FID
Jaipur & New Delhi
11-17 October 1998

Establishment of a digital library to support agricultural research, education and extension in India

R. RAMAN NAIR (India)

Abstract

Twenty-four universities and over 300 specialized institutions and non governmental organisations are engaged in agricultural research, education, extension, and developmental activities in India. Altogether, they generate a vast ocean of information which consists of about 400 doctoral thesis, 12,000 papers and 2,500 books, journals, audio visual productions and other documents in a year. Available information is not shared and disseminated within and among these institutions. This study examines the problem of information/knowledge transfer in agricultural sector in India and how the already implemented technological advances in hardware, data compression procedures and software implementation are utilised to pool information resources and to develop a national level digital library on agriculture. It discusses the plan of the library consisting of a national centre of digitised documents and a site connected to other related sites and databases, the web server and other softwares involved, the type of collections of documents to be digitised, proper utilisation of the existing network and communication links to make it accessible. Minimum standards for computation facilities and communication links essential at the participating/contributing institutes are suggested. The paper also stresses the role of digital librarian in massive digitalization, storage, indexing, access search, coordination and management of universal information. How far such an electronic library can help to attain efficient operation of fully integrated management of agricultural systems is examined.

Introduction

Agriculture is the most vital sector of the economy of India. It is a source of food, clothing, raw material, employment, and foreign exchange and accounts for 30% of the national income. The growth in agriculture will need to be sustained and improved. This necessitates the availability of required information and data. Information technology has given us solutions for processing huge quantum of data recorded in various media efficiently and at an amazing speed. Hence IT has to play a vital role in speeding up the process of agricultural research in the country. The popularity of internet and www has developed an awareness in agriculture sector about the need to collect, organise, manage, preserve and disseminate information in digitised form.

Researchers in agricultural and biological sciences are interested not only in analysing information and data on ecological and biological changes and related experiments but also on economic and demographic processes at micro and macro levels. No change, be it environmental, technological or other, results from one single factor, but from interaction among several variables. The researcher requires a complex of information to carry on his assignments satisfactorily. The pace of his enquiry would necessarily have to be slowed down on account of non-availability of information.

The regular users of an agricultural information service consists broadly of the senior teachers who manage research, teaching and other activities and provide technical support for agricultural development efforts, persons responsible for the preparation, implementation and evaluation of the projects funded by agencies responsible for conducting studies related to planning and development in the agricultural sector and doctoral fellows and students. They use information for analytical studies and preparation of schemes and projects for national and international organisations and for the state and central development plans.

Type of information and data required by the users of an agricultural information system varies largely by their horizon of activity. Research experiments, their application, and information and statistical data, both at the micro and macro levels relating to agricultural development, are in demand. Apart from scientific reports, information bulletins from research institutions, records of experiments conducted, patents, standards, dissertations, etc., are also frequently sought by agricultural scientists. One cannot forecast all types of information that would be required for the completion of a specific project.

Sources of information on agriculture

Compared to the developed countries, agricultural information systems in India are not well organised nor developed in the right direction. Huge quantum of information is generated as well as collected by research institutions under state and central governments and autonomous institutions which include 46 Indian Council of Agriculture Research (ICAR) Institutes, 28 State Agricultural Universities (SAU), four National Bureaus, 29 National Research Centres, 80 All-India Co-ordinated Research Projects, 206 Krishi Vigyan Kendras, eight Trainers Training Centres, etc. Altogether, they generate a vast ocean of information which consists of about 400 doctoral thesis, 12000 papers and 2500 books, journals, audio visual productions and other documents in a year. But the pooling and sharing of information is not well coordinated or effective at institute, state and national levels. Most of the institutions engaged in education research, extension and development in agricultural sector hold vast quantum of information collected and generated during their normal course of working.

Collection and storage problems

For research in agricultural economics, cooperation, rural development, banking, etc., it would be essential to study or re-examine the evidence for making new interpretations or to establish different relationship for which printed sources of information are not available and manuscripts or unpublished records may be the only resource. Correspondence files in government departments, business firms, banks, and research institutions contain unpublished information of immense value to the researcher in agricultural economics. Information in agriculture, biosciences and related areas contained in large number of publications issued by government and various organisations are not easy to locate and procure. Information on such publications do not reach the user or the libraries in time. Most such publications go out of sales within months of their release. They are either sold out; as only a limited number of copies are printed or weeded out from sales list as slow moving publications.

Another group of publications is the unpriced ones printed for limited circulation. Being unpriced, they are not available for purchase, but may be obtained from the agency which sponsored the publication. In the absence of personal influence and contacts, attempts for collecting them will not succeed. Apart from priced materials numerous highly informative materials are prepared in mimeographed form by research institutions for limited circulation.

Information about their availability is very difficult to obtain and getting copies of such publications will require extraordinary effort.

Information recorded by research agencies usually take a long time, sometimes six to seven years to get published. In the case of scientific serials owing to heavy backlog in publication and pressure of funds, some issues are abandoned which results in non-availability of such data in some particular areas. By the time information is made available, it would become obsolete. During the period between generation of knowledge and its eventual publication, the information generated is normally kept for restricted use and as such is out of reach of ordinary researchers. It is difficult for scientists to get such unpublished documents. But as most of these documents are now kept in electronic form; institutes under ICAR can transfer a copy to a centrally located electronic storage place accessible to all institutes with different types of access permissions.

Various research institutions other than the officially designated agencies work on subjects and choices coming under agriculture. The results of such research may or may not be published and circulated. It is now practically impossible to get hold of the vast quantity of such information. Here again, repetitive research, wastage of time, money and manpower is the result. In the absence of readily available recorded information, the researcher has to tap other sources of information. Researchers usually approach agriculture related departments, research institutions and firms. As materials available with government departments are not properly indexed or listed, the researcher is forced to go through long and tedious process to ascertain whether any material of his interest is available or not. In case they are available, numerous problems confront him in his attempt to copy them. Records of labs in research institutions also pose the same problem if the search is on information about unfinished work.

Collections are not well organised and it may not always be possible for traditional libraries with staff constraints to scan all the available materials to retrieve the information, the researcher is looking for. Again providing information as such from any source may be erroneous or misleading. Information on the same subject compiled by different agencies need not be strictly comparable. Under the circumstances, it would always be best to leave the choice of selection of data to the researcher himself after making available documents on all views on the subject in some easily accessible form.

Many old reports and other information materials available in agricultural research institutions are deteriorating at rapid rate. Preserving them in their original form is difficult and not cost effective. Digitising them can ensure their preservation, in cost effective manner and can help to provide more extensive access to their contents. Apart from the provision for easy accessibility of required information for the researcher, the libraries could identify the types of data required by its research community and request the data generating agencies for supply in digitised form under resource sharing programmes information on areas of studies where sufficient information is not available. Research libraries specialising in agriculture biosciences and related areas can effectively do this 'liaison work' between the data generating agencies and the research community.

Library and information systems supporting agricultural research in developing countries have many problems. Usually they are not given required priority in the planning and management of agricultural research information systems. The status of library, information and documentation professionals must be improved for example by recruiting

professional with information technology specialisation. They must be allowed the professional responsibility to develop effective services. Researchers must be made aware of the real value of information and the availability of library and information services of required quality. They need to be trained to make effective use of them.

Solutions offered by IT

A digital library developed considering the following factors can solve most of the problems discussed above and also efficiently cater to the information requirements of researchers in agricultural sciences at less cost:

- avoiding duplication in generation and collection of data by different agencies;
- making comparable by quality control and standardisation of information from various agencies;
- forming a central agency that can act as document or information repository;
- making surveys to locate materials, in individual or institutional collections and wherever the custodians are willing to transfer them, a central agency can collect, preserve, index and make them available in digital form for researchers.
- listing materials which the custodian may prefer to keep with him and index them giving location also in computerised databases.
- copying rare materials to electronic mediums and maintaining such databases at central agency for the use of the scientists;
- establishing at national level an agency like Agricultural Library and Information Commission for monitoring the work. The urgency and importance of the problem arise from the fact that manuscripts, unprinted documents and some electronic documents that can help research on agricultural economics, rural development, etc., susceptible to decay and loss cannot be preserved and utilised properly unless such an agency takes initiative for establishing an electronic library where such documents can be copied and preserved in digitised form.
- making available micro earth stations, internet connection, and library and information service packages/softwares to libraries long before establishment of information systems and networks.

Attempts for modernisation

The establishment of the International Services for Agricultural Research (ISNAR) which began operation in 1980 with in the framework of Consultative Group on International Agricultural Research (CGIAR) was based on the need, recognised by leaders all over the world for an international organisation to work for the strengthening of national agricultural research systems. ISNAR is mainly involved in working together with the national agricultural research systems to develop adequate institutional structures and improved research planning and management capabilities. Major emphasis is placed on effective management of the resources available to the country. Specific areas of work usually undertaken by ISNAR include formulation of research strategies and policies, programme development and management, monitoring and evaluation of research activities, ensuring that research results are tested by farmers and the identification and implementation of effective linkages between national and international research programmes. ISNAR has developed close working relationships with most of the national agricultural research systems worldwide. In the course of this work ISNAR has observed that the weak information management is a feature of many agricultural research systems throughout the developing world. Arrangement for flow of information from libraries to research and extension are often minimal or based on ad hoc indicators.

With support from ISNAR, ICAR has initiated the project, Agricultural Research Information System (ARIS), to enable the pooling and sharing of information generated in Agricultural Universities and ICAR institutes, to access and disseminate agricultural information to our scientists from worldwide sources and to bring

information technology culture to our scientific community serving the agricultural sector. ARIS consists of the modules; management information system, personal information system, financial information system, library information system, and information technology training system.

The major activity planned by ICAR under this project is the modernisation of libraries in agricultural universities and other research institutions. The libraries are the stores of information recorded in traditional and electronic mediums and are envisaged by ARIS as the central hub of information services in all research and development institutions. An approximate 50% of the estimated cost of ARIS, i.e., 500 million rupees, will be utilised for automation of libraries, their networking and also developing information stores in electronic mediums at these libraries.

Essential linkages

A national agricultural research system is one part of an agricultural knowledge system concentrating on the country concerned, but extending across the world. It generates knowledge itself, but it must in turn acquire knowledge from outside if that which it generates is to be really useful in helping to increase food production. Information needs to flow freely within the system if research findings are to be successfully applied for the benefit of the national population. Unfortunately this is not the case in most systems and blockages frequently occur between different groups of researchers and between the system as a whole and its clients. The chances of a positive information flow are improved if appropriate linkages exist; if information collection, storage, and retrieval services exist, and if specific people have responsibility for information dissemination. Two broad types of linkages that have been found to be particularly important for national agricultural research systems are; scientific linkages with research and educational institutions including national, regional and international entities and linkages with clients ranging from farmers and extension workers to policy makers and planners.

Institutional linkages

National agricultural research is not an isolated effort. On the contrary, it is an integral part of a world complex of agricultural research ranging from the academic and basic research centres in both developed and developing countries to the final testing of new materials and methods on farmers fields. These activities generate a vast pool of informatin on which national research can and should draw to avoid wasteful duplication of efforts. Information generated in national research should form an integral part of this pool of knowledge and technological information. But this depends on the existence of information exchange mechanisms that make such interchange possible.

Similar considerations apply on the national level. In each country there are a number of important organisatons outside the main agricultural research system. Often these include institutions where a wide spectrum of expertise and knowledge is usually available, but for various reasons frequently not involved in the national system's activities. This may also be the situation with the private sector which can be both a client for and an active partner in research effort, facilitating an increase in resource and bringing research closer to the end users. To take advantage of these resources requires administrative flexibility, and above all, clear institutional policies that facilitate co-operation.

Publications are the most important means by which scientific links can be forged between researchers in a country or region and by which they in turn can be linked to the internatonal scientific community. As we have seen earlier,

usually the results of research activities are not made known even within the country itself. The research system must ensure appropriate and regular publication of research results. The accurate and timely provision of relevant information with recognition of authorship, should be the main objective of such publications. The newsletters, bulletins and report series are forms that have proved their effectiveness and not their online versions enable cost effectiveness and speed. In particular, annual reports of research activities must not be delayed simply because facilities are not available to produce a high quality printed product. They can be brought out in electronic form as well as kept in some electronic storage device providing access facilities to other institutes. It is essential for the successful planning and monitoring of agricultural research that research results already obtained throughout the country be made available on timely and coordinated basis.

Initially publications should be assessed on their applicability to local needs, which does not necessarily coincide with their relevance abroad. Researchers should therefore be encouraged to publish their results in useful packages in electronic form, rather than to wait until they warrant a publication of a high standard. However if an item is of more than local value, it should be written for international use with some editorial help. Researchers should be encouraged to make presentations at local, scientific or professional meetings. Participation of researchers at such meetings, even when not presenting a paper, should be promoted. Scientific societies have a unique role to play in the publication and exchange of information. For all these digital media can be used which will enable their release through a digital library immediately on finalisation of their draft manuscripts.

Sharing digitised resources

Library and information services should receive adequate budgetary allocations and steps should be taken to increase funding, particularly in foreign currencies, for purchase of books and periodicals in electronic media. Even if the national agricultural research systems were to significantly improve the publications and dissemination of research findings, there could still be a large proportion of non conventional information material. This non-conventional literature is very important to agricultural research in developing countries. For example, research has been conducted on the problems of livestock production in India by Indians and foreign experts, consultants, post graduate students, and research workers throughout the continent. However, much of this potentially valuable information is filed away and forgotten. Such research documents can be copied in digital media and put in a digital library accessible to all.

Grey literature from experiment stations, government departments, educational institutions and libraries can be collected, copied and stored in a DL for the use of livestock researchers, planners and educators. Each participating institution can be provided in digitised form with a copy of the complete set of documents collected from that institution as well as information on other materials available at a central DL. This method can be followed by every SAU and pooling together of the resources of the State Agriculture Universities (SAU's) and other institutes; a national DL collection can be developed. This is of vital importance in preventing duplication of efforts and the wasting of scarce resources. It could provide a solid basis on which to build future research activities in agricultural sector. Library and information units must ensure that they play a central role in identifying, collecting, assessing and disseminating such non conventional literature.

One linkage between national systems and the international agricultural research community which certainly can be explored by ARIS or similar agricultural information systems is participation in international cooperative information systems such as AGRIS and CARIS. This provides the methodology and training for bringing locally produced information under bibliographic control, and provides the vital two way link with other research systems throughout the world. Unfortunately much of the research carried out in the developing world remains unpublished. Thus the development of an information system on research in progress based on the above method is of particular importance.

Information _farm linkages

The application of science and technology for development in agricultural sector requires conditions different from those needed in the industrial sector. Changes in agricultural practices; a prerequisite for increasing food production requires the approval and participation of a great number of individuals often scattered over vast areas. Such changes must take place at the grass root level even if they are the results of very sophisticated research as for example in the use of the high yielding varieties of rice.

In this respect, the role of extension officer or agricultural advisor in transforming the results of laboratory and field trials into tangible benefits such as increased crop yields, is of critical importance. The extension agent's knowledge of both ecological and socio economic constraints at the local level is very important in selecting the appropriate information and presenting it in the appropriate way. Unfortunately in many systems, good working relationships between research scientists, extension staff and information professionals do not exist. Research staff often blame the information support for their failure in maintaining quality and contemporary relevance as well as extension service for low impact of research results at the farm level while in their turn extension worker complain about the lack of truly applicable results coming from the research as well as lack of timely information support on research results. Institutional links are often weak because research, information and extension are not usually at the same level.

Information workers have to act as a link between the farmer and the researcher, researcher and extension worker as well as extension worker and farmer. Encouraging results have been achieved in the countries where establishment of a specialist section for liaison between research extension and information sections with scientists trained in information technology are available. They prepare materials for extension work and do the work and feed the ideas of farmers, extension workers and information system back to research systems. Library and information system have significant involvement here in the setting up of suitable systems for collecting, storing and retrieving and disseminating the extension material so produced and also supporting extension in reforming their production.

The agricultural research community is at last coming to recognise that farmers throughout the world posses a great deal of practical information about their land and soils, their crops, and livestock. The methods and techniques they use are soundly based on long generations of experience and careful observation. A combination of international scientific knowledge with indigenous local knowledge could yield far more effective results than could either on its own. The current interest in farming systems research and farmer participation in agricultural research reflects the importance that is now being attached to this indigenous store of knowledge. Researchers and extension workers are paying more attention

to the farmers opinions and methodology. If only they could be persuaded to write reports on their discussion and investigations at the grass root level, perhaps one could at last begin to capture some of this truly fugitive information on paper and so bring it into the category of non conventional literature as a first step in the area of documented knowledge. DL systems also can record and store traditional knowledge using audio, video, and text input mechanisms with support of extension divisions so that preservation of the valuable knowledge for coming generations is ensured.

Digital library (DL) for agriculture

The current storage technology enables cost effective local storage of huge quantum of data. Till recently we used to talk of storage capacity in giga byte. But now in digital libraries terabyte of storage has become common. If pages of books are scanned as images one million books with an average 250 page per book will require 25 terabyte of storage. In one gigabyte storage approximately one and half hours video or audio can be stored.

Digital libraries help to perform searches that are impractical manually. The huge quantum of agriculture related information which include text images, video sound etc. being created and stored daily makes it very difficult to find specific information from it when required. Images, films etc. make this very complicated for instance retrieving the pictures of geographical areas with brown colour in some areas cannot be easily done using manual methods because maps are not generally indexed by colour. But from a DL it can be speedily and efficiently done using various packages available for that. Many packages available for DL enables search by colours, textures and even shapes of images. Storage of all information materials required for agricultural education research extension or development by SAU's research institutes or their divisions locally is becoming popular. Digital libraries can enable greater access to content from multiple locations and provide information support to projects going on at different locations. Hence now there is less need to poses everything at different divisions, institutions, or locations. Importance is to be given to enable access to a digital library which is to be made reliable by support from all user institutions.

Digital storage mechanism

Digital library can be defined as a system which stores text, images, audio, animations and video in digitised form at one site or at various sites links them and provides access to resources contained in all sites that are linked. It is a library which has all the information in electronic form with electronic devices to access the digitised information. In digital libraries, it will become necessary to limit access to some portions, charge for access and delivery of information, and manage content which may be even gegabytes or even terabyte. Scalability for future growth also will become necessary. Digital library technology is of very recent origin. Development of a technology strategy plan and implementation of a proof of concept will be essential. From this proof of concept the implementation can be enlarged to incorporate more content and application of requirements that become necessary.

DL solutions

Many solutions are available for storage, management and distribution of all types of digital content including text images, audio, animation and video. Such solutions enable creation storage and management, search and access, distribution and rights management of information in digital form in an open, scalable multiplatform environment. The function can be integrated into a single management system.

The digital library architecture should enable flexible and scalable storage and management. A triangular client/server model with a library server, object servers and clients can enable this. The library server should be the centre of the infrastructure. It should manage the central stock of full text and catalogue information and local stored objects using a variety of technologies, provide secured access to the objects held in the collection and communicate with object servers.

The solutions should enable storing information in digital form like text image audio and video in the object servers on single or different locations in a network to enable delivery of information in different media. Client should get direct access to information sought from a collection regardless of the location of data. Implementation across multiple platforms following integration of additional object servers on some or different platforms and scaling up one operating environment to another should be possible. The solution should enable growth and management of terra bytes or peta bytes of data in one or more systems. Available solutions for digital libraries are mainly intended as stand alones. But they should enable integration with existing library systems so that a single interface only will be essential for users.

Most of the SAUs and ICAR institutes have document collections in various media in electronic form or paper. Important paper documents can be captured in electronic form. They also will need a management system and the package should provide solution for this.

DL planning and development

Initially, at SAU level and ICAR/national level strategic technology plan for digital library is to be developed. This plan should address current and future needs and align with the mission and goals of the institutions which the system intends to serve. The plan is to be developed by a team consisting of the cross section of the institutions/organisations including the people responsible for library and information service management.

The issues related to physical resources, personal and organisational structure as well as policies and procedures for management of intellectual content should be considered. Initial points to be addressed are examination of current and future information services and resource requirements of the institutions, the quality of procedures of current informaiton services to meet institutional needs and the priorities for current and future requirements. Physical facilities, application of systems currently installed, appropriateness of centralised-decentralised technological support as well as identification of areas where outside services may be appropriate should be considered under physical resources.

Training of current and future staff as well as identification of the changing role of information professionals within the organisation and skills assessment should be considered. There is a significant change in technological capabilities. Hence there is a need for addition or different skills within the staff responsible for information services. The skills and talents that are available to the institution which is to maintain the system regardless of departments should be considered to enable maximum use of available skills. This can help identify necessary skills and provide training to current staff or hiring new staff with required skills.

To harness skills available; technology cooperation within and across departments and institutions is important. Organisational structures and management styles may need to be evaluated and changed if essential to enable cooperation of various departments. Creation of formal and informal teams to tackle projects can enable such a cooperation. Current policies and procedures on information access and sharing within and beyond an institution is to be

assessed. Computer and communication technology provides means of access to information previously not possible and may require adjustment to traditional methods followed. In addition, budget, planning for long term maintenance and replacement of systems should be included throughout the planning process. Digital library can enable quality and cost effectiveness in information support to agricultural research, education, extension and development. Introduction of high-resolution capture devices, sophisticated search engines, approvable large storage of digital content and other developments in IT enables the implementation of digital library.

DL projects for agriculture

Consultative Group on International Agricultural Research (CGIAR) is an informal association of 48 public and private sector members that support a network of 16 international agricultural research centres. CGIAR has developed the largest full text electronic library on agriculture and biosciences. It gives practical problem solving research in key areas like productivity, management of natural resources, improving policy environment, institution building, germ plasm conservation and building linkages in agricultural system. This electronic library contains all the publications originally brought out by 19 international agricultural research centres. It contains in full results of 24 years agricultural research recorded in documents including key books, serials, conference proceedings, reports, maps, graphs and photographs produced by research centres worldwide. In print the items will cost more than Rs.60 laksh. Any DL established for supporting agricultural research in developing countries can get it from CGIAR for including in their DL.

International Development Research Centre (IDRC), Ottawa, has developed an electronic library containing information on development research going on all over the world supported by World Bank, Food and Agriculture Organization (FAO) and the international organisations. IDRC database also can be acquired under a resource sharing programme.

Centre for Agriculture and Biosciences International is an intergovernmental organisation. It maintains an electronic database covering subjects like agricultural engineering, animal breeding, animal diseases, arid lands, diary sciences, forestry, forest products, horticulture, nutrition, veterinary science, entomology, plant breeding, plant pathology, soils and fertilizers, weeds and world agricultural economics. The database contains information including abstracts of papers published in 8500 journals on the concerned topics in 37 different languages, and also books, reports, thesis, conference proceedings, patents, annual reports and guides. The coverage is for 1970. Over 1,60,000 items will be included in the database every year. The Commonwealth Agriculture Bureau (CAB) database on agriculture and allied subjects covering the period from 1973 to present consisting of 3,00,000 records can be acquired and put in DL which will be an asset to the state's agricultural research and development programmes.

Indian Agricultural Research Institute (IARI), New Delhi has established the facilities for maintaining a DL. It has facility for storing approximately 1.5 crore of digitised pages of books and also hours of video, audio, and other multimedia files. It has collected complete information in digital media on world wide research on agriculture and related areas conducted during the last 10 years. The institute has also developed a campus LAN with main hub located in the library to which all divisions of the institute are connected. LARI is also planning to connect all ICAR institutes and SAUs to their network so that research workers

of the country are able to access this electronic library.

Kerala Agricultural University has already completed the implementation of an electronic library as per the concept design prepared by the author. Its storage capacity is 5 crore and 40 lakhs printed pages and pictures which is equal to 1,40,000 books of average 500 pages each. The electronic library in addition to text and graphics can hold 56 hours of educational video. From national and international agricultural research institutes the unit has under various Memorandum of Understanding (MOUs) received support for establishing this electronic library, as electronic copies of their complete publications or library collections which in total comes to approximately 2 crore 45 lakhs printed pages and three hours video. This DL contains libraries developed by CGIAR, IDRC and CAB. The system has facility for recording texts in CD-ROM media. With the addition of some minor components multimedia files also can be recorded and kept in this DL. The library and information science professionals joining with IT solution providers have customised some search enquiries according to our requirement which will enable automatic pooling of resources in a subject group and retrieving information from that at a single stroke of the key. This is the first such system in India which KAU and ICAR can be proud of. A library local area network (LAN) is already completed at this university and text and video from the electronic library can be accessed by any of the student or scientist through systems provided in central library LAN. Campus network are coming up under ARIS programme in main campus and distant campuses under the university. The electronic library can be accessed online through these campus networks when they are commissioned; from any building and any station. If necessary support for launching a website and getting leased line connection to GIAS etc are provided by central agencies this site can be developed very easily in a national DL.

Benefits of DL

Environmental scientists favour digital libraries. The slogan 'burn a CD ROM, save a tree' is becoming popular. Digital technology is the best method for reducing paper usage which plays havoc with worlds' forests and environment. Environmentalists are putting all efforts to make the common man aware of the benefits extended by digital technology for preservation of our nature. Before long, libraries will have no choice other than acquiring digitised documents in many subject areas.

In 1980s Lancaster stated that 25% of the reference books will be in electronic form by 1990. Now it has become true. Encyclopaedia Britannia and McGraw Hill Encyclopaedia of Science and Technology and most other popular reference sources are available in digital medium long since. Now we have to say that most of the highly used references books are available in digitised form. Lancaster has also predicted that 50% of the existing secondary sources like abstracting and indexing services will be available in electronic form by the end of this century. If we take the field of agriculture, we can see that 90% of such documents are now available in electronic form. CAB which publishes more than 40 abstracting journals in agriculture and allied areas are making them available in electronic media also. So evolution of digital libraries (DL) was faster than predicted. Benefits of DL are that they:

- can provide access to very large collections of documents both primary and secondary
- can support multimedia
- can provide link to different digital objects
- can support and provide search and retrieval interface
- can support traditional library mission of collection, development, organisation access and preservation

- can support publicity and integration of new information

Conclusion

Developments occur at an unprecedented speed in all spheres of human activity including agriculture. This contributes to information explosion and challenges in assessing, organising and disseminating information. Development in information technology is also quite staggering. Information has a very important role to play in all spheres of human activity including agricultural education, research, extension and development. Information can be used as an effective tool in bringing the government and people to work together in realising the goals of agriculture. New access dissemination and processing mechanisms, storage mediums and the like offer possibilities that could never be dreamed of earlier. Libraries if they are to servive and useful have to become part of an exciting and dynamic electronic information landscape. The new technologies of remote sensing and Geographic Information System (GIS) have brought into existence numerous databases that help improve environmental management. The major factors affecting environmental management is not legislation. Legislative back up already exists. The major issues are the agency to implement the provisions of existing laws and the challenge of retrieving and making accessible the information already available to the decision makers.

Many problems have already been brought into focuess by techno globalisation. IT is pervasive and also dynamic in nature. The discipline environmental informatics has already been emerged with the primary object of using IT for assistance in monitoring, control information management, computation and analysis and decision support. We have to give importance to the development of adequate information infrastructure and application of IT in agricultural development.

Library's mission will remain much the same as it has for centuries. But the mediums and methods will be different OPAS, automated circulation systems, CD ROMs, online databases and access mechanisms to resources world wide will be the materials and functions they will be dealing with now. The greatness of libraries will depend far less on their huge collections than on the strength of their services and their ability to connect electronically with one another. Libraries have to move away from ownership to access.

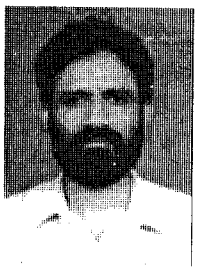
Digital library for agricultural research can enable access to agricultural information not easily obtainable previously and an ability to record knowledge from agricultural sector and distribute it to people working in the sector through out the country or enable access to all. Establishment of digital libraries at major agricultural research institutes and pooling the resources at region or national level can improve the efficiency of information support and quality of education, research, extension and development activities in agricultural sector.

References

1. Deshmukh, P.P. [1987]. Information systems for agricultural sciences and technology, New Delhi, Metropolitan 1987.
2. Evenson, Robert and Jha (Dawanatha) (1973). Contribution of agricultural research systems to agricultural production inIndia, Indian J. Agr. Econ. **28**(4), 1973.
3. Dayamt, Yujiro and Ruttan, Vemon, W. [1979]. Agricultural development, an international perspective, Baltimore, John Hoplins, 1979.
4. Hornik Robert, C.[1988]. Development communication, Information, agriculture

and nutrition in the third world, New York, Longman.

5. Mohammed Kunju, A and Raman Nair, R.[1996]. Development of an Academic database and network. AIU National Seminar on Information Technology in Higher education, Rabindra Bharathi University, Calcutta, 1996.
6. Raman Nair, R.[1996] Agricultural and farm information system for Kerala. At the ILA National Seminar, December, 1996. Directorate of Public Libraries, Andhra Pradesh, Vijayawada, 1996.
7. Raman Nair, R.[1996] Priorities in information management systems for agricultural research and development in India. At the National Conference on Role of Libraries in National Development. University of Calicut, 1996.
8. Raman Nair, R. and Francis, A.T.[1996]. Information needs of agricultural scientists in India: Problems and prospects, at the LASLIC National Seminar, University of Calcutta, 1996.
9. Raman Nair, R.[1996]. Automating agricultural university libraries: Need for standards and guidelines. Proceedings of CALIBER 97, Patiala, 1997.
10. Raman Nair, R.[1997]. Sustainable management of library and information systems in agricultural universities, Accepted for presentation at National Seminar held at Punjab University. Chandigarh, 1997.
11. Raman Nair, R.[1997]. Impact of information superhighway on library and information services at Kerala Agricultural University. Accepted for presentation at National Seminar held at Tamil Nadu Agricultural University, Coimbatore, December 1997.



R. Raman Nair is presently the Librarian of Kerala Agricultural University. He has developed a multimedia compatible library automation system (McLAS) for Govt. Women's College, Thiruvanathapuram and has designed and implemented the library LAN of Kerala Agricultural Universaity which ia one of the largest multimedia library and information systems in the country. He did his MLISc from Benaras Hindu University, MA, LLB, DPA Computer Science etc. from Kerala Sri Venkateswara and Annamalai Universities and has about 20 years experience in the profession. He has published over 14 books and 120 research papers.

Address: University Librarian, Kerala Agricultural University, Trichur-680654