commission (CWC) – Central Water & Power Research Station (CWPRS) – Centre	Irrigation and Water Resources.

translation services. It also provides services in the form of information publications such as Indian Science Abstracts etc. The INSDOC has also regional centres at Bangalore, Madras and Calcutta.

The libraries and technical information services provided by major organisations such as Bhabha Atomic Research Centre, Indian Agricultural Research Institute, Directorate General of Health Services, Indian Standard Institution also provide a very useful information base in their respective areas of interest.

During the last few years, new initiatives have been taken through an Inter-ministerial project coordinated by the Department of Space on developing a National Natural Resources Management System (NNRMS). This system is being evolved to promote the utilization of the Indian Remote Sensing satellite data on aspects relating to natural resources required for major sectors like Agriculture, Mineral Resources, Hydrology etc. This system when fully operational will perhaps be an example of using inter-disciplinary technologies as well as an integrated approach to resource management. In the area of Environment efforts are being initiated to develop a major Environmental Information System using network

concepts through the efforts of Department of Environment. The efforts of the Department of Science and Technology have been mainly to evolve, in a phased manner, the concept concerned with the development of NISSAT. As mentioned earlier, at the present moment efforts have been mainly concentrated in developing sectoral centres connected with Durg, Food, Leather and Machine Tools.

The existing activities in the field of developing information systems for science and technology are necessarily based on decentralised infrastructures available in specialised departments, ministries connected with science and technology. Efforts are on the way to evolve a comprehensive and integrated approach for linking these information infrastructures in a network concept. It is only when such an exercise is completed, we can consider having developed a truly national information system for science and technology which was envisaged in the fifth Five Year Plan.

### III. SOME PROBLEMS AND FUTURE PROSPECTS

A major issue which has contributed significantly to the lack of a coordinated development of information

Table 2 National Focal Points for International Information Systems (List not exhaustive)

Sl. No.	Information System (UN Agency)	Indian National Focal Point
1.	UNISIST (UNESCO)	Deptt. of Science & Technology, Technology Bhavan, New Mehrauli Road, New Delhi - 110016
2.	Marine Environmental Data Index (MEDI) (UNESCO)	National Instt. of Oceanography, Niranar Panaji, Goa - 403004
3.	Aquatic Sciences and Fisheries Information System ASFISO (FAO)	National Institute of Oceanography, Niranar Panaji, Goa - 403004
4.	INFOTERRA (UNEP)	Deptt. of Environment, Bikaner House, New Delhi - 110011
5.	International Register for Potentially Toxic Chemicals IRPTC (UNEP)	Indian Toxicology Research Centre, Chattar Manzil Palace, Lucknow 226001
6.	Agricultural Information System - AGRIS (FAO)	IASRI/Pusa Complex, Hillside Road, New Delhi - 110012
7.	International Nuclear Information System INIS (IAEA)	Bhabha Atomic Research Centre, Trombay, Bombay - 400085
8.	Global Environmental Monitoring System - GEMS (UNEP)	National Environmental Engineering Research Institute, Nehru Marg, Nagpur - 440020
9.	Food Science and Technology Abstracts (FSTA)	Central Food Technological Res. Inst. Cheluvamva Mansion, V. V. Mohalla, P. O. Mysore - 570013

system is the rapid development in the technologies connected with generation, processing and dissemination of information. Modern technologies, involving digital data communication using satellites, as well as the rapid development in the micro processing capabilities and the sophisticated computer systems have no doubt reduced the time gap required for the generation, processing and dissemination of information. Information received in time is extremely valuable and hence these modern technologies play a very important role in the operation of information systems. Nevertheless, these technologies very often tend to depend on the large capital investments as well as the supply and maintenance of sophisticated equipments which are not necessarily produced indigenously in a developing country. As a result of rapid technological development, the choice of hardware

and the corresponding development of software needs specialised capabilities in terms of trained manpower and equipment production capabilities within a country. These are not always easy to generate even in a large country like India. The professional manpower required to make use of these modern technological developments have proved to be grossly inadequate. Modern technologies provide a very useful methodologies for decentralised collection and dissemination of information. However, this also implies the availability of hardware and more importantly professional manpower in different remote parts of the country. Such manpower is not easily available except in a few well endowed and modern urban based technical institutions. Further, the rapid technological developments also tend to bring in rapid obsolescence and hence planning for long-term requirements of an

information system becomes difficult. It is, therefore, proposed that in the 7th Five Year Plan (1985–90) emphasis be given to the development of quality of manpower required for setting up and operating an appropriate National Science and Technology Information System. The need for the information system should cover both bibliographic and management information required for scientific work as well as an integrated data base for decision making and policy formulation in the field of Science and Technology. It is important to ensure standards in information handling and compatibility of hardware and software; selectivity in the creation of data base is emphasized so that information that will be generally needed is available and surfeit of information that can result in a waste, both of energy and money, is avoided. What is important is that information is readily available at low cost. The use of unnecessarily sophisticated hardware, routine accessing of international information systems, where one has to deal with high operational costs characteristics of advanced countries and aspects relating to copyrights can all make information expensive. It is suggested that the efforts made so far by individual institutions, government departments, etc., should be integrated through joint efforts in evolving a comprehensive and appropriate Science and Technology Information System. In this process, wherever possible, the modern advancements in information technologies must be developed and utilised.

The basic approach in evolving such a National System should take into account the need for three different kinds of information:

- a) Scientific and Technical Information;
- b) Techno-economic Information; and
- c) Management Information

The aim of Scientific and Technical information would be to provide information for Scientific Research in specific sectors of various S&T fields. These could include sectors such as Pure Sciences (Life, Physical & Chemical sciences) as well as applied sciences such as Engineering Sciences. In each of these disciplines specific sectors, for example, Aeronautics, Food, Leather, Metallurgy, Fertilizer, Transport, Petrochemicals, Mining, Heavy Engineering, Machine Tools, etc., could form the sectoral activities of these information systems. The Techno-economic information is to provide information for development, production and other economic activities which depend on very valuable S&T inputs. These techno-economic

informations would be extremely important for planning the activities of various Government Departments which are responsible for the growth of various economic and service sectors and hence these information systems should be integrated in the government framework through a centralised Computer System providing appropriate data bases and terminals to the requirements of the Government Departments. The Management Information Systems would also be required by the Planners, Administrators and all those engaged in management of R&D information relevant to policy framing and decision making. These three aspects of information systems are not necessarily independent but would have to be very closely related and inter-connected to each other. It is once again here that modern technologies providing networking of sophisticated computer systems and data bases using modern communication systems such as microwave, satellite communications etc can suitably be utilised. Further, greater emphasis would have to be given to Research and Development Programme in the area of information science itself. This would enable the design, development and implementation of advanced computer based methodologies and also generate specialised manpower in the field of informatics to be used in the building up of an intracity and intercity computer network in the country and in interconnecting various policy/decision making arms of the government. These efforts connected with the building up of modern information system in science and technology would have to be strengthened before greater emphasis is given to linking with international science and technology system. A global information system coupled with Regional Information systems will no doubt prove very useful in interlinking different parts of the inter-dependent world but it is necessary to stress that unless the National Information Systems are developed and grown, thus strengthening the endogenous capability for utilising science and technology information, the main objective of setting up of the Global Information System would not be achieved.

#### IV. CONCLUSIONS

India has recognised the importance of developing modern and appropriate information systems in Science and Technology for national development. With the growing infrastructures for the science and technology activities in the country, such a requirement has been further emphasised in the socio-

economic development plans of the country. While several information sectors have grown in various educational and research institutions as well as in government departments, it is felt that an integrated development of a National Science and Technology Information System is very essential. Inter-connecting various independent information centres using the recent developments in Computer Networks based on modern communication Technologies using microwave and satellite linkages would have to be given greater attention. While these developments and capabilities show a great promise for developing comprehensive National Information System for Science and Technology, it is also recognised that there is a need for generating and training appropriate manpower required for the use and applications of these modern technologies. The need for Global and Regional Information System in Science and Technology will have to be justified only on the basis of first developing a National Information System for Science and Technology which can then be linked to these Regional and Global information systems using modern technologies.

### ACKNOWLEDGEMENTS

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## ANNOUNCEMENT

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### WORLD ENVIRONMENT CENTRE—DUTCH GOVERNMENT CONFERENCE FOCUSES ON ROLE OF ENVIRONMENT IN DEVELOPING AFRICAN AND MIDDLE EASTERN ECONOMIES

As governments rush relief aid to famine-afflicted nations in Africa, the World Environment Centre and Dutch Government are bringing top international officials together to discuss lasting development aid for the region—environmental assistance.

The forum: the Centre's fourth international conference on environment and development. The focus of the *September 25-27, 1985*, conference: Opportunities in Africa and the Middle East for all partners in the development process. This includes government officials, development lenders, multinational business and industry executives, consulting engineers and grassroots groups.

The concept of environment and development, or investment protection through environmental protec-

tion, has been the theme of a series of international conferences sponsored by the non-profit, non-advocacy World Environment Centre.

The fourth conference, "Environment and Development: Opportunities in Africa and the Middle East," will be co-sponsored by the Dutch Government and held in The Hague. The keynote speaker is Dr. Pieter Winsemius, the Netherlands Government Minister of Housing, Physical Planning and the Environment.

For further information contact the conference manager Frederica Capshaw, World Environment Centre, 605, Third Avenue, 17th Floor, New York, NY 10158, USA. (Telephone (212) 986-7200)