

# PRIORITIES IN INFORMATION MANAGEMENT SYSTEMS FOR AGRICULTURAL RESEARCH AND DEVELOPMENT IN INDIA

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## ABSTRACT

*The paper surveys the application of computer and communication technology to support information management for agricultural research, education, extension and development in India in the recent past under the support and leadership of CGIAR, ISNAR, ICAR and other organizations. Evaluates existing systems and points out the failure to modernise library systems to function as the heart of information systems as the cause of ineffectiveness of our major programmes in the field. Attitudinal changes required are discussed and suggestions for improving the situation put forward.*

## INTRODUCTION

Agriculture forms the backbone of our economy and despite concentrated industrialisation it is the source of livelihood for over seventy percent of our population. Agricultural research develops technologies that can increase food production and agricultural information systems access, store and disseminate the knowledge generated by research to the extension worker and also to the farming community. Dr. R.S. Paroda, the Secretary of Department of Agricultural Research and Education and Director General of ICAR has stated the importance of library and information systems in agricultural development in one of his recent addresses to agricultural scientists thus. As a consequence of rapid developments taking place in science and technology, there is a virtual information explosion the world over. For achieving an optimal utilization of these developments, it is essential that the scientist in the Indian National Agricultural Research System have a quick access and free exchange of information at local, national and international levels. The Global Village, Shrinking World, Digital Revolution etc are some of the

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terms being used to describe the importance of information. In the fast developing world, time is a crucial factor and availability of timely information is necessary to provide cutting edge to provide the success of any research programme. Fortunately with the phenomenal development in computer technology we are in a position to accomplish the task of the information management so that the information is both integrated, and disseminated and shared.

The role of information in agricultural development was recognised in India even from the beginning of this century. Indian Council of Agricultural Research (ICAR) which is the apex organization at national level for the promotion of science and technology programmes in the areas of agricultural research and education established in 1929 has generation of knowledge and dissemination of information as its main objectives. The following are its mandates.

- \* to plan, undertake, aid co-ordinate education, research and its application in agriculture, agroforestry, animal husbandry, fisheries, home science and allied sciences.
- \* to act as a clearing house of research and general information relating to agriculture, animal husbandry, home science and allied sciences and fisheries through its publications and information system, and instituting and promoting transfer of technology programmes.
- \* to provide undertake and promote consultancy services in the field of education, research training and dissemination of information in agriculture, agroforestry, animal husbandry, fisheries, home science and allied sciences.
- \* to look into the problems related to the broader areas of rural development concerning agriculture, including post harvest technology, by developing post harvest programmes with other organizations such as ICSSR, CSIR, BARC and the universities.

The explosive developments that occurred in the last decade in Information Technology created a growing awareness among those concerned with agricultural development also of the important contribution agricultural library and information systems can make to the farming community not only by increasing yield level of crops but also for alleviation of its economic status.

### 3. SUPPORT FROM CGIAR AND ISNAR

The initiative and support for the establishment of the agricultural library and information systems and networks in India as well as other developing countries came from Consultative Group on International Agricultural Research (CGIAR) and International Service for National Agricultural Research (ISNAR).

#### 3.1 CGIAR

Consultative Group on International Agricultural Research (CGIAR) is an informal association of 48 public and private sector members that supports a network of 16 international agricultural research centres. One of those centres, ICRISAT, is located in Hyderabad in India. The World Bank, FAO, UNDP and UNEP are the co-sponsors of the CGIAR. The mission of CGIAR is to contribute through research to promoting sustainable agriculture for security in developing countries. ICRISAT supported by CGIAR is also part of a global agricultural research system. It also forms the nucleus of and provide leadership in national agricultural information system in the subject areas mandatory to it.

#### 3.2 ISNAR

International Service for National Agricultural Research (ISNAR) was established in 1980 at Hague within the framework of CGIAR which work for strengthening of national agricultural research systems in developing countries. ISNAR works closely with national agricultural research systems to develop adequate institutional structures and improved research planning and management capabilities. It gives stress to the effective management of the resources available to the country. Major areas of work of ISNAR are formulation of research strategies and policies, program development, resources development and management, monitoring and evaluation of research projects, ensuring that research results are tested by farmers, and the identification and implementation of effective linkages between national and international research activities.

During the last one and half decade of its existence ISNAR worked closely with national agricultural research systems of developing countries. ISNAR found that the weak library systems and the resultant ineffective information management in agricultural sector is a common feature of the developing countries. Facilities

for a two way flow of information between research and extension are found to be lacking or minimum. Linkages with university faculties of agriculture, public corporations and private sector are also not very efficient. Relationship of research systems with farmers; the vital component in research and development is extremely poor. ISNAR found that traditional library services in agricultural research, education and extension is to be converted to information systems providing effective services using computer and communication technology. This only can enable national agricultural sector to utilise research results already obtained by the international agricultural research centres and other international and national organizations. Similar weakness was identified by Indian Agricultural Research System while reviewing the agricultural research of the second half of the eighties. Hence in the beginning of nineties ICAR started supporting computerisation of library and information services of research institutes under it.

Recently there is a growing awareness among those concerned with agricultural development of the important contribution agricultural library and information systems can make to the farming community not only for increasing yield level of crops but also for alleviation of its economic status.

#### **4. AGRICULTURAL RESEARCH INFORMATION SYSTEM (ARIS)**

In the beginning of nineties ICAR started supporting computerisation of library and information systems of research institutions established by it and also state agricultural universities with the aim of improving research management by bringing information technology culture to scientific community. For this ICAR has established a separate division called Agricultural Research Information Centre (ARIC) at its headquarters. Under the division ICAR started the project called Agricultural Research Information System (ARIS) with the financial aid of World Bank for National Agricultural Research project (NARP). Collaboration among scientists in India, systematic access to research information available in India as well as in other countries, better project management of agricultural research and modernization of the office automation tools used by the scientists and administrators are the major goals of ARIS programme.

ISNAR gave the required guidance and technical support to ICAR for the establishment of ARIS. Initially an expert group consisting of members from ISNAR and ICAR was formed to formulate a strategy for implementing ARIS programme. The expert group conducted extensive visits to ICAR institutes and state agricultural universities to understand the information needs of agricultural scientists, assess how far the present library and information systems are effective in timely dissemination of required information, and to formulate plans to modernise and vitalise the systems. The group gave a phased plan for implementation of the ARIS project. The expert group also examined the aspect of creating the ARIS network. It studied in detail the data communication alternatives available in India and gave necessary recommendations for a network that exist in close cooperation with other information systems and networks.

ARIS programme envisages point to point connectivity to all state agricultural universities, research institutions under ICAR, project directorates, national research centres and zonal research stations through a wide area network (WAN) using dial up, leased lines and V-SATs. Initially the proposed WAN will utilise the existing facilities of Educational and Research Network (ERNET) and National Informatics Centre Network (NICNET). Besides the infrastructural facilities ARIS consists of the following five information modules as per the plan envisaged.

- \* Agricultural Research Management Information System (ARMIS)
- \* Agricultural Research Personnel Information System (ARPIS)
- \* Agricultural Research Financial Information System (ARFIS)
- \* Agricultural Research Library and Information System (ARLIS)
- \* Training Manpower in the Field of Information technology

Financial aid of World Bank under NARP will be closed by 1996. But ARIS programme is of long term nature. Hence ICAR proposes to incorporate it in the National Agricultural Technology Project (NATP) to be funded by the World Bank. Provision for support will be there in the Ninth Plan also.

ARIS programmes implemented up to the present succeeded in generating a wide interest in library and information technology and also in the use of computers and communication equipments among agricultural scientists. ICAR has already established point to point connectivity for E-Mail to about seventy institutes under it. ICAR has also conducted several computer training programmes under ARIS project in the areas of data communication and networking, personal computer trouble shooting, E-Mail Windows, and also on procurement of computer and network equipments for enhancing the connectivity through wide area networks.

#### **4.1 AGRICULTURAL RESEARCH MANAGEMENT INFORMATION SYSTEM (ARMIS)**

ARMIS will provide information to research managers on different resources maintained under various databases using computerised management tools and software packages. It will enable generation of reports related to specific aspects that can facilitate decision making. Procurement of equipments and inventory, providing connectivity system operation and overseeing and information on parliamentary questions and answers will come under this module.

Explosive developments are occurring in information technology industry. Hence computer and communication hardware and software become obsolete within no time. So continuous upgradation of hardware and software acquired at various institutions under ARIS programme will be inevitable. ICAR has included about 300 Krishi Vega Kendras in the list of sites to be connected with WAN for E-Mail and other services. Before long the connectivity will be extended to each and every scientist engaged in research in ICAR institutions and agricultural universities in the country. Providing point to point connectivity will require equipments such as UNIX and LAN servers, printers, UPS, VSATs, modems, routers and leased lines.

A local area network connecting about thirty computers has been already installed at ICAR headquarters. E-Mail and file transfer services are available between these nodes and ICAR institutions and 150 countries of the world through a UNIX server at present. The E-Mail addresses of all important officers of ICAR, about 70 ICAR institutes are functional. The remaining institutions will be expected to be connected within a shortwhile.

A number of VSATs have been installed in various ICAR institutes and agricultural universities for hooking to WAN and INTERNET. For effective utilisation of their capacity creation of local area network is a must which also serves another objective of providing connectivity to each scientist working in a particular institute. But many institutions lag behind in effectively utilising the systems and equipments allowed to them. It will be better if ICAR forms a group which evaluates and monitors the activities of receiving agencies. For smooth working of ARIS network ICAR proposes to develop its own resources. Initially help from external agency will be taken up. ICAR will be forming an Information systems unit which will be responsible for the day to day management of the network in order to ensure its high uptime and usability. It will also coordinate among ICAR institutes and universities to have free and useful information exchange over the network. It will be creating sub units in each of the campuses to take care of the local management without much dependence on external agencies.

#### **4.2 PERSONNEL INFORMATION SYSTEM (ARPIS)**

Under ARIS there will be a personnel information system and recruitment system of ICAR. Already a software had been developed for that purpose. Data of approximately 5000 agricultural research scientists has been entered in the database. The database will be updated continuously. Before long the system will be extended to scientists working in state agricultural universities and also for other supporting staff. A software for the recruitment system of the Agricultural Scientists Recruitment Board is also under testing.

#### **4.3 AGRICULTURAL RESEARCH FINANCIAL INFORMATION SYSTEM (ARFIS)**

Financial information system consists of three areas namely monthly accounts, monitoring of grants to All India Coordinated Research Projects and General Provident Funds. Computerisation and consolidation of monthly accounts was undertaken to tackle the problems of monthly accounts from voucher level. Suitable proformas were developed and circulated by ICAR to institutes and universities. Based on suggestions received from them they were revised. Necessary codes were also developed for various institutes, accounting heads and funding sources. necessary software for voucher level data entry

was developed and distributed for generation of data to test run the programmes. A manual of computerisation of financial information was also prepared at ICAR.

The system for monitoring grants to All-India Co-ordinated Research Projects consist of three parts: budget allocation, release of grants, and audit utilisation certificate. Preliminary data in respect of budget allocations were collected from the concerned sections dealing with respective research projects, in respect of their sub centres and budget allocations. the data was codified after making a comprehensive list of institutes. A software has been developed for release of grants to universities based on respective demands. The financial information system developed under ARIS is being implemented at all ICAR institutes. A training programme on it was also organised at NAARM in Hyderabad.

#### **4.4 AGRICULTURAL RESEARCH LIBRARY AND INFORMATION SYSTEM (ARLIS)**

Agricultural Research Library and Information System (ARLIS) is envisaged as the most important module under ARIS programme. According to the Report of the Working group on Agricultural Research and Education for the Ninth Plan under the chairmanship of Dr. R.S. Paroda, modernization of libraries in ICAR institutes and State Agricultural Universities will be the major exercise to be carried out during the Ninth Plan. All libraries will be fully computerised and linked to the IARI library which has been identified as the National Agricultural Library.

In any education and research information system the store of information of permanent value exist in libraries. In all other division bits of information or raw information required at various stages of research process only will exist and the access processing and authentication can be manged by computers and communication systems with minimum possibilities. Quantum of storage of such information required at a time is also less. When the data processed there gives final result or product and the information is packed for future use it is transmitted to a permanent store which manages collections of knowledge by scientifically organising and disseminating it in time to support research and extension. Such stores which are the modernised libraries or information systems have to manage in



computer memories unlimited quantum of information. Those who manage such stores have to continuously watch worldwide generation of knowledge in areas on which specialists of the institution work so that duplication can be avoided saving valuable financial and human resources. So for keeping the knowledge watch, accessing information from electronic libraries world wide, organising and managing huge quantum of recorded knowledge collected in print and electronic memories, and for quick and efficient dissemination of required information highly sophisticated computer and communication hardware and software will be essential for the ARLIS.

Libraries have to become the heart of every institute and university campuses. IARI library is envisaged as the central hub of the wide area information network planned at present. Unless the information contained in the libraries could be put in the ARIS network effectively the sytem will be body without soul. Preparing databses of collections existing in institutes and universities is to be complited within a specified time limit if ARIS is to be fully effective. Thus automation of libraries and their networking will form a major part of ARIS. Of the estimated cost of 100 million rupees for ARIS fifty percent is proposed to be utilised for automating libraries and for preparation of electronic publications and databases to be stored in library systems. Ten percent of the amount is proposed to be utilised for training the required library and information service professionals and also training the scientists in searching retrieving their information from the modern systems. The remaining forty percent is meant for hardware software items and their maintenance.

#### 4.5 TRAINING OF MANPOWER

Training of the scientists on the use of computer and communication equipments for various day to day activities and also retrieval of information required for research from libraries, databses and networks is nother important goal of ARIS. Besides this ARIS had to train library and information managers to access, store and disseminate information speedily and effectively to our scientific community using the tools and techniques of current technology. Under ARIs various training programmes are being planned for agricultural scientists, library and information managers and other technical manpower at institutes and universities. Besides this research

scholars and are trained continuously, ICAR has already imparted training on day-to-day use of computers, networking PC trouble shooting, MS Windows, E-Mail, Information and library management, etc to more than 100 staff members working in institutes and universities.

Library and information system being the most important module of ARIS programme ICAR has given special emphasis on training library and information service professionals. A group of library professionals were already given intensive training at Hyderabad under ARIS programme. Besides this to keep the ARIS network running sufficient people from each campus also will be provided adequate training for setting up various information servers and online databses, and administration of Novel Netware to manage LAN and UNIX networks. This will also include training on management of modems, VSATs and routers, basic PC hardware configuration and trouble shooting.

## **5. INFORMATION SUPPORT FROM ALLIED SECTORS**

Various information systems and networks exist in India under Government of India and other organizations. Some of the information systems specialise in specific areas of interest to the agricultural sector. Some covers agriculture and allied subjects and are also used at present by agricultural information systems. Some international organizations also offer information services in agricultural and allied subjects through their Indian offices.

### **5.1 NIC AND AGRICULTURAL INFORMATION**

The National Informatics Centre Network started in the mid eighties under Planning Commission connects approximately 750 earth stations with links to all district headquarters and a number of public sector undertakings. It supports various specialised information systems and connects many agricultural universities participating in such programmes. Some of the important management information systems implemented by NICNET in agricultural sector are; agricultural census, agricultural input survey, agricultural commodity, prices movement and market arrival monitoring, crop statistics, seed management, fertiliser production and consumption, irrigation water deliveries, monitoring of reservoir levels, program monitoring for rural development, land records system management

of food economy, wheat and rice procurement, foodgrain stock and price, sugar information, public distribution etc. These information systems of NICNET are of immense value for agricultural research and development.

## 5.2 INFORMATION ON TRADITIONAL AGRICULTURE

General Information Service Terminal - National Informatics Centre (GISTNIC) is a project of National Informatics Centre (NIC). It has developed an electronic library on traditional sciences and technologies in India which is continuously updated and is accessible online. Two of the major areas covered by it are related to agriculture. They deal with the following areas.

- \* traditional Indian agriculture, agronomical methods, practices and implements.
- \* traditional irrigation, water resources management, and hydrology and ground water management.

The Gistnic database covers traditional irrigation methods, ground water direction methodology, canal irrigation, river irrigation, water lifting and distribution mechanisms, and irrigation of hilly areas and deserts. Traditional methods of testing and preparation of various methods of soils, preparation and preservation of seeds, pest control manures, plant propagation, traditional implements, post harvest process, agronomical methods, crop patterns etc are also covered. GISTNIC is an unique source of information for agricultural scientists who are concerned with sustainable development.

## 5.3 BTIS NETWORK

Department of Biotechnology under Government of India established Biotechnology Information System (BTIS) in 1986 for harnessing the scientific knowledge in various interdisciplinary areas of biotechnology and its dissemination to scientists working in several frontier areas at research and development organizations. It comprises specialised information centres in the following six identified areas of biotechnology.

- \* genetic engineering
- \* animal cell culture and virology

- \* plant tissue culture, photosynthesis, and plant molecular biology
- \* oncogenes, reproduction physiology, cell transfor mation, nucleic acid and protein sequences
- \* immunology
- \* enzyme engineering, immobilised biocatalysts, microbial fermentation and bioprocess engineering

To store and analyse information powerful computer and communication facilities have been established in the apex centre at Department of Biotechnology and at distributed information centres functioning at various universities and other institutions. The BTIS network provides facilities for E-Mail, interactive massaging, and file transfer, remote login, UUNET connectivity and Dialogue access. BTIS maintains various databanks on genetic resources required for scientists working in the areas of molecular biology and genetic engineering.

#### **5.4 ERNET Support**

Educational and research Network implemented by DOE with UNDP support has over four hundred organizations connected to it within India and also neighbouring countries. They include many agricultural research institutes, universities, organizations and specialised information systems at national and international level. Services of INTERNET can also be accessed through ERNET. There are also many other organizations and networks in India like VSNL, INET, etc., which offers network services and access to international libraries and agricultural information systems.

#### **6. NEED FOR ATTITUDINAL CHANGES**

Establishment of computer and communication networks and processing, transfer and access of data required for day-to-day activities and processes of research will not make a system an information system. An information system should have at its centre a store of specialised information organised for use. It is the responsibility of information service professionals working at such centres to access and collect information at these stores and disseminate information required for research without wasting the time and effort of the scientist.

The chances for positive information flow can be ensured only if appropriate linkages are established, and the responsibility for collection, storage and dissemination of information is entrusted to the group with specialisation in library and information science. In a developing country like India eighty percent of information of value to location specific research will be existing in traditional mediums only. At least for another decade printed publications will continue to be the most important means by which scientific links can be fogged between research going on in different localities. Hence the people who manage libraries or information have to provide services belonging the traditional and electronic mediums and methods. Unfortunately all these aspects are disregarded in most of the campuses in India where modern information systems are being established. In the enthusiasm given by the computer and communication equipments we often forget the purpose of those tools in an information system. But machines can do no magic. Automation of libraries is a preliminary for any research information system. Eighty percent of the existing knowledge, recorded in traditional mediums are to be documented in electronic mediums. Required packets of information should be acquired from worldwide stores cost effectively for our systems. Without all these an information system will be a system without any information of permanent value.

If an Agricultural Information System at the national level is to be really functional and useful the library and information professionals must work in close cooperation with the scientists doing research in agriculture. While the scientist is an expert in the subject involved and can be expected to know which information is most relevant in a given situation the agricultural librarian or information scientist is an expert in the organization and management of information resources. There is a need for better understanding of the role of librarians and information scientists. Identifying and entrusting to the librarians and information specialists their areas of activity has become very essential in our situations to extract maximum utility of the resources we spend for establishing information systems. Achieving a better understanding between the scientists and librarians is going to be one of the important challenges the decision makers in agricultural sector at the national level have to face in the coming days which will be marked by explosive developments in information technology.

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