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INFORMATION AND COMMUNICATION TECHNOLOGY IN AGRICULTURAL DEVELOPMENT: A COMPARATIVE ANALYSIS OF THREE PROJECTS FROM INDIA

Shaik. N. Meera, Anita Jhamtani, and D.U.M. Rao

Abstract

A study was conducted that examined the performance of three ICT projects in India. The projects have quite different origins and purposes, but all are concerned with improving the delivery of information to farmers and other rural dwellers. One project is managed by the government of Madhya Pradesh as part of an exploration of e-governance. A second project is run by sugar cooperatives (with some government support) in Maharashtra and attempts to expand services to growers. The third project is an experiment by a large private agricultural input supplier to provide information to farmers in Andhra Pradesh. The study describes the organisation of each project; discusses the types of farmers involved and assesses their utilisation of the services; and looks at the backgrounds and performance of the functionaries who manage the projects. The projects studied varied with respect to the type of services provided, but these included marketing information, extension advice, information about rural development programmes, and other information from government and private sources.

Research findings

- *The ICT projects provided external and on-the-job training for personnel, although there were variations with respect to sufficient orientation towards ICT for agricultural extension.*
- *All projects reviewed had younger, better educated, male farmers as their primary users, but a government project in a marginal area was fairly effective at reaching poorer and illiterate clientele.*
- *In the state government project, users most valued access to market information, land records and information on rural development programmes. In the cooperative project, question-and-answer services, accounting, and farm management information were valued most. In the private company experiment, participating farmers valued various types of information on practices, management of pests and diseases, and rural development programmes.*

Policy implications

- *ICT projects to serve resource-poor farmers require qualified and well-motivated staff to serve as an interface with computer systems. Staff for agricultural extension projects should have adequate training in agriculture.*
- *Efforts should be made to ensure that farmers have faith in the ICT project personnel and that they are committed to the goals of the project.*
- *Before ICT projects are established in a region, rapid rural appraisals should be done to assess the type of information most in demand.*
- *Government should reorient its policies in order to harness ICT's potential for contributing to agricultural development.*

Contact details

Dr. Shaik.N.Meera, Scientist, Division of Extension, Communication and Training, Central Rice Research Institute, Cuttack, India-753006, INDIA. *Email*: mir_shaik@rediffmail.com, mir_shaik@yahoo.com

Dr. (Mrs.) Anita Jhamtani, Principal Scientist, Division of Agricultural Extension, IARI, New Delhi-110012, INDIA.

Dr. D.U.M. Rao, Senior Scientist, Division of Agricultural Extension, IARI, New Delhi-110012, INDIA.

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Acronyms

ICT	Information and Communication Technology
TKDL	Traditional Knowledge Digital Libraries
ITK	Indigenous Technical Knowledge
NGOs	Non-Governmental Organisations
FPF	Faith in Project Functionaries
BPL	Below the Poverty Line
NICNET	National Informatics Centre Network
GIS	Geographical Information System
NIC	National Informatics Centre
WiLL	Wireless in Local Loop

INFORMATION AND COMMUNICATION TECHNOLOGY IN AGRICULTURAL DEVELOPMENT: A COMPARATIVE ANALYSIS OF THREE PROJECTS FROM INDIA

1 INTRODUCTION

Today a new paradigm of agricultural development is fast emerging: in both developing and developed countries the overall development of rural areas is expanding in new directions; old ways of delivering important services to citizens are being challenged; and traditional societies are being transformed into knowledge societies all over the world.

The report of the 'Task Force on India as Knowledge Superpower' (GOI, 2001) emphasised the necessity of developing the capacity to generate, absorb, disseminate and protect knowledge and exploit it as a powerful tool to derive societal transformation. Information and Communication Technology (ICT) is seen as an important means of achieving such a transformation. When used as a broad tool for providing local farming communities with scientific knowledge, ICT heralds the formation of knowledge societies in the rural areas of the developing world. However, this can only be realised when knowledge and information are effectively harvested for overall agricultural and rural development. The development of precision farming in countries of the North emphasises knowledge-intensity; hence the agricultural paradigm in the developing world will have to be recast to take advantage of knowledge availability to achieve multiple goals: of income, food, jobs, etc. ICT has a significant role to perform in evolving such a paradigm, as was evident from the Interdisciplinary Dialogue on IT: Reaching the Unreached (Swaminathan, 1993).

ICT in the revival of social organisations

ICT can give a new impetus to the social organisations and productive activity of agriculture which, if nurtured effectively, could become transformational factors. The 'knowledge' itself will become a technology for overall agricultural development. Agricultural extension, in the current scenario of a rapidly changing world, has been recognised as an essential mechanism for delivering knowledge (information) and advice as an input for modern farming (Jones, 1997). However it has to escape from the narrow mindset of transferring technology packages to transferring knowledge or information packages. If this can be achieved, with the help of ICT, extension will become more diversified, more knowledge-intensive, and more demand driven, and thus more effective in meeting farmers' information needs. ICT has many potential applications in agricultural extension (Zijp, 1994). It can bring new information services to rural areas where farmers, as users, will have much greater control than before over current information channels. Access to such new information sources is a crucial requirement for the sustainable development of the farming systems.

Convergence of ICT with agricultural development

Broad basing agricultural extension activities; developing farming system research and extension; having location-specific modules of research and extension; and promoting market extension, sustainable agricultural development, participatory research, etc. are some of the numerous areas where ICT can play an important role. Several research studies conducted on extension organisations have revealed that the delivery of goods is effective when the grass roots extension worker covers a small area of jurisdiction, with multiple purposes (broad basing). The existing system of large jurisdictions, each with a narrow range of activities, is less effective. However, broad basing requires grass roots workers to be at the cutting edge of extension and master of many trades, which is not really possible. IT can help here, by enabling extension workers to gather, store, retrieve and disseminate a broad range of information needed by farmers, thus transforming them from extension workers into knowledge workers. The emergence of such knowledge workers will result in the realisation of the much talked about bottom-up, demand driven technology generation, assessment, refinement and transfer. Agricultural extension systems in most developing countries are under-funded and have had mixed effects. Much of the extension information has been found to be out of date, irrelevant and not applicable to small farmers' needs, leaving such farmers with very little information or resources to improve their productivity. ICT helps the extension system in re-orienting itself towards the overall agricultural development of small production systems. With the appropriate knowledge, small-scale producers can even have a competitive edge over larger operations. When knowledge is harnessed by strong organisations of small producers, strategic planning can be used to provide members with least-cost inputs, better storage facilities, improved transportation links and collective negotiations with buyers.

ICT can also play an important role in bringing about sustainable agricultural development when used to document both organic and traditional cultivation practices. Developing countries can create Traditional Knowledge Digital Libraries (TKDL) to collect and classify various types of local knowledge so that it can be shared more widely. These libraries could also

integrate widely scattered references to Indigenous Technical Knowledge (ITK) systems in a retrievable form. Thus IT could act as a bridge between traditional and modern knowledge systems.

Areas of IT convergence

Applications of IT in support of agricultural and rural development fall into five main areas, as outlined by Don Richardson (FAO, 1996). These are:

- economic development of agricultural producers;
- community development;
- research and education;
- small and medium enterprises development; and
- media networks.

Some agricultural development services that can be provided in the developing world, using ICT, are:

- online services for information, education and training, monitoring and consultation, diagnosis and monitoring, and transaction and processing;
- e-commerce for direct linkages between local producers, traders, retailers and suppliers;
- the facilitation of interaction among researchers, extension (knowledge) workers, and farmers;
- question-and-answer services where experts respond to queries on specialised subjects ICT services to block- and district-level developmental officials for greater efficiency in delivering services for overall agricultural development;
- up-to-date information, supplied to farmers as early as possible, about subjects such as packages of practices, market information, weather forecasting, input supplies, credit availability, etc.;
- creation of databases with details of the resources of local villages and villagers, site-specific information systems, expert systems, etc.;
- provision of early warning systems about disease/ pest problems, information regarding rural development programmes and crop insurances, post-harvest technology, etc.;
- facilitation of land records and online registration services;
- improved marketing of milk and milk products;
- services providing information to farmers regarding farm business and management;
- increased efficiency and productivity of cooperative societies through the computer communication network and the latest database technology;
- tele-education for farmers;
- websites established by agricultural research institutes, making the latest information available to extension (knowledge) workers and obtaining their feedback.

ICT initiatives for agricultural development in India

There have been some initiatives in India, using ICT for agricultural development. In most of these projects, agriculture is only a small component. Indian experiences with IT projects are:

- *Gyandoot* project (Madhya Pradesh);
- *Warana* Wired Village project (Maharashtra);
- Information Village project of the M S Swaminathan Research Foundation (MSSRF) (Pondicherry);
- *iKisan* project of the Nagarjuna group of companies (Andhra Pradesh);
- Automated Milk Collection Centres of Amul dairy cooperatives (Gujarat);
- Land Record Computerisation (*Bhoomi*) (Karnataka);
- Computer-Aided Online Registration Department (Andhra Pradesh);
- Online Marketing and CAD in Northern Karnataka (Karnataka);
- Knowledge Network for Grass Root Innovations – Society for Research and Initiatives (SRISTI) (Gujarat);
- Application of Satellite Communication for Training Field Extension Workers in Rural Areas (Indian Space Research Organisation);

In adddition to the above, a few non-governmental organisations (NGOs) have initiated ICT projects such as:

- *Tarahaat*.com by Development Alternatives (Uttar Pradesh and Punjab);
- *Mahitiz-samuha* (Karnataka);
- VOICES – Madhyam Communications (Karnataka);
- Centre for Alternative Agriculture Media (CAAM);

Some exclusive agricultural portals are also available, such as:

- *Haritgyan*.com
- *Krishiworld*.net
- TOEHOLDINDIA.com
- Agriwatch.com
- ITC's *Soyachoupal*.com
- *Acquachoupal*.com
- Plantersnet.com, etc.

Despite the huge potential to harness ICT for agricultural development, only a few isolated projects have been initiated in India and a few in other parts of the world. Interestingly, many of these projects were started by NGOs, private organisations, cooperative bodies and governmental organisations other than agricultural departments. This shows the apathy of agricultural development departments towards incorporating ICT into their day-to-day activities. To formulate a strategy for overall agricultural development, the isolated ICT projects need to be studied and the experiences generated must be documented in order to draw lessons for the future.

2 OUTLINE OF STUDY

This paper is an outcome of the thesis entitled 'A Critical Analysis of Information Technology in Agricultural Development: Impact and Implications', submitted in partial fulfilment of the award of PhD at the Indian Agricultural Research Institute, New Delhi. The study tried to focus on the use of ICT in agricultural development and the possibilities of incorporating the ICT in Agricultural Extension system.

The study was conducted in India to analyse some of the intricacies involved in harnessing ICT for agricultural development. Three projects were selected: *Gyandoot* in Madhya Pradesh; *Warana* Wired Village project in Maharashtra, and *iKisan* in Andhra Pradesh. They were purposively selected because each of them fits into one of the three broad categories into which ICT initiatives in India may be classified. These are

government initiatives (*Gyandoot)*, non-governmental (cooperative) initiatives (*Warana*) and private-sector initiatives (*iKisan)*.

Another reason for selecting these projects was that the areas in which they operate are quite contrasting in terms of their geographical and agro-climatic conditions, the prosperity of their agriculture and the socio-economic conditions of their farmers. *Gyandoot* is in Dhar District, Madhya Pradesh, which is a tribal-dominant and drought-prone area. *Warana* is operated in the agriculturally prosperous Kolhapur and Sangli districts of Maharashtra. The project was located here because of the strength of the cooperatives in this region. *iKisan* operates in a number of districts in Andhra Pradesh, where varying socio-economic conditions of farmers are found.

The population of the study consisted of farmers randomly selected from all those using the services of the projects, plus members of project staff. Forty farmers from each project area were selected, a total of 120. Similarly, 30 functionaries of each project were chosen. These 90 individuals ranged from operators of the kiosks to project designers and coordinators.

In all three projects, the farmers' access to ICT is through the operators of *soochanalaya*, also called kiosks or booths, staffed by project personnel who have had computer training. The operators of these kiosks are responsible for both information gathering, i.e. collecting information useful to their farmer clients, and information sharing, i.e. disseminating such information to the clients.

A kiosk generally consists of a small room in a building connected in some way with the project. In *Gyandoot* it is usually a room in a village administration building; in *Warana* it will often be in a building owned by the cooperative; in *iKisan*, it may be rented from a private landlord.

The arrangements for operating the kiosks vary from project to project:

In *Gyandoot* the operator, typically an educated youth who has received training from the local council, is not an employee of the project but an entrepreneur who runs the kiosk on commercial lines. Kiosks are owned both by village committees and privately. In the former case the operator is selected by the committee and the local community and pays 10% of his income to the district administration to maintain the network. A private owner, on the other hand, pays a licence fee of Rs. 5000 a year to the *Gyandoot Samiti*.

In the *Warana* project the 56 kiosk managers are employees of the Warana Nagar Cooperative Society. This is also the case in the *iKisan* project.

The methodologies used to evaluate the impact of ICT on stakeholder communities are still an open issue. Since ICT for agricultural development is so new, any attempt to evaluate only the end result would be premature and it is too early to expect concrete and sound results from the projects. For these reasons the evaluation focused more on process than on result impact.

To measure process impact some aspects from the Scott McConnell model (2001) were used. A number of variables and their indicators were studied and technical evaluations of the projects were carried out.

An assessment of the staff of the three projects selected involved studying the following variables: their effectiveness, their orientation towards ICT extension, their faith in people, education, professional qualifications and the training they had received.

In the present study these criteria are defined as follows:

- Effectiveness refers to the extent to which the functionary is competent to carry out the job.
- Orientation refers to the individual's attitude towards ICT extension, i.e. using it in agricultural development projects.
- Faith in people refers to socio-political outlook and having faith in the capabilities of people for development work, in their capacities, group behaviour/social action and social strength.
- Education refers to formal academic qualifications.
- Professional qualifications are academic qualifications with specialisation in computer applications.
- Training refers to experience with an ICT project formally provided to staff members either before joining the project or while in service.

In order to ascertain the information the farmers need, an exhaustive list of possible needs was prepared. The farmers in the study were asked, in the context of the particular ICT project in which they were involved, to rate the list of needs according to how relevant they were to their circumstances. This gave a picture of what information the farmers in each project really needed.

Faith in Project Functionaries (FPF) refers to the faith expressed by the farmers in the ability and competence of the project staff.

Goal commitment refers to how much interest was shown by the farmers in the goals of the ICT project. The degree of interest gives a measure of the farmers' participation in the project and their understanding and internalising of its goals.

Other variables considered for the study include the farmers' age, education, any subsidiary occupation, landholding, exposure to mass media, frequency of use of ICT services and computer literacy.

Both Survey Research Design and Exploratory Research Design were used in this study. The data collected were entered and analysed using SPSS (Statistical Package for Social Sciences). The analysis was done using descriptive statistics, correlation and multiple regressions.

3 DESCRIPTION OF THE SELECTED PROJECTS

Gyandoot project

Gyandoot operates in Dhar District, a remote, tribal-dominated, drought-prone area of Madhya Pradesh. The district has a population of 1.7 million, 54% of whom are tribal and 40% living below the poverty line. On 1 January 2000 Dhar District began the new

millennium with the installation of a low-cost, self-sustainable rural intranet project, owned by the community. The name of the project, *Gyandoot*, literally means purveyor of knowledge. It is essentially an e-governance project whose main focus is to harness IT effectively in order to improve governance at village, block and district levels. The focus is overall rural development rather than exclusively agricultural development.

Gyandoot's information services have been classified as follows:

- agricultural best practices (particularly soybean);
- prices of agricultural produce in different market centres;
- online registration of applications for land records
- online provision of land records;
- education facilities such as personality tests, quizzes, question banks, etc. (for students);
- online driving licences;
- a rural email facility;
- a village auction site;
- information regarding government (rural development) programmes;
- Ask the Expert;
- transparency in the working of government;
- *Gaon ka akbaar* (village newspaper);
- online matrimonial sites;
- *swaliram se puchiye* (information for children);
- *avedan patra* (application formats for rural development schemes);
- registration of births and deaths;
- list of people below the poverty line (BPL).

About a quarter of the services provided by the project are related directly to agricultural development (such as agricultural best practices, market prices, online land registration certificates, the village auction site, Ask the Expert). A relatively small database has been developed regarding the best practices (packages of practices) for various crops such as wheat, gram and soybean which the farmers are using.

The prevailing prices of prominent crops (wheat, gram, soybean, etc., giving varieties) at local and other auction centres of the country are available online. Other services with direct impact on agricultural development were the provision of land registration (*Khasra*) certificates to the farmers. The farmers make their applications through the kiosks at a cost of Rs. 10 and, after 10 days at the most, an intimation that the land registration certificates are ready is sent to the kiosk concerned. There were some legal bottlenecks in providing these services at the beginning but they have been dealt with over a period of time.

A village auction site was also available to the farmers for a period of three months. This costs Rs. 25 per head and could be used for selling land, agricultural machinery, bullocks or equipment. It opened a new horizon of e-transaction in these rural areas. The middlemen usually involved were successfully eliminated and buyers could browse the list of commodities for sale for Rs. 10.

The Ask the Expert facility uses a group of experts in agriculture, animal husbandry, health, etc. to answer questions by farmers and villagers about their problems, the latest techniques, improved technologies, etc. A user is charged Rs. 5 for this service.

Warana Wired Village project

The *Warana* cooperative complex in Maharashtra has become famous as a fore-runner of successful integrated rural development emerging from the cooperative movement. The *Warana* cooperative sugar factory, registered in 1956, has led this movement, resulting in the formation of over 25 successful cooperative societies in the region. The total turnover of these societies exceeds Rs. 60 million. Warana Nagar has an electronic telephone exchange, connecting nearly 50 villages, which has permitted dial-up connections from village kiosks to the servers, located at Warana Nagar. There are many infrastructure facilities in and around Warana Nagar. About 80% of the population is agriculture-based and an independent agricultural development department has been established by the cooperative society. The region is considered to be one of the most agriculturally prosperous in India.

The project was initiated with six business centres, six IT centres and 70 village booths (kiosks). The project aimed to provide the following services:

- utilising IT to increase the efficiency and productivity of co-operatives by setting up a state-of-the art computer network, providing agricultural, medical and educational information to the villagers at facilitation booths in their villages;
- providing communication facilities at the booths to link villages to the *Warana* cooperative complex, bringing the world's knowledge to the villagers' doorsteps through the internet via the National Informatics Centre Network (NICNET), and establishing a geographical information system (GIS) of the surrounding 70 villages, leading to greater transparency in administration especially in matters related to land.

There are six web-based applications that may be accessed by villagers from the facilitation booths. They provide information about:

- employment and agricultural schemes and government procedures;
- automated assistance in completing applications for government documents such as ration cards and birth and death certificates;
- crop information;
- bus and railway timetables;
- medical facilities; and
- water supply details.

From the booths villagers can interact with the *Warana* management to register grievances and seek redress. Agricultural marketing information is available from the *Warana* web-server, giving market arrival and the daily prices of various regulated commodities. It is also possible for students to access educational and vocational information from the booths.

Other applications include the management information system for sugarcane cultivation developed by the National Informatics Centre (NIC) which leads to speedy and accurate data exchanges between the

factory and the farmers, using the village facilitation booths. This information is essential to the farmers.

The land records application permits villagers to view and print extracts using data from a land database stored on a compact disc, or from the website of the *tehasil* to which they belong, right at their village booth (a *tehasil* is a sub-division of a district concerned with tax revenues). A Geographical Information System (GIS) has also been developed. It includes a base map of the 70 villages involved in the project, socio-economic information, e.g. about schools, population, land under cultivation and linking cadastral maps, all translated into *Marathi* (the regional language of Maharashtra).

iKisan Project

iKisan is the ICT initiative of the Nagarjuna group of companies, the largest private entity supplying farmers' agricultural needs. *iKisan* was set up with two components, the *iKisan*.com website, to provide agricultural information online, and technical centres at village level.

The project operates in Andhra Pradesh and Tamil Nadu. However, it really proved popular in Andhra Pradesh where nine technical centres (kiosks) were established in different districts. Farmers are able to become members by paying Rs. 100 per year or Rs. 20 per month. Project services are available only to member farmers.

The operators of the *iKisan* technical centres are agricultural graduates who act as the interface between the computer networks and the farmers. They are there to provide both on- and off-line information services. They collect online information from the *iKisan*.com website, and pass it on to the farmers. In addition, they assist farmers to access information from the CD-ROM, comprising a vast database, with which each centre is provided.

The operators, being agricultural graduates, are able to diagnose, analyse and advise about diseases and pests. With their knowledge of both agriculture and ICT, they probably constitute the best part of this project.

The major objective of *iKisan* is to provide need-based wholly agricultural expertise at village level, to increase the productivity of selected crops in selected regions.

Their online services include information on 20 crops, namely rice, chilli, cotton, soybean, maize, groundnut, turmeric, banana, citrus, coconut, tomato, red gram, Bengal gram, green gram, black gram, aubergine, sunflower, sugarcane, castor and mango. Another service called Let Us Talk allows online chat among farmers or between farmers and experts. There were four modules in this – chat, expert chat, bulletin and Ask Us.

Market information with respect to the products and services of the companies in the Nagarjuna group is available online, as are weather forecasting and current events.

The offline services provided by *iKisan* are concerned with:

- crop diagnostics, disease and pest management;
- soil testing, sampling and fertility;
- information about agricultural equipment and other inputs and their availability;
- market information;
- crop insurance information;
- information regarding cropping patterns and systems;
- question-and-answer services;
- poultry- and animal husbandry-related information.

4 PROCESS IMPACT

The capacity of the *Gyandoot* project in terms of the number of kiosks operated was found to be 39. These provide services in nine blocks of Dhar District, each kiosk serving 25 to 30 villages, with a population of between 20,000 to 30,000. The time elapsing between new information being received by the project staff and the average member of the farming community receiving it, ranges from one day to one week. The total budget of the project was Rs. 2.5 million, which was spent on the development of the intranet, the relevant database and other project-related equipment. It is worth noting that the day-to-day maintenance costs of the intranet are not included in this budget. This cost is borne by the individual *panchayat*s (local government councils) and the kiosk operators.

The number of farmers accessing the *Gyandoot* services was found to be 2340 per week. An average of 10 farmers per day visit a kiosk to access its services. This number is encouraging in a tribal-dominated, drought-prone area. Most of the information provided by the intranet was gathered by project staff from different development departments and some from magazines. However using ICT in this way, as an information-gathering tool, was not popular in the project, and staff carried out the task only once a fortnight. This should be improved to provide timely information and the latest packages of practices. The degree to which ICT was used as an information-sharing tool, in other words to disseminate information to farmers, was very frequent, i.e., once a day.

The project uses an application server type of database management system. The customised software is menu-driven Hindi language software with *Kirtidev* fonts. The project has only one server with 128 MB RAM and a speed of 733 MHz. As far as network connectivity is concerned, 32 kiosks use fibre optics and seven have Wireless in Local Loop (WiLL). There is only one hub centre. The operating system is Windows.

The capacity of the *Warana* project in terms of number of kiosks was more than either *Gyandoot* or *iKisan*. At the start of the project there were 70 kiosks at village level. However, at the time of investigation, the number had fallen to 56. These 56 village-level kiosks serve the majority of the villages in Kolhapur and Sangli districts in Maharashtra. The project's capacity, in terms of time taken for information to reach the farmers, was one to two days. Because the farmers of the region need the information on the tonnage of sugarcane, payment details, etc. as soon as possible they reported that they were getting the information sent from the sugar administration building within a day.

The project, whose total budget is Rs. 25 million, is funded by the Government of India, Maharashtra state and the Warana Nagar cooperative. The annual maintenance cost of the project was found to be Rs. 2.5 million. The number of farmers accessing its services is 4250 per week. An average of 13 farmers per day access services at each kiosk. The information provided by the project is gathered from various development departments and from magazines. The degree to which ICT was used for information-gathering was found to be rare, i.e. once a fortnight. As in the case of the *Gyandoot* project this could be improved in order to provide timely information and the latest packages of practices, etc. The degree to which IT was used as an information-sharing tool was 'very frequent', i.e. daily.

Three types of database management systems are used in the project, namely application, internet and mail servers. Three types of customised software have been developed by the National Informatics Centre in the Marathi language. (This is reportedly the single largest set of applications developed in Marathi so far.) The network connectivity comprised 10 Mbps intranet and internet through telephone lines. Two Mbps WiLL were also used. Wired LAN (local area network) was also present.

The *iKisan* project started off with nine information centres or kiosks, but this had increased to 18 by the time of the investigation. These 18 centres serve villages in different areas of Andhra Pradesh. The time taken for information received at the kiosk to reach the stakeholder community ranged from one day, in the case of services such as market information and weather forecasts, to one week in the case of more complex information. The number of farmers accessing the services of the project was found to be 810 per week. An average of eight persons per day access information at each technical centre. Project staff use ICT as an information-gathering tool very rarely, i.e. once a month. Most of the information they gather is collated from *iKisan* or Nagarajuna reports, Acharya NG Ranga Agricultural University's (ANGRAU) Agriculture Guide and other agricultural magazines. The degree to which ICT is used as an information-sharing tool is 'very frequent', i.e. daily.

The technical evaluation of the project revealed that three types of database management systems are used, namely, application server, internet server and mail server. Customised software in Telugu has also been developed. Two servers, each with a capacity of 40 GB, are used. The network connectivity is of 100 Mbps with leased line connectivity (5 MB APOLO 61C/64 Kbps). There are three hub centres, each connected by 10 terminals. The operating system is Windows 98 with NT servers.

User equity

The user equity (gender equality, economic equality) of the project services was determined. In the case of *Gyandoot*, 85.5% of the 2340 farmers using the services each week were men and 14.5% women, i.e. 2000 men and 340 women. This reveals that there is no user equity where gender is concerned.

The analysis with respect to poverty came up with somewhat interesting findings. It was found that 34% of ICT users were in the Below Poverty Line (BPL) category. Considering that 40% of the population in this region is BPL, the fact that 34% of them use ICT is highly significant. However, there is still scope to increase the percentage of BPL users.

In *Warana*, of the 4250 farmers accessing project services each week, 3655 (86%) are male, meaning that 595 (14 %) are female.

In the case of *iKisan*, of the 810 farmers accessing the services per week, 800 (98%) are male and only 10 (2%) female.

5 PROJECT STAFF

To harness the power of the new technologies, people working on ICT projects for agricultural and rural development need to be competent. In fact, the success of any ICT project will depend largely upon the orientation and sensitivity of the people who control the power of ICT to serve the needs of rural people. So, an attempt has been made to understand the project functionaries' characteristics in terms of their socio-personal, professional and psychological competencies.

Educational qualifications

A comparative analysis of the educational qualifications of the functionaries of the three ICT projects under study revealed some interesting differences between them. In *Gyandoot* half of the staff were either matriculates, meaning they had completed their secondary education (up to Class 10) and were eligible for college or university entrance; or were intermediates, i.e. with an additional two years of tertiary education, though not to degree level. On the *Warana* project half were graduates, and on the *iKisan* project 57% were graduates, specifically in agriculture.

While *Gyandoot* encourages matriculates to become private entrepreneurs in ICT ventures, *iKisan* prefers technically qualified people for its projects. *Warana* follows a middle path by encouraging cooperative members to work in their ICT projects. A large majority, about 83%, of *Gyandoot* functionaries possess professional qualifications in computers (27% of them to graduate level). This compares with around 70% in *Warana*, none of whose staff had a computer degree, and *iKisan* (17% with computer degrees). Thus the *Gyandoot* staff appear to be well qualified technically.

Training received

Training is essential on these projects, and it may be given on the job, before joining or soon after joining the organisation. Each project tailors its training to its specific aims but in general it consists of orienting the new recruits to the goals, procedures and the envisaged activities of the ICT project. Nearly 87% of *Gyandoot* functionaries reported having received a one-month course during which they had a good exposure to the philosophy, approach, objectives, procedures and activities of the project.

In addition to the month-long training course before becoming a member of staff, the new recruit receives

Table 1 Project training received

N=90

Training	*Gyandoot* (n=30)	*Warana* (n=30)	iKisan (n=30)	Total Sample
Training not received	4 (13.33)	1 (3.33)	3 (10.00)	8 (8.88)
Training received	26 (86.66)	29 (96.60)	27 (90.00)	82 (91.11)

individual guidance each week. Further, a full-day meeting is held every month, attended by all the *soochak,* to discuss new initiatives and find solutions to new problems. Thus the training support in the *Gyandoot* project was judged to be adequate.

Nearly 97% of staff on the *Warana* project reported having received training on joining the project. This consisted of showing them how to carry out functions such as collecting and printing on-line payment slips and giving them to farmers; providing solutions to the farmers' problems with sugarcane cultivation; sending emails to the Head Office (to the sugar administration building) concerning farmers' problems, etc. Training the kiosk managers along these lines was very important to the success of the project and although the functionaries were poor in technical qualifications, the short (seven to 10 days) training courses they received somewhat compensated for this.

About 90% of the *iKisan* project functionaries reported having received training. *iKisan* is a highly technical project in which each village kiosk has a large database to provide instant advice to farmers. To cite an example of this service, suppose a farmer brings a diseased/infected specimen to the kiosk seeking advice, his sample is compared with on-screen photo images of disease symptoms, enabling a diagnosis to be reached, and highly precise technical advice is given by the agricultural science graduate managing the kiosk. This is done by using CD-ROMs already developed on specific subjects. In order to provide such a service, adequate technical training to use the CD-ROM, to assimilate technical information and give proper advice to the farmers is required, all of which is provided to the *iKisan* staff. All in all, adequate and proper training courses are provided to the personnel of the three ICT projects. Inadequate educational or technical qualifications are compensated for by on-the-job training.

Orientation towards ICT extension

It was found that, of the three projects, the staff of *iKisan* were most favourably disposed to ICT extension (70%). Only 26.6% of the personnel in the *Warana* project were favourable and in *Gyandoot* it was 33%. This orientation towards extension on the part of the *iKisan* staff may be due to the predominance of agricultural graduates in the project. However, it should be said that, despite the variations in approach between the three projects and the stated opinions of the personnel, their extension efforts were all generally effective.

Project staff's faith in people

In *Gyandoot*, a large majority of the respondents, about 73%, showed a moderate level of faith in people. Only 13% showed a low level of faith. In *Warana*, about 60% of the functionaries showed a moderate level of faith and about 23% a high level. The distribution was normal but skewed towards the higher level of faith in people. In *iKisan*, 53% of the respondents showed a moderate level of faith, while 23% showed a low level.

Personal effectiveness

Table 2 shows how the staff of the three projects were rated in terms of personal effectiveness. A high level of effectiveness was found in 34%, a moderate level in 58%, and 18% were considered low-level. The frequency distribution was found to be normal with a peak of 73%.

In *Gyandoot*, education and professional qualifications together enhance the professional competence of the staff, which may in turn improve their personal effectiveness. Their faith in people and their orientation towards IT extension were also found to be logically associated with their personal effectiveness. In *Warana*, orientation towards ICT extension and faith in people were found to be significantly associated with personal effectiveness. In the case of *iKisan* , four variables – education, training received, orientation towards ICT extension and faith in people – were found to be statistically correlated with personal effectiveness. However, training was found to be negatively associated with one's personal effectiveness. This can be substantiated by the fact that the staff of one project rated themselves less effective despite training because the database held by this particular project was enormous, and the more an individual learnt on job training the more ignorant he felt, and rated himself ineffective. Among the total sample of project functionaries working in different ICT projects, four variables – education, professional qualification, faith in people and orientation towards IT extension – were found to be positively and significantly related with personal effectiveness.

Table 2 Effectiveness of functionaries

Personal effectiveness

Categories	Frequency	%
Gyandoot		
Low (<Mean-1SD)	04	13.3
Moderate (Mean+1SD)	22	73.3
High (>Mean+1SD)	04	13.3
Warana		
Low (<Mean-1SD)	07	23.3
Moderate (Mean+1SD)	15	50.0
High (>Mean+1SD)	08	26.6
ikisan		
Low (<Mean-1SD)	06	20.0
Moderate (Mean+1SD)	21	70.0
High (>Mean+1SD)	03	10.0
Total Sample		
Low (<Mean-1SD)	16	17.7
Moderate (Mean+1SD)	52	57.7
High (>Mean+1SD)	22	34.4

Table 3 Correlation coefficients of project functionaries' personal effectiveness

Variables	'r' values			
	Gyandoot (n=30)	*Warana* (n=30)	*iKisan (n=30)*	Total sample (N=90)
1. Education	0.648**	0.352	0.420*	0.515**
2. Professional qualifications	0.423*	0.086	0.130	0.237*
3. Training received	-0.029	0.033	-0.387*	-0.122
4. Orientation towards IT extension	0.644**	0.523**	0.665**	0.600**
5. Faith in people	0.738*	0.614**	0.637**	0.694**

* Significant at 0.05 level of probability
** Significant at 0.01 level of probability

To further probe and discover the variables contributing to the variance in personal effectiveness, multiple regression analysis was done. A perusal of results given in Table 4 reveals that 55.92% of variation in the personal effectiveness of all project functionaries could be explained by the five variables included in the regression equation. F ratio was 21.31, which was significant at 0.01 level of probability. Of the five variables, only two – faith in people and orientation towards IT extension – were found to contribute significantly.

Table 4 Regression analysis of functionaries' personal effectiveness – total sample

Independent	Partial 'b'	't' value
Education	0.60020	1.38
Professional qualification	0.40023	0.62
Training received	0.59007	-0.59
Faith in people	0.21476	2.55*
Orientation towards IT extension	0.39190	4.90**

R square = 0.5592
F = 21.31**
* Significant at 0.05 level of probability
** Significant at 0.01 level of probability

It can be concluded that faith in people and orientation towards ICT extension contributed significantly to the perception of personal effectiveness in the personnel of all three projects.

6 CHARACTERISTICS OF FARMERS USING ICT SERVICES

Of the farmers using the three projects' services, 52% were middle-aged, 37% young and 11% old. The frequency distribution was highly skewed towards the younger respondents. In *Gyandoot* 90% of the farmers belong to the middle-aged or young groups, as do 98% of *Warana* farmers and 80% of *iKisan* farmers. In the total sample this accounts for 89%. All four frequency distributions were found to be highly skewed towards the younger age range. This means that more young people are getting involved in ICT projects for agricultural and rural development.

Among the farmer respondents from the *Gyandoot* project, 22.5% were illiterate while 20% had completed the 5th standard at their local primary schools. At the *Warana* cooperative, the figures were 15% illiterate or functionally literate, and 32.5% with primary education. In the *iKisan* project villages, only 7.5% were illiterate or functionally literate, 20% had primary education, nearly 38% had studied up to middle school and nearly 33% were educated up to high school level. The pooled data revealed 15% were illiterate or functionally literate; about 24% had primary education; nearly 26% were educated up to middle school; and nearly 32% per cent had studied up to high school level. Given the respondents' low level of education, the fact that the services provided by the ICT projects are in the appropriate local language, Hindi, Marathi or Telugu, is an advantage.

Table 5 Distribution of respondent farmers by landholding

N=120

Landholding	*Gyandoot* (n=40)	*Warana* (n=40)	iKisan (n=40)	Total Sample
Marginal (<1 ha)	8 (20.00)	14 (35.00)	2 (5.00)	24 (20.80)
Small (1–2 ha)	20 (50.00)	17 (42.50)	20 (50.00)	57 (46.70)
Medium (<5 ha)	10 (25.00)	9 (22.50)	17 (42.50)	35 (29.16)
Big (<5 ha)	2 (5.00)	0 (0.00)	1 (2.50)	4 (3.33)

It is worth noting that nearly 70% of the farmer beneficiaries of *Gyandoot* are small, marginal farmers. In the *Warana* Wired Village project, the figure is nearly 78%. On the other hand, the frequency distribution of respondent farmers in the *iKisan* project is highly skewed towards medium land holdings. The high percentage of small farmers in the *Gyandoot* project is accounted for by the fact that it operates in a tribal district inhabited by many of the resource-poor and weaker sections of society. Similarly in the *Warana* sugar cooperative union small farmers abound, hence the inclination of the project coordinators towards small and marginal farmers. However *iKisan* is a private venture and a bias towards resource-rich and bigger land owners was observed. In addition, the highly technical advice on offer at *iKisan* usually has a better uptake by better-off farmers.

Exposure to mass media

Of the whole sample of 120 farmers, nearly 50% had a high exposure to the mass media, and about 38% medium exposure, leaving only 12% in the low exposure category. As can be seen in Table 6, more than 80% of farmers in each of the projects under study have a medium to high level exposure to mass media. (The media referred to here do not include the information relayed through the projects' ICT services.)

Frequency of use

In the *Gyandoot* project, about 52.5% of farmers were found to be using the ICT services once a month, and 45 once a fortnight.

Among the respondents of the *Warana* Wired Village project the frequency of use is about 45% a fortnight and another 45% a month. At least 5% of the

Table 6 Distribution of respondents based on mass media exposure

N=120

Mass media exposure	*Gyandoot* (n=40)	*Warana* (n=40)	*iKisan* (n=40)	Total Sample
Low	7 (17.50)	6 (15.00)	2 (5.00)	15 (12.50)
Medium	15 (37.50)	14 (35.00)	17 (42.50)	46 (38.33)
High	18 (45.00)	20 (50.00)	21 (52.50)	59 (49.66)

farmers use the services once and sometimes more than once a week. This may be explained by the fact that this ICT project is an integral component of a large cooperative organisation, the *Warana* Sugar Cooperative. All the members of the cooperative use the ICT services since all payments and savings accounts, etc. are handled by computers and ICT, especially the intranet.

At the *iKisan* project villages, 52.5% of farmers use the ICT services at least once a month, about 40% once a fortnight and 7.5% weekly. This constitutes by far the most frequent use in all three projects. However this is to be expected, since *iKisan* is a private enterprise providing technical advice only on agriculture, and paid for by its members.

In all these projects, nearly 85 to 92% of the farmers were found to be computer-illiterate. However this does not deter them from using the ICT services, the reason being that well-trained staff are available at all the internet and intranet kiosks to serve their needs. The fact that the farmers do not feel there is a barrier to their obtaining information is a tribute to the grass roots staff and to the effectiveness of their training.

7 INFORMATION NEEDS OF FARMERS

The main focus of ICT in agriculture is meeting the farmers' needs for information. Each of the projects studied was designed to meet these needs in their target population, according to their individual mandates and the agenda they had established. An attempt was therefore made to find out what agricultural development information the farmers really considered relevant to their needs. An exhaustive list of information requirements, as voiced by the respondent farmers, was prepared. The farmers were then asked individually to rate how appropriate the various items of information were to their particular circumstances.

Marketing information

The *Gyandoot* farmers perceived market information, including daily updates on the prices of agricultural commodities in the markets of the surrounding district, as one of the most relevant ICT services. This was seen as 'most appropriate' by 90% of farmers, enabling them to sell at those markets where their goods would command the best prices.

In *Warana*, 50% of the farmers felt that information about prices in markets outside their own villages was their highest priority. About 50% of farmers in the *iKisan* project villages agreed that this information was 'appropriate', while another 35% felt it to be 'most appropriate'. These same farmers perceived getting information on the latest agricultural commodity prices in the local markets as 'quite appropriate'.

Facilitating access to land records/ online registration

In *Gyandoot*, 82.5% of farmers perceived obtaining access to land records as 'most appropriate'. (Since *Gyandoot* is owned and run by the district administration, they can provide authentic records.) In *Warana*, only 30% of farmers perceived it as 'most appropriate', another 30% seeing it as 'appropriate'. In the whole sample about 50% of farmers saw the provision of information on land records as being 'appropriate'. Another 40% thought it 'most appropriate'. In all, the farmers perceived this information as relevant to their needs. However it may not be possible for a private company network to provide government revenue records on land.

Question-and-answer service

About 67.5% of *Gyandoot* respondents perceived this as 'most appropriate'. The service, called 'Ask the Expert', consists of a group of specialists on agriculture and animal husbandry answering farmers' questions about the latest techniques and new technologies in their areas of expertise, and giving advice on various problems. This was seen as 'most appropriate' by 87.5% of *Warana* farmers, as providing an opportunity to obtain answers to specific queries. About 60% of the *iKisan* farmers perceived it as 'most appropriate', the rest considering it as 'appropriate'.

Information about rural development programmes and subsidies

About 57.5% of *Gyandoot* respondents felt this information was 'most appropriate' because it provided detailed information on all government programmes relating to rural development. The information was indeed most appropriate for the poor tribal farmers to whom the programmes were addressed. In fact it was extremely appropriate, since the district was reeling under a drought that had lasted for three or four years from 1999. Once the tribal people became aware of the rural development programmes they realised they could get help through the subsidies and benefits the programmes provided.

In *Warana* nearly 53% of farmers saw information on rural development programmes as being 'appropriate'. This sort of information was particularly needed by small, marginal farmers.

In *iKisan*, about 65% of farmers saw provision of information on the government's rural development programmes as 'most appropriate', even though they were relatively well off and part of a private ICT venture.

Weather forecasting

Information on rainfall, temperature and humidity was considered 'most appropriate' by about 47.5% of farmers participating in the *Gyandoot* project. In the *Warana* project, however, 45% saw it as 'less appropriate'. Of the total sample about 60% perceived

weather forecasting as 'appropriate', while about 27.5% rated it as 'most appropriate'.

Latest (best) packages of practices

Approximately 70% of *Gyandoot* farmers considered the provision of information on 'best practices' for cultivating soybean and wheat as 'appropriate', in the hope that they might save their crops despite the longstanding drought in the district. They were also looking forward to receiving information regarding drought-resistant varieties. In the *Warana* project, around 68% of farmers felt that information regarding the best packages of practices for various crops cultivated in the area, particularly sugarcane, was 'most appropriate'. In the total sample about 52.5% of farmers saw the provision of information on best agricultural practices as 'most appropriate' and about 42.5% saw it as 'appropriate'.

Post-harvest technology

Information on post-harvest technology, particularly storage, was considered 'appropriate' by about 70% of *Gyandoot* farmers. However, in *Warana* 47.5% of farmers perceived such information as 'less appropriate' because the cooperative caters for all their needs in this regard. About 47.5% of farmers in the *iKisan* project thought this information 'appropriate' while another 40% perceived it as less 'less appropriate'. It may be that the farmers do not seek out this information because they are unaware of the value added of food processing.

General agricultural news

Farmers were able to obtain general information and news of various agricultural events in their districts. About 67.5% of the *Gyandoot* farmers felt this information was 'appropriate'. In *Warana*, 47.5% of farmers rated it as 'appropriate', whereas 40% rated it as 'less appropriate'. Around 57.5% of *iKisan* farmers perceived the provision of agriculture-related news as 'appropriate', while about 37.5% thought it 'less appropriate'.

Information on crop insurance

Detailed information on crop insurance schemes, the type of damage covered and compensation offered, premiums to be paid, etc. were felt to be 'appropriate' information by about 55% of *Gyandoot* farmers. However, a majority of the *Warana* farmers, about 75%, thought it 'least appropriate'. This latter group perhaps regards crop insurance as irrelevant because it has been fortunate enough not to experience its necessity over the last few years.

Farm business and management information

About 92.5% of the *Gyandoot* farmers considered information on farm business and management as 'less appropriate', probably because most of them are subsistence farmers who do not anticipate being able to take on any farm business. *Warana* farmers did not feel a need for this information either, 57.5% of them perceiving it as 'less appropriate' in their context. Basically most of these farmers did not know enough about the subject to gauge its significance. Contrastingly, in *iKisan*, about 47.5% of farmers perceived this information as 'appropriate', while another 30% thought it 'less appropriate' for them.

Input prices and availability

Information relating to the availability of agricultural inputs and prices was also perceived as 'less appropriate' by 72.5% of *Gyandoot* farmers. The *Warana* farmers, however, operating in an agriculturally prosperous area where inputs are always in demand, regarded it as 'appropriate'.

Early warning and management of diseases and pests

Early warning systems about outbreaks of disease and pest infestation, and information about how to manage such outbreaks, were felt to be 'less appropriate' by about 70% of the *Gyandoot* farmers. In a period of unbroken drought the farmers felt that pests and diseases did not pose a major threat. However, early warning systems, particularly in the case of sugarcane, were perceived as 'appropriate' by about 52.5% of the *Warana* farmers who have always demanded timely information about disease or pest outbreaks. Nearly 66% of *iKisan* farmers, who were all medium farmers, considered such information as 'most appropriate'.

Dairying and marketing of milk and milk products

In *Gyandoot*, 67.5% of farmers felt this information was 'less appropriate', probably because there were very few dairy farmers, given that the drought had led to dried-up pasture and a shortage of fodder. The *Warana* farmers did not feel a need for this information either, possibly because they concentrated so much on cultivating sugarcane. Besides, the dairy cooperative at *Warana* also takes care of milk marketing. All in all, the information relating to dairying and milk marketing was perceived as 'less appropriate' by 40% of farmers and by 32.5% as 'appropriate'.

Accounting and payment

This service was provided only in *Warana* where it was seen by 75% of the farmers as 'most appropriate'. This is understandable, since the *Warana* project aims to improve the efficiency of the cooperative setup and also aims at direct accounting and an easy payment system.

Soil testing and soil sampling information

This service was provided only in *iKisan*. About 60% of farmers perceived it as 'appropriate', naturally enough in a project focused on agricultural development, in which soil sampling is very useful.

In general it can be concluded that the farmers involved in the *Gyandoot* project considered market information, facilitation of access to land records, a question-and-answer service and detailed information on the government's rural development programmes 'most appropriate' to their needs. Information on the

best packages of practices, post-harvest technology, general agricultural news and information on crop insurance schemes were perceived by most of them as 'appropriate'. Information perceived as 'less appropriate' includes that on farm business and management, agricultural input prices and availability, early warning systems of disease or pest outbreaks and information relating to dairying and marketing of dairy products.

In the *Warana* project, the farmers felt that the question-and-answer services, accounting and payment, best practices and market information were their 'most appropriate' information needs. They placed a lower priority on information regarding input prices and availability, disease and pest early warning systems, rural development programmes and general agricultural news, rating them as 'appropriate'. But few categories of information were perceived as 'less appropriate' to their conditions.

In the *iKisan* project, farmers rated the early warning systems, information on rural development programmes, question-and-answer services, information on cropping systems and planning and best practices as 'most appropriate' for them, while rating as 'appropriate' weather forecasting, soil testing and sampling, general agricultural news, facilitation of access to land records, post-harvest technology, farm business information, input prices and availability and crop insurance. Dairy information was not needed by a majority of the farmers.

Goal commitment

The study tried to estimate how highly the farmers involved in each of the three projects were committed to its goals. In both *Gyandoot* and *Warana* it was found that about 60% of farmers had a middling level of commitment, while 37.5% were highly committed. In the case of the *iKisan* project, about 87.5% of farmers were found to possess a medium level of commitment, leaving only 7.5% who said they were highly committed. This may be due to the fact that the *iKisan* farmers perceive the project as a commercial venture and are either unable or unwilling to internalise its goals.

Gyandoot is a people's project funded by the government of Madhya Pradesh. It is quite comprehensive, encompassing all departments at district, block and *tehsil* level. It provides a window through which farmers can interact with the machinery of government and this accounts for the high level of commitment observed. Similarly, in the case of *Warana*, the fact that it is a cooperative project is important. Its underlying ethos, of connecting all the farmers through a cooperative bond and team spirit, inspires a high level of commitment to its goals.

Correlates of frequency of use of information services

The frequency with which the farmers used the information services of each ICT project was correlated with a few socio-personal variables such as age, education and land holding. It was found that the age of a respondent correlated negatively with frequent use of the internet services in all three projects (Table 10).

It was also found that education was positively associated with frequent use of information services in the *Gyandoot* and *Warana* projects. This augurs well for their successful implementation as the younger, more educated farmers quite frequently used their intranet services. However, in the case of *iKisan*, neither age nor education was associated with frequency of using ICT services.

Table 7 *Gyandoot* project: farmers' perception of their information needs N=40

Information needs	Most appropriate		Appropriate		Less appropriate	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Question-and-answer service	27	67.50	13	32.50	0	0
Market information	36	90.00	3	7.50	1	2.50
Latest (best) packages of practices	5	12.50	28	70.00	7	17.50
Disease/pest early warning system and management	0	0	12	30.00	28	70.00
Input prices and availability	0	0	11	27.50	29	72.50
Weather forecasting	19	47.50	18	45.00	3	7.50
Information on RD programmes/subsidies	23	57.50	11	27.50	6	15.00
Directory and information on crop insurances	2	5.00	22	55.00	16	40.00
General agricultural news	1	2.50	27	67.50	12	30.00
Farm business and management	1	2.50	2	5.00	37	92.50
Dairy, AH related information marketing milk/milk products	0	0	13	32.50	27	67.50
Post harvest technology	4	10.00	28	70.00	8	20.00
Facilitation of access to land records/registration online	33	82.50	7	17.50	0	0

Table 8 *Warana* project: farmers' perception of their information needs

N=40

Information needs	Most appropriate		Appropriate		Less appropriate	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Question-and-answer service	35	87.50	5	12.50	0	0
Market information	20	50.00	18	45.00	2	5.00
Latest (best) packages of practices	27	67.50	13	32.50	0	0
Disease/pest early warning system and management	19	47.50	21	52.50	0	0
Input prices and availability	7	17.50	23	57.50	10	25.00
Weather forecasting	7	17.50	15	37.50	18	45.00
Information on RD programmes/ subsidies	6	15.00	21	52.50	13	32.50
Directory and information on crop insurances	4	10.00	6	15.00	30	75.00
General agricultural news	5	12.50	19	47.50	16	40.00
Farm business and management	3	7.50	14	35.00	23	57.50
Dairy, AH related information marketing milk/milk products	5	12.50	15	37.50	20	50.00
Post harvest technology	3	7.50	18	45.00	19	47.50
Facilitation of access to land records/registration online	12	30.00	12	30.00	16	40.00
Accounting and easy payment services	30	75.00	10	25.00	0	0

Table 9 *iKisan* project: farmers' perception of their information needs

Information needs	Most appropriate		Appropriate		Less appropriate	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Question-and-answer service	24	60.00	16	40.00	0	0
Market information	14	35.00	20	50.00	6	15.00
Latest (best) packages of practices	21	52.50	17	42.50	2	5.00
Disease/pest early warning system and management	26	65.50	13	32.50	1	2.50
Input prices and availability	13	32.50	16	40.00	11	27.50
Weather forecasting	11	27.50	24	60.00	5	12.50
Information on RD programmes/ subsidies	26	65.00	12	30.00	2	5.00
Directory and information on crop insurances	13	32.50	17	42.50	10	25.00
General agricultural news	2	5.00	23	57.50	15	37.50
Farm business and management	9	22.50	19	47.50	12	30.00
Dairy, AH related information marketing milk/milk products	11	27.50	13	32.50	16	40.00
Post harvest technology	18	45.00	20	50.00	2	5.00
Facilitation of access to land records/ registration online	24	60.00	14	35.00	2	5.00
Soil testing and soil sampling information	5	12.50	24	60.00	11	27.50

Table 10 Factors associated with use of IT services by farmers (specific correlations found in data analysis)

Combination of factors	Correlation coefficients ('r' value)			
	Gyandoot (n = 40)	*Warana* (n = 40)	*iKisan* (n = 40)	Total farmers (n = 40)
Frequency of use of IT – Age	-0.685**	-0.610**	-0.180	-0.500**
Frequency of use of IT – Education	0.588**	0.521**	0.132	0.375**
Frequency of use of IT – Landholding	0.277	0.163	0.414	0.121
Faith in functionaries – Age	-0.734**	-0.325**	-0.712**	-0.579**
Faith in functionaries – Education	0.508**	0.373**	0.703**	0.448**

* Significant at 0.05 level of probability0.121
** Significant at 0.01 level of probability

Another interesting feature observed was that landholding was not asssociated at all with the frequency of using ICT services, indicating that all farmers, irrespective of their landholding size, were using them. It means that farmers' landholding size has no bearing on their frequency of use of ICT services.

Correlates of faith in project staff

As can be seen, also in Table 10, the farmers' faith in project staff was found to be significantly associated with age and education: the younger, more educated farmers involved in the three projects expressed a higher level of faith than the older, less educated farmers. This is a welcome sign, auguring well for the successful implementation of the projects.

8 CONCLUSIONS

Some conclusions can be drawn from the findings of the study:

- Efforts should be made to incorporate ICT in all endeavours related to agricultural development.
- The organisations and departments concerned with agricultural development need to realise the potential of ICT for the speedy dissemination of information to farmers.
- Government at national and state level in India has to reorient agricultural policies so that a fully-fledged strategy is formed to harness ICT's potential for assisting overall agricultural development. As part of this process policy makers should utilise the analysis of the ICT projects in this study, to become acquainted with how such projects function.

It was found from the study that *Gyandoot*, with an investment of only Rs. 2.5 million, could make an impact on the stakeholder community, showing that future initiatives need not be investment-intensive. It is not only the technical infrastructure of an ICT project that matters, but efficient administration and good horizontal communication. When ICT projects for agricultural development are set up, attention should be paid to these two features of effective projects.

The extent to which project staff used ICT as an information-gathering tool was found to be rare in all three projects. However, its use as an information-sharing tool was very frequent. Future initiatives should make full use of ICT for both purposes. Any imbalance between the two needs to be checked in the early stages.

User equity from a gender perspective was found to be very low in all three projects. Efforts should be made to remedy this in future ICT initiatives by incorporating information modules targeted specifically towards women farmers, young people, etc.

The personal effectiveness of the *iKisan* staff was higher than in the other two projects. However, the overall picture of the three projects was of a medium to high level of personal effectiveness, which is a good indicator for organisational performance. It is recommended that, when recruiting personnel for ICT initiatives, graduates – preferably in agriculture – should be selected to work as the interface between ICT and farmers, since this ensures effective delivery of services. Other qualities to take into account when choosing staff are a high orientation towards ICT extension and faith in people. Intensive training in the use of ICT modules should be given to staff working directly with the farmers. (It is not necessary for them to have formal computer qualifications.)

Generating awareness among young and middle-aged farmers about the availability of ICT services is the first step to be considered to increase farmers' participation in ICT initiatives. Older farmers should be brought into the chain of ICT networks at a later stage. Also, since small and marginal farmers are using ICT services, more emphasis should be given to providing information relevant to their farming systems. Strong interfaces should be developed at village level so that the problem of computer illiteracy among farmers may be resolved. User-friendly software, graphic interfaces and pictorial information would encourage more IT use.

It is recommended that, in drought-prone and less endowed areas, future ICT initiatives provide information services such as facilitation of access to land records, question-and-answer services, information on rural development programmes, weather forecasting, marketing information, best package of practices for dry land agriculture, information on crop insurance and post- harvest technology. The *Gyandoot* project should consider these aspects.

In the case of well endowed areas where cooperative setups are prevalent, ICT initiatives should focus on providing services such as question-and-answer sessions, cooperative-related accounting methods, market information, input prices/availability and early warning systems for disease and pest problems. The *Warana* project should look into these matters.

Where commercial farmers are dominant, as in the *iKisan* area, ICT services should provide early warning of disease and pest problems, question-and-answer services, information on cropping systems and planning, best and latest packages of practices for commercial crops, weather forecasting, soil testing and sampling, post-harvest technology, input prices/ availability, farm business information and crop insurance.

It is also recommended that, before ICT services are set up in a region, efforts are made to develop among the farmers both a satisfactory level of faith in the intentions of the ICT staff and a firm commitment to the goals of the proposed project. It is also suggested that participatory and rapid rural appraisals are carried out to ascertain what information the farmers need. In the process, the farmers' self-fulfilling faith in the information services provided should be enhanced. It is further recommended that the farmers be instructed in how to get the best possible use out of the services provided.

The aspects of the three projects which the study investigated are proving to be effective in reaching the farmers. This bodes well for the possibilities of harnessing ICT in the developing world despite widespread apprehension to the contrary.

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