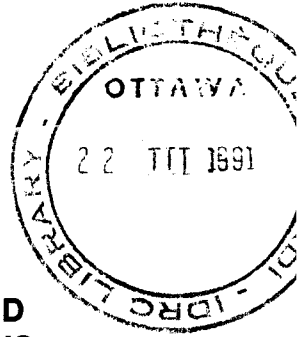


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NEW DIRECTIONS IN AGRICULTURAL INFORMATION SYSTEMS AND SERVICES FOR DEVELOPMENT : SOME PRACTICAL OBSERVATIONS

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ABSTRACT/RESUMEN

As communications improve between nations, and as an understanding of the role of information as a resource which could facilitate the solution of problems of development, new types of information systems are being developed to meet the needs of developing countries. Perhaps the most innovative changes can be observed in the field of agriculture. Information systems are usually developed in response to a felt need for new knowledge or its application; thus, as global, regional and national priorities on issues related to agricultural research evolve, and as ways in which new information technologies could be effectively applied to manipulate data develop, information systems and services can be expected to reflect these developments. Recent information systems and services now involve new users, new subjects, and new formats.

This paper will attempt to identify the issues that have led to the development of agricultural information systems in developing countries and give some examples, based on types of projects funded by the agricultural information program of the Information Sciences Division of the International Development Research Centre. An attempt will be made to trace a link between types of information systems in developing countries with evolving issues and concerns in the field of agricultural research and development, and the development of new information technologies.

A manera que las comunicaciones mejoran entre naciones, y mientras se desarrolla un entendimiento del papel de la información como un recurso que pueda facilitar una solución a los problemas del desarrollo, nuevos tipos de sistemas de información están siendo desarrollados para enfrentar las necesidades nacionales. Tal vez se pueden notar los cambios mas innovadores en el campo de la agricultura. Los sistemas y servicios de información recientemente establecidos, involucran a nuevos usuarios, nuevos temas, y nuevos formatos. Los sistemas de información se desarrollan, generalmente, para responder a una percibida necesidad de nuevos conocimientos o sus aplicaciones. Por esa razón, en cuanto se desarrollen las prioridades globales, regionales y nacionales, y los medios en que nuevas tecnologías de información puedan efectivamente aplicarse la manipulación de datos, se puede esperar que los servicios y sistemas de información reflejen ese desarrollo.

Con ese documento se tratará de identificar los asuntos que hayan conducido al desarrollo de sistemas de información agrícola en los países en desarrollo y de dar algunos ejemplos, basados en la experiencia del Centro Internacional de Investigación para el Desarrollo (CIID) con proyectos financiados sobre su programa en información agrícola. Se intentará determinar un vínculo entre tipos de sistemas de información para países en desarrollo con asuntos que contengan temas evolucionarios en el campo de investigación agrícola y el desarrollo de nuevas tecnologías de información.

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NEW DIRECTIONS IN AGRICULTURAL INFORMATION SYSTEMS AND SERVICES FOR DEVELOPMENT: SOME PRACTICAL OBSERVATIONS

INTRODUCTION

Food is a basic need and agriculture a basic activity. In developing countries, increased agricultural production is essential not only for feeding growing populations but also for improving economic growth, and the standard of living of rural populations. The way to such increased production is to be found in the development and application of improved technologies through agricultural research. To perform effective research, it is important for the researcher to have access to the results of relevant research performed elsewhere.

Because of the global pervasiveness of agriculture as an activity, access to the results of research performed internationally is important to the agricultural technology development process.

The way in which agricultural information systems have developed is evidence of the recognition given to the importance of providing access to the results of agricultural research. Early formal agricultural information systems were developed to capture in a comprehensive way and to make accessible information on research performed globally.

Information services for development were concerned with facilitating the transfer of this information to developing countries. Global information systems such as AGRIS and CARIS and of specialised agricultural information centres (SIACs) based at the International Agricultural Research Centres were established for this purpose.

RECENT DEVELOPMENTS

(a) Agriculture

In the past two decades, there has been a rapid evolution in development, brought about by technological advances in many fields. Improved communication linkages have virtually eliminated international boundaries, resulting in improved flow of information between developed and developing countries and a consequent global awareness of national issues. A spin-off from this was the concept of interdependence, and the notion of sharing and networking. By the 1980s, the global perception of development had altered considerably. In addition, as the capacity of developing countries to determine their own technological solutions to national problems improves, their development needs have also changed.

Issues in the field of agriculture at international, regional and national levels have undergone similar changes. More widespread use of improved agricultural technologies during the last two decades, has brought about progress in world food production. The early "green revolution" strengthened the realisation of the potential for increased food production and the elimination of hunger in developing country regions through the application of modern agricultural technologies.

Within a decade after the "green revolution", however, it was clear that because of the location-specific nature of resource and crop management problems, a number infrastructural conditions needed to be in place in developing countries in order for the application of scientific methods to realize the expected potential. Agricultural research agendas began to focus on increasing the capabilities of research systems in developing countries to identify problems, and to adapt technologies to local conditions. During this period, information systems and services began to be concentrated on the development of regional and national agricultural information services in developing country regions.

By the late 1980s, with improved understanding of the development process, it became clear that interactions between agriculture and research, environmental and socio-political factors were closely linked to the future of agriculture and food production. The new theme was sustainable agriculture which needed to take into account all the local factors that impinge on and influence effective agricultural research and the successful adoption of agricultural technologies. Some areas identified for priority attention include: resource management and environmental degradation, germplasm conservation and research management. Other issues include the role of women in agriculture and nutrition. Agricultural production for the generation of income was also seen as important for improvements to development, and pricing policies, marketing and trade were included as issues for on agricultural development agendas.

Finally, concerns about effective technology transfer led to the recognition of the farmer as the ultimate decision maker in the adoption of technologies and the importance of extension agents and farmers in the research process.

(b) Information technologies

Side by side with these developments in agricultural issues have been the phenomenal strides made in the development of information and communications technologies, and the recognition of the importance of information as a resource that is essential for economic development. Advances in computer technology have made it possible to enhance the ability of traditional library and documentation services to handle the vast store of information produced as a result of the developments in agricultural technologies noted above. In last decade with the introduction of microcomputer-based technologies, the cost of owning and operating computers have decreased. At present, the universal availability of microcomputers and the associated technologies and software programs offer a broad range of applications for solving many of the problems related to information management at the national level.

Innovative uses of information technologies have led to the development of new information systems and services; and communications technologies are now linked with these to maximise the efficiency of information use at the local level. One application has been the establishment of networks and the linking of institutions, countries, researchers, through electronic mail, facsimile and computer conferencing.

More sophisticated applications such as management information systems (MIS) will, in the future, be an important planning tool for administrators and researchers in developing country agencies. Such a tool can facilitate improvements in the planning and management of agricultural research.

EFFECTS ON AGRICULTURAL INFORMATION SYSTEMS AND SERVICES

What effects have these new developments had on agricultural information services for development? This paper will examine the development and change in emphasis in projects supported over the last two decades by the Agricultural Information Program of the International Development Research Centre (IDRC). It suggests that the pattern of development of the program reflects how agricultural information systems and services have responded to the developments in the agriculture and information sectors over the period under review.

Based on the philosophy that research is an integral part of the development process, the mission of IDRC is to contribute to development through research and research-supporting activities. The aim of its mandate is to support applied research whose results could be expected to benefit the poorest members of developing country populations. The strategy of the Centre is to concentrate on the building of indigenous research capabilities through support for projects in which national researchers define and address their own problems and needs.

Because IDRC bases its approach to development on the philosophy of "responsiveness"- that is, sensitiveness to the priorities established by developing country governments, agencies and individuals, it is felt that the trend observed in its projects can be taken as an indicator of global and national trends in the development of agricultural technology transfer issues and of the role of information in this transfer process.

An examination of projects funded under the Agricultural Information Programme (AIP) of IDRC for the period 1970 - 1990 shows a gradual change in the types of projects it has funded over the years. The AIP has historically been concerned with improving access to information to facilitate the transfer and adoption of technologies developed both within and outside the national situations, and has done this through support for international, regional and national institutions. The aim has been to strengthen institutions at the global level to develop information systems which would facilitate the performance of research and the transfer of research results to and among developing countries.

Initially, projects provided support for the development of global information systems such as AGRIS and CARIS and of Specialised Information Analysis Centres (SIACs) based at the International Agricultural Research Centres. The goal of these projects was to encourage and facilitate the development of information services in agencies whose research agendas were aimed at developing countries issues.

During the late 1970's and continuing into the 1980s projects were supported whose objectives included the development of regional and national agricultural information services in developing country regions. The main purpose of these projects was to assist in the development and strengthening of national capacities to participate in and to have access to global information services.

An additional and important objective of such projects was the establishment of permanent national agricultural information centres. The aim was to ensure not only that researchers in developing countries had access to information in support of their research, but also that research information produced locally was captured and made available both to national researchers/planners and shared globally through international information systems on an on-going basis.

During the late 1970s and the 1980s the agendas of the agricultural sector began to show a preoccupation with issues that influence the adoption of agricultural technologies at the national level; it was clear that issues of agricultural research management peculiar to national situations needed to be investigated and that agricultural research policies needed to be adjusted to the realities at the national level. One reflection of these concerns at the international level was the inclusion by the CGIAR of two new institutions into its group: the International Food Policy Research Institute (IFPRI), and the International Service for National Agricultural Research (ISNAR).

During this same period, IDRC-supported agricultural information projects showed a gradual shift from bibliographic information systems to other kinds of information systems. Much of this also had to do with the advent of new technologies which allowed for new, faster and more efficient ways of storing and manipulating information. In addition, the objectives of many of these new projects were concerned with adding value to the information services to reach new users. These projects were much different from the library-type information service projects traditionally supported by IDRC and indicated that countries were now looking at users including but not limited to researchers.

In recent times, concerns have been expressed at the international level and in many national agencies that technologies developed as a result of agricultural research are not being adopted by potential users. As a result of this, much agricultural research effort is lost. Since the ultimate purpose of agricultural research is to provide for improved and increased food production at the national level

through the adoption of appropriate technologies, these concerns have caused a new look to be taken at the technology and information utilization process.

Discussions on the impact of agricultural research tend to focus on such issues as on the contribution of research to knowledge, and the returns of research on investment. Of greater relevance to the role of information is the question of the utilization of results and the effect of agricultural research has had on improving the lives of developing country peoples.

In a paper prepared for IDRC on the question of utilization of research results of projects supported by the Centre, four concepts were identified as necessary in any discussion of the relationship between research and the process of development. Three of these relate to information: dissemination and diffusion; utilization; and the impact of the use of information or technology on some aspect of economic or social development. The fourth factor cited relates to the identification of policy issues. It is clear that the focus is on the user: did the information reach the intended beneficiaries? was the information used? was it used effectively? Other question that might be posed are: did the right information feed into the research determination process?

Examples of recent projects in agricultural information demonstrate the preoccupation with these issues: the focus is on the range of users of in the agricultural sector and on the provision of different types of information systems and services suitable for these users. The major characteristics of these projects could be identified as : (1) to increase the capacities of national planners to formulate research strategies that are relevant to national needs; (2) to ensure that the results of agricultural research are brought closer to the producer/farmer level; (3) to provide new, non-traditional information that complement research information; and (4) to adapt new information technologies to meet national needs.

EXAMPLES OF RECENT INFORMATION PROJECTS

The examples given here represent a selection of projects that were developed over the last five years.

I. New Users

(a) Planners

One project which focuses on national planners is the Agricultural Research Management Information System (ARMIS) in the Philippines. This project represented a new type of information system supported by the Centre, and a great deal of pre-project planning went into the process of project development. This process involved the active participation of national administrators, researchers and information personnel. The aim of the project is to improve the decision-making capability of research managers by making available to them large volumes of organized data for planning, monitoring, evaluation and routine administrative tasks. Information modules to be developed will allow for the monitoring of research projects from implementation to completion; keeping track of outputs and the technology generated; technology transfer, verification and dissemination activities.

The data collection and manipulation requires a high level of computer skills and software development. The agency involved, the Philippines Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) already had several computerized system modules dealing with research projects, bibliographic information, agricultural technology, equipment infrastructure and manpower, and financial management.

The project also reflects national concern with reaching out to rural areas. There are fourteen administrative agricultural regions in the Philippines. The project includes a pilot activity which will develop, at the level of two of the fourteen regional agricultural research consortia, the capacity to

collect and organise regional information. The project will allow for the consolidation of the existing systems at the national level and the development of a computer-based information system that will organize data collected at the regional level.

One of the results of the project will be to facilitate the systematic flow of information between the regional units and the Headquarters. In addition, to serve regional needs, all requests for information from the national database will be provided to the regions from the Headquarters.

Another project that has very recently been approved also identifies planners as the target user. This project will build a comprehensive statistical database of indicators which cover all aspects of the Ecuadorean farming sector for the period 1950-1990. The project is intended to allow planners in Ecuador to have access to information which will facilitate their ability to design agricultural research and development plans that are suitable to the diverse ecoregions of the country. The project will also create a local capacity for the systematic collection, organisation and handling of data generated by different organizations in Ecuador and will enable its redistribution to planning and research institutions.

(b) Farmers

At the other end of the information chain, at the post-research level, concerns have been with the reception and utilization of the results of research. One interesting project developed during this recent period has been the Thai Agricultural Colleges Transfer of Information Cooperative Service (TACTICS). The objective of this project is to upgrade and strengthen the capability of the Thai Agricultural Education System to provide information to teachers, students, farmers of its 44 vocational agricultural colleges. Activities include the collection of farm management data in four regions; analysis, presentation in appropriate forms and distribution of data collected to extension workers, farmers, teachers and students; and provision to the agricultural colleges of local agricultural information to support extension services and teaching/learning activities.

One of the objectives of the project is to analyze farm management data on 25 commodities using microcomputers. Data on each crop would be collected and analyzed, and packaged into Farmers' Reference Manuals and Teachers Reference Manuals. The project provides for the translation of packages for extension agents and farmers into the Thai language.

One project from this region whose target user is the farmer is a market information system developed in the Caribbean. The agency responsible for this project is a non-governmental organisation, the Association for Caribbean Transformation (ACT). The ultimate user of this system is the small farmer. The primary objective is to permit the small farmer to have relevant and up-to-date information which will be useful in crop production and marketing. Under the project, a computerised database of statistical information was developed. Data was collected on 40 crops including vegetables, root crops and tree crops. The database contains five modules - commodity prices, input prices, costs of production, demand and supply information and transportation and trade. The ACT Information Service provides information price forecasts, market profiles, production plans and the identification of trade opportunities. The target beneficiaries are small farm households, vendors who sell in the local retail market, and hucksters who buy at the farm gate and trade with neighbouring territories.

(c) Decision makers (planners, farmers, others)

In Tanzania, a project for the creation of a pilot agricultural cooperatives database was funded in 1988. The aim of the project was to facilitate the management and control of the massive data resources held by the complex agricultural cooperatives system of the country. Agricultural cooperatives have to distribute farm inputs and collect, store and market produce 10-30 different agricultural commodities of different requirements for their members. In addition, they are required to provide the Government with information on the main market channels for major agricultural produce which earns foreign exchange for the country.

Thus their users include Government agencies, researchers, producers, exporters. Information covers the areas of crop procurement, transportation, sales and storage; inputs; storage facilities, transportation, credit, markets both internal and external, and manpower. The system would need to produce information to support decision making, analysis, strategic planning by users at different levels of the agriculture sector.

During a Phase I, the project examined the possibility utilizing the computer to develop the information system. The needs identified called for a fairly sophisticated data processing system which would improve the efficiency of existing manual systems of collecting, storing, transmitting, and retrieving information in the agricultural cooperatives movement. The project included the design and testing of a prototype database using microcomputers and a database management system. A second phase will involve the collection of actual data from cooperative unions, and implementing the database approach developed, in three pilot regions of the country.

II. New Agricultural Research Structures

While the Information Sciences Division has always subscribed to the notion of the importance of networking in the sharing of resources among developing countries, two recent agricultural information projects have taken the idea one step further by linking the researchers in existing research networks through the establishment of an information system dedicated to the functions of the networks. The two research networks are the West African Farming Systems Research Network (WAFSRN), and the Red Internacional para Sistemas de Produccion Animal en America Latina (RISPAL). Both these networks utilize a research methodology Farming Systems Research (FSR) which involves the participation of the farmer and the incorporation of conditions at the small farm level as well as farmer practices and knowledge into the research process. WAFSRN links researchers and research activities

in sixteen countries in the region and the Red Internacional para Sistemas de Produccion Animal en America Latina (RISPAL) is a network linking 15 research projects in animal production carried out by 20 institutions in 10 countries.

The interest of the agricultural Information Program in these two projects is to assist in the continuous sharing of the results of research being carried out in the different projects in the Network. The importance of such sharing lies in the fact that projects are located in similar microenvironments. As a dynamic system of research where the results of one step of research feeds into the next step, an effective on-going flow of information is among national researchers, assumes a high level of importance. The projects also assist in the promotion of the notion of the importance of farmer participation in the development of technologies and the resulting impact of research on large numbers of small farmers.

An example of another network that represents an new model in international cooperation in agricultural research is the International Network for the Improvement of Bananas and Plantains (INIBAP). Bananas and plantains are staple food crops in all areas of the developing world. Thus INIBAP functions in a decentralised way with four regional networks in Latin America and the Caribbean, East Africa West Africa and Asia. Research issues relevant to regions are identified and coordinated at the regional level and carried out by national institutions in accordance with their needs and problems. A centralised coordinating centre links and supports the regional networks. INIBAP is the first international agricultural research network to operate in a decentralised mode.

The information system was designed very early in the formation of the research Network and sought to structure information activities which would meet the needs of national researchers in the regional research networks both through the development of regional/national information systems and for the establishment of a strong backstopping base at the co-ordinating centre. At present activities at the coordinating centre have resulted in building up of a centralized database of research information on

banana and plantains, the development of an international database of information on research projects, the publication of a trilingual International Newsletter (**Musarama**) for distribution to all regions and other coordinating activities such as translations and training. One of functions of the coordinating centre is to link the regional information centres and to ensure the governance issues which will guide the regional information systems are in place.

At the regional level the Program is also supporting the development of information systems to support regional research and to link the region with the centralised information activity. The first regional information system has been developed in Latin America and is coordinated by the UPEB Documentation Centre functioning as the regional information node for INIBAP.

CONCLUSION

The examples of IDRC-supported agricultural information projects given above, signify emerging types of information activities and point to new roles for agricultural information and to possible expanding roles for the agricultural information specialist. Systems now demand the ability to structure databases, to manipulate information to produce new types of outputs, and to look to a widening user community. The planner is identified for special attention, recognizing the crucial role played by well planned and relevant research priorities; the extension agent and the farmer as those ultimately affected by results of technology development now appear as new targets for information services.

New technologies. As can be seen from the above examples, many of the "new types" of information systems would not have been possible were it not for the increasing availability and accessibility of new information technologies. It is anticipated that these technologies will play an increasing role in information delivery systems. Such media as computer networks, communication

systems, and videotext will all assist in facilitating the flow of information among different user groups in the agricultural technology chain.

The primary use of CD-ROM in agricultural information has been as a medium to decentralize access to remote databases: all the major computerized agricultural databases are now available on CD ROM and many developing countries have them. One of the drawbacks of the present CD-ROM databases is, of course, that acquiring the documents cited can be quite problematic. However, we can perhaps envision in the near future the appearance of other optical technologies which will provide full text databases at affordable prices. It is also not unrealistic to imagine the actual production of such discs at the national level to further decentralize nationally produced information for direct use by the extension agent/advisers.

Another useful information technology which can make inroads into agricultural research management and planning is that of geographical information systems (GIS). While this technology is not so new, there are many exciting possibilities for its application to agricultural research planning and development.

Expert systems are another form of information technology which is being investigated by the Information Sciences Division as a possible medium for the delivery of information to the extension agent/farmer. This application of expert systems is a very complicated process. The Information Tools and Methods Program (ITM) of the Information Sciences Division works to adapt develop and test new information technologies and methods for developing country applications. The agriculture information program works closely with ITM to examine ways and means to adapt of such systems and information technologies to meet agricultural information needs for developing country applications.

Another technology that deserves mention because of possible future impact on agricultural information transfer is that of machine aided translations. While the development of very impressive systems for

machine translation are on-going in a number of scientific disciplines, its application to agriculture promises real returns when one considers that, for example, all the major agricultural databases are predominantly in English. In addition, there is the question of translation of research reports, into the major languages - at least those produced by the IARCs, and of signal works and reference monographs that are now only available in one language.

Finally, the role of telecommunications in the development of agricultural information systems must be mentioned. Such technologies as computer-messaging, bulletin boards or other data communication techniques through regular telephone lines, packet switching, or packet radio networks, offer real possibilities for agricultural information transfer among countries and within countries. Information systems will be expected to increasingly take advantage of such technologies to improve their services.

FUTURE DIRECTIONS

Using knowledge for development

While it is recognized that the purpose of research is to produce knowledge, it has been postulated that "much more knowledge required for development is already available than is likely to be produced any time soon" and thus, "it is the dissemination and utilisation of information that has a direct impact on development rather than the production of new information".

With the massive store of agricultural information potentially accessible the task of the information specialist is to ensure that all levels of users involved in agricultural technology transfer are provided with the necessary information to fulfil their roles in the process; and to utilize all the tools that are now available for the development of services which would add value to existing information resources.

Such a task is consistent with the basic concept information transfer as one of the functions of information science. The importance for information specialists is to ensure that information is used effectively. For agricultural information specialists the ultimate purpose of our activities is that the use of such information brings about improvement in agricultural management and production leading to improved nutrition and standards of living.



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