Agricultural Development in India in View of Information Technology

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Abstract: The job of Information Technology to develop agricultural research, education and extension to improve quality of life in rural area is well established. IT can assist an average Indian farmer to get applicable information regarding agro-inputs, crop production technologies, agro processing, market support, agro-finance and management of farm agri-business. The agricultural extension mechanism is becoming dependent on IT to provide proper and location specific technologies for the farmers to furnish timely and proficient advice to the farmers IT can be a best mean not only to develop agricultural extension but also to expand agriculture research and education system. IT in agricultural research management for textual and non textual documentations and deciding prioritization of research areas needs to be reinforced. The crop forecasting, input management, command area management, watershed management, land and water resources development , drinking water potential mapping precision management, natural disaster management, fishery management , hill area development and post harvest management are the key areas, where Information Technology can play its imperative impact.

Introduction

The population of India has already been crossed 103 billion and is still escalating alarmingly and that put a great strain on the food grain production of India. On a rough calculation it is an acceptable fact that India achieved success in food grain production from a bare 51 million tons in 1951-52 to 212 million tons in 2003 but India is still hungry. What would happen if India needs to produce an additional 50 million tons of food grain by 2010 AD to feed its increased population? This creates a major challenge not only for the policymakers but also more directly to the agricultural educationist, scientists and extension workers.

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The Information and Communication Technologies can create new opening to bridge the gap between information haves and information have-nots in the developing countries. The task force on 'India as Knowledge Superpower' emphasized the need to harness ICT for community transformation. The agriculturally prosperous developing countries like India cannot overlook agriculture in such transformation. The emerging ICT have momentous role to perform in agricultural development. There are many possibilities of integration of ICT in agricultural, for the overall agricultural and rural development.

Change in crucial point:

It is exciting to note that, in India there is a growing realization of the multiple roles that Information Technology (IT) could play in overall growth of the country. The politicians and policy makers have also emphasized the significance of exploiting the profit of IT for the overall progress of the country. It is a solid view of the Government that if any technology can generate new prospects to link the space between haves and have-nots in society in the current time, it is information communication technology. The policy makers have also realized that IT to improve the lives of the two fifth of the population, which lives below the poverty line, the Government must play a catalytic and enabling role. Besides the central administration, several State Governments have also committed themselves to make strategies, which intentionally plan as extensively as possible to capture the benefits of IT, including the less privileged segments of society. In addition to the Central and State Governments, different civil society organizations are also convinced of the potential role of IT on the socio-economic revolution. A number of initiatives towards harnessing IT for rural development and poverty alleviation have been taken by these bodies. Even the private corporate sector, perhaps in the context of declining world demand, is increasingly looking towards the domestic market as a source of revenue generation.

Various Risk holders:

Nowadays there are various stake holders- central and state governments, civil society organizations and the private corporate sector. Depending upon the character of the actors involved, the information communication technology projects in the country may be broadly separated into two groups. The first group refers to those initiated by the central and state governments essentially concerned with e governance. The second group refers to the initiatives undertaken by the non government organizations and the commercial sector. During the year of 2002, the states like Kerala, Karnataka, Andhra Pradesh, Maharashtra, Bihar, Orissa, Uttar Pradesh, Madhya Pradesh, Gujarat, Haryana,

West Bengal, Rajasthan, Punjab, Assam, Nagaland, Delhi and Sikkim have initiated many e-governance to harness advantages of information technology. The inter-state variation in the initiatives for harnessing information technology for development is observed but now all other states have also realized its importance.

Need of ICT in Indian Agriculture

At present, the ratio of farmers to extension workers is as low as 1000:1. Although the appointed Village Local Workers (VLWs) disseminate information, there is lack of accountability. These two issues have created an urgency to effectively address the information needs of poor farmers. In addition, the cost involved in face-to-face information dissemination at the right time and the difficulties of reaching the target audiences have also created the urgency to introduce ICT for this purpose. It is only through the introduction of ICT that information can also be updated and extended at the lowest cost. There are several ICT models in Indian agriculture, which have made significant difference to agricultural operations (Meera, Jhamtani, & Rao, 2004).

Regarding the gist

Access to information and improved communication is a critical prerequisite for sustainable agricultural development. Recent communication technologies when useful to conditions in rural areas can facilitate advanced communication, boost participation, disseminate information and distribute knowledge and skills. It is said that extension through information technology would be the major form of technology dissemination in the near expectations.

It is experiential that the rural community still has trouble in accessing essential information to make timely decisions. It is necessary that information accessibility is demand driven rather than supply driven. The challenge is not only to improve the accessibility of communication technology to the rural population but also to improve its significance to local development. Considering the important need to access to well-timed information and improved communication, this issue is in center of attention on attempts made in different countries to transfer information to the rural population.

There is a concern that the gap between the information rich and information poor is getting wider. New ITs are creating to solve problems of rural poverty, inequality and giving an opportunity to link the gap between information-rich and information-poor and support sustainable development in rural and agricultural communities. However remote rural communities still lack basic communication infrastructure. The challenge is not only to improve the accessibility of communication technology to the rural population but also to improve the relevance of information to local development.

ICT Initiatives for Agricultural Development in India by Various Agencies

Some initiatives in India that use ICT for agricultural development are:

Sr. No.	Organizations	Projects undertaken
	Central government sponsored	Department of Agriculture and Co-operation's National Agriculture Technology Project AGMARKNET Community Information Centres Warana Wired Village Project of Maharashtra: Application of satellite communication for training field extension workers in rural areas (Indian Space Research Organisation)
	State government sponsored	
	Rajasthan	Janmithra
	Madhya Pradesh	Gyandoot
	Andhra Pradesh	e-Seva (Computer-Aided Online Registration Department),
	Karnataka	Bhoomi (Land Record Computerisation), Raitha Samparka Kendra Online, Marketing and CAD in Northern Karnataka
	Tamil Nadu	Rasi, Miyams Karchipular
	Gujarat	Seva (Automated Milk Collection Centres of Amul dairy cooperatives)
	Maharashtra	Setu, Online Complaint Management System - Mumbai
	Kerala	E-Srinkala
	Corporate sector sponsored	
	ITC-IBD	E-Choupal
	EID-Parry (Nagarjuna group of companies, AP)	ikissan Kendra, Tata Chemicals Chirag Kendra
	Non-government organizations and other private sector organizations	Information Village Research Project in Pondicherry Agriwatch.com Drishti.com Tarahaat.com by Development Alternatives Mahitiz-samuha VOICES by Madhyam Communications

Source: Yogisha, Ramappa, Mahajanshetti, & Vijayakumar, 2008

Some exclusive agricultural portals are:

Haritgyan.com	Krishiworld.net
TOEHOLDINDIA.com	Agriwatch.com
ITC's Soyachoupal.com	Acquachoupal.com

Plantersnet.com

IT IN AGRICULTURAL RESEARCH MANAGEMENT

The major contribution of agricultural research in India has been reflected in various agricultural revolutions during the post independence period. The result of agricultural research boosted the food production and we could see the Green, White, Blue and Yellow revolutions in the fields of Cereal crops (wheat), Milk, Fisheries and the Oil Seeds witnessing the Golden Revolution of horticulture crop production. However with the advent of new emerging agricultural technologies there was a change in focus from increased production to increased efficiency.

The new areas of concerns for agricultural research included the sustainability in agriculture, food security and demand driven research than merely the supply driven. For this purpose, the findings of laboratory research need to reach the unreached. Further for this dissemination a careful documentation methodology and proper communication media will plays significant role. In this sphere, the Information Technology can be fully utilized for proper transfer of technology to the farming community and also those living in remote areas of villages. However there is still scope for tapping and harnessing all available resources in areas of application of Information Technology. Hence it is worthwhile to strengthen the role of IT in agricultural research management.

IT can be best mean for research documentation, experiments, and analysis of results presentations. In the changing scenario under Indian and global context affect the entire process of agricultural research, especially the identification of thrust areas of research. The skill to distinguish between what is urgent and what is important will hold key to the success in deciding priorities. Such skill can be acquired by IT.

- **IT for research documentations: Textual and Non textual documents Textual documents** – To present information in the form of *Written text* e.g. books, periodicals, catalogues, statistical compendia, trade publications, patents, etc. and *Non textual documents* - e.g. maps, plans, graphs, diagrams, posters, paintings, photographs, slides, sound tapes, films, videotapes, artistic monuments and magnetic documents for computer processing IT can be the best mean in agricultural research management.

- **IT in Prioritization of Research:** The changing scenario under Indian and global context affects the entire process of agricultural research, especially the identification of thrust areas of research. The skill to distinguish between what is urgent and what is important will hold key to the success in deciding priorities. Such skill can be acquired by IT.

- **IT in Research Communication:** The benefits of Internet connectivity can be utilized for better collaboration amongst scientists for exchange of their views.

IT IN AGRO-BASED RURAL DEVELOPMENT

It is assumed that 60 to 85% of household consumption belongs to agricultural products so agriculture plays important role in industrial development, it provides raw materials to industries like cotton textiles, jute, sugar, tobacco, edible and non edible oils, leather, plantation industries etc. The food processing industries is also dependent on agriculture. Lots of agro based materials are exported in European and Gulf countries by India. In all such agro

-based industries, role of IT needs to be improved. IT Tools are very useful in creating effective linkages in agro based industry activities. These linkages are concerning dissemination of useful information. Linkages of the producers can be with State Federations and National Federation and Board, Finance Corporation. Advertisement is best way to add value of products. This market again can be very well established with available database of product wise information on products with comprising data of competing nations of the world. IT can help in this direction.

IT IN AGRICULTURAL PRODUCTION

The IT Approach for commercial crops, horticultural crops or floriculture have to focus on Integrated System may be for plant nutrition or plant protection. The well established Integrated Plant Nutrition Approach and Management and Integrated Pest Management (IPM) need to be strengthened with the help of IT Tools. The Post Production Technology (PPT) needs to be utilized properly. The end user, beneficiaries and all concerned especially with export of agricultural produce need to be trained to access the Internet facilities available as one of the most useful IT Tools of the computer era.

IT AS GEOGRAPHICAL INFORMATION SYSTEM (GIS) IN AGRICULTURE:

The use of IT through GIS is very encouraging in India. The important areas like Crop forecasting (procurement policy, crop insurance, relief measure) , Cropping System (input management : fertilizer, Crop Diversification, intensification, degradation measures, sustainability measures), Command Area Management ,Watershed Management ,Land and Water Resources Development ,Drinking Water Potential Mapping Precision , Natural Disaster Management (flood, drought), Fishery (inland, Marine), Hill Area Agriculture Development Management, Post Harvest Management and Precision Farming can be reinforced with the help of Information technology in India.

Indian Agricultural Web Sites

- www.ycmou.com/agri
- www.khetiwadi.com
- www.kisan.net
- www.krishiworld.com
- www.nic.in/agrico
- www.pravara.com
- www.agrinto.com
- www.nabard.org
- www.agriwatch.com
- www.ciks.org/agri.html
- www.agri.mah.nic.in

Scope of rural Internet:

Enormous benefits await rural communities and agricultural organizations when communication improves between the non-governmental organizations, government services, private sector entities and educational institutes that support rural and agricultural development. By sharing information about their activities in the fields of agriculture, rural development, forestry, fisheries, health, nutrition, and education, these agencies can better serve rural people and farmers. They can make use of "lessons learned," determine and use "best practices," and coordinate information about particular regions or successful development approaches. At the same time, rural communities and agricultural organizations can benefit equally from improved vertical channels of communication that enable rural extension agencies and farmers to communicate with decision-makers and others concerned with development.

An integrated approach to the expansion of Internet services will promote often-neglected horizontal communication between agencies linked to rural and agricultural development. At the same time, an integrated approach will provide the tools to enable rural people and farmers to enter directly into new vertical communication relationships with external agencies. Improving horizontal communication can improve the quality and relevance of information resources and physical resources available to rural people. Improving vertical communication between rural people, farmers and decision-makers can improve the quality of decisions that affect rural communities and agricultural organizations. An integrated approach provides for vertical communication by establishing rural Internet access sites, and by enhancing horizontal communication between such entities as agricultural development organizations, agricultural input and equipment suppliers, government extension services, rural development organizations, health care agencies, and agricultural research and documentation centres.

Improved horizontal communication can also include existing media services that serve rural stakeholders. For example, throughout the developing world, rural radio and, increasingly, television broadcast services, are important information delivery mechanisms. Their services improve significantly through the exchange of information and news by way of the Internet.

Internet services, in conjunction with existing and more widely used communication media such as rural radio, will enable the broadest enhancement of information and communication resources for rural people. For example, national or regional agricultural market information systems or extension information systems hosted on the Internet can be excellent information sources for the staff of rural radio stations throughout a region or nation. Using information on current market prices including national variations and international figures broadcast by rural radio stations, farmers can negotiate better prices from local buyers.

Improved horizontal communication and improved information resources can improve the quality of the decisions and interventions that impact upon rural people. At the same time, these improvements can enhance rural peoples' direct participation in development. Establishing rural Internet access sites and facilities in concert with efforts to enhance horizontal communication networks among the agencies involved in rural and agricultural development is the essence of the integrated approach highlighted in this paper.

Experiences of Rural Internet users of many developing and developed countries indicate that the Internet provides them with a very convenient method for quickly accessing a large volume of information without being impeded by geographic barriers in the form of new ideas, discussion, expert advice, continuing education resources, increased global understanding and cultural awareness, and information that helps to make them better and more informed citizens. In addition to this, social benefits including new opportunities to overcome geographic isolation, increased social interaction, opportunities to organize and advocate for social change, equalization of urban/rural disparities and new links between urban and rural communities were also experienced. Agribusiness users emphasize the Internet's value in enabling them to expand their markets to global audiences and to establish national and global business networks and alliances that would otherwise be inaccessible.

Barriers in ICT Implementation

Educating and catering to the information needs of farmers across nearly seven lakh villages in India indeed sounds unrealistic as this would require immense financial investment. A one-time major investment in establishing communication technologies in the required places restricts the government's objective of covering more people regularly because of insufficient power availability in rural areas, poor ICT infrastructure, ICT illiteracy, non availability of timely relevant content, non-integration of services, poor advisory services and lack of localization, and in particular non availability of agricultural information kiosks/ knowledge centers at the grass root level.

Moreover, farmers sometimes become averse to adopting technology as they think that it might result in their losing their traditional methods of cropping practices. They simply do not want to use such systems, even if the cost incurred is negligible. Therefore, the attitude and mindset of farmers needs to be changed first. There is a need to win their confidence and create awareness about the benefits of ICT in agriculture.

Issue of IT based Extension in India:

Access to satellite based Internet is a big challenge in developing nation like India. Poor quality of connectivity, low bandwidths is very common problems. In India, waiting for years to own a telephone connection in most parts, except metropolitan areas, was a big problem. Now a day the number of rural and urban fixed telephones and cellular mobiles are growing with the help of policy initiatives and market potential. At the same time, more thrust towards wiring rural people, especially in a country like India where large sections of people live in rural areas, is still needed. Unless these people are connected, `India going on-line' will once again divide the rich and the poor. It needs more conviction and political will to focus the rural unconnected in the Market age.

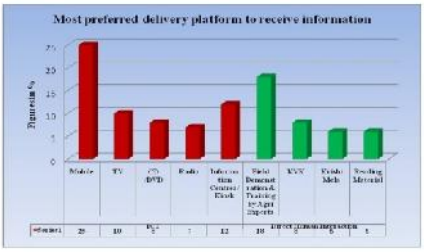
The second major problem with regard to using satellite based communication for extension is content availability in the Internet. Even if a person from a developing country is

connected, he/she is connected to western information. 97 per cent of all Internet hosts are in developed nations, home to 16 per cent of the world's population. [6] Statistics show the majority of users are from developed nations. Naturally, the information available on line is not meant for developing countries citizens. The information for development from developing countries perspectives and the database creation of local knowledge and practices according to their demand is little available or not at all. More than the access to technology, content creation seems to be a very difficult task.

Take the case of indigenous knowledge and traditional agricultural practices in a country like India, which is valuable. Eminent people have been emphasizing the need to document such practices to help sustainable development for a better world. Unless a specific content creation effort is going to take place, there is a greater risk of this knowledge being endangered. The developing nations will have to borrow the technology and not necessarily all the content.

In order to arrive at a reasonably clear picture of the country of existing communication habits and channels in rural areas, especially among the poorer households, from an analysis of the available data, certain trends emerged. For example, of the total households, the telephone density is as low as phones per household. Reach of electronic media, especially television, is reasonably high when one considers the prevalence of poverty in the villages of India. The predominant sources of information are the local petty shopkeeper, the market place, and the agricultural input supplier. A very considerable amount of information transaction takes place between the rural poor households and this also acts as a primary source of information. In other words, the information channels start and terminate within the supra-locality.

Establishment of information centers in villages



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It is stressed that Internet initiatives for rural and agricultural development must consider the fact that different regions, organizations and communities have different applications and technical needs. In some areas it is possible to have farmers and rural residents as direct Internet users while in other areas the capacity of intermediary organizations (such as extension field officers, NGOs, rural schools, libraries, health clinics, government satellite offices) need to be built up, or assistance given in the establishment and promotion of community information centres linked to the Internet.

Successful rural and agricultural Internet communication and information systems have some common elements. Some of the elements include preliminary participatory assessment of communication and information needs with intended users. Awareness building, sensitizing decision makers; commitment to participatory rural and agricultural development; user participation in design, implementation and management of information and communication services and commitment to manage and sustain these services; provision for technical training, user support and outreach within the user community.

In our country services provided by the Government are inadequate both in terms of infrastructure, technology and in empowering people with information. To provide information to local rural people through satellite based communication technology according to their needs and demands, Information centre at village level can be established by involving local people in choosing the actual location of center, providing rent free space and electricity and recruiting volunteers.

This concept was first implemented in Sweden. Information centers in isolated rural communities with Pentium personal computers, printers, a modem, a fax machine, Internet and electronic networks, access to databases, libraries and a consultant can make information accessible to a wider audience. Such centers not only facilitate single-point access to external information services e.g. government marketing and price information or to global information through the WWW, but also help in organization of virtual village-to-village meetings and tele-training events thus facilitating local sharing of information. Each centre should contain data on agriculture, health-related information especially for the rural farmers, women and children. A directory of government schemes should be made available to rural families on local prices of agricultural input or produce, cultural/public events in the locality, local transport/traffic details including timing, grain prices, general and crop insurance schemes, hospitals and medical practitioners, as well as information about integrated pest management in various crops. These databases should be in local languages. In addition, interactive CD-ROMs on various issues can be made available. Information demand is different in each village; hence great care should be taken to address the need for location specific information.

It is stressed that Internet initiatives for rural and agricultural development must consider the fact that different regions, organizations and communities have different applications and technical needs. In some areas it is possible to have farmers and rural residents as direct Internet users while in other areas the capacity of intermediary organizations (such as extension field officers, NGOs, rural schools, libraries, health clinics, government satellite offices) need to be built up, or assistance given in the establishment and promotion of community information centres linked to the Internet.

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Application of IT based agricultural communication in India:

The global communication revolution has been an important part of our country and now India is opening up to the world economy. As result, the situation has changed dramatically. Though we still have a lot of catching up to do, there is no doubt that the old days and worries there in have gone for good. Like other people, farmers also want latest, newest, most modern, most up-to-date, up-to-the-minute and most recent information of any corner of the world at there door.

A few years ago it was difficult to gat such information for Indian farmers, but now in India also many spectacular, wonderful, amazing, fantastic, excellent and fabulous satellite based communication facilities are available in the hand of Indian farmers.

There are cases of application of information and communication technologies in extension that have made a difference in the delivery of extension services in rural India. Some of these include the Warana Wired village Project in Maharashtra; Milk collection in dairy co-operatives (National dairy Development Board); Information Villages Project (MS Swaminathan Research Foundation-International Development Research Centre); Information Technology application for Indian Rural Postal System (CMC Limited, Hyderabad); Knowledge Network for grassroots innovations (IIM, Ahmedabad); Application of Satellite Communication for Training Field Workers and Extension Workers in Rural Areas(ISRO); Computerisation of Mandal Revenue Offices (MROs) and computer aided administration of revenue department in Andhra Pradesh

Warana Wired Village Project:

Warana Nagar, a cluster of 70 villages in Maharashtra is a central eye of the "Wired Villages" project. In 1960, a visionary like Tahasaheb Kore propagated the idea of co-operatives in Warana Nagar, as a method of achieving socio-economic development. He showed how this could bring all the farmers together; to share information, increase productivity, and profits. Thus was born the "Warna Nagar Co-Operative Society". The society has a Chairman and a Board of Members and is free from political influence and society members are free to elect the board members. There are about eight sub co-operative bodies, working under this main society viz.; Warna Dairy Development Society, Warna Co-operative Bank, Warna Foods, Warna Women's Co-operative society etc. Sugarcane is major crop of this area and most of the sugar production of the two districts Kolhapur and Sangli is processed at this Society. From each village 200 - 300 farmers are registered as society members. The "Wired Village" project was initiated by Mr. Vinay Kore, the son of Mr. Tahasaheb Kore and the present Chairman of the Warna Co-operative Society two years ago and actual implementation began in April 1998. The Project has been jointly implemented by GOI through National Informatics Centre (NIC), Government of Maharashtra and Warana Co-operative Society with the share of financial support being in the ratio of 50:40:10. The manpower and maintenance cost is borne by the Warna Co-operative Society itself. The project area is a cluster of 70 villages consisting of 46 villages from Kolhapur and 24 villages from Sangli districts of Maharashtra.

This project has been initiated to serve the information needs on different crop cultivation practices of major crops, sugarcane cultivation practices, pest and disease control, marketing information, dairy and sugarcane processing information etc. to the farmers, right up to their village level.

NIC, Pune was involved in setting-up the hardware and software and NIC, Delhi established connectivity of WAN links such as VSAT and dial-up connections. The software required for the system such as web page designing, database designing and client based applications used by the farmers such as dairy; sugarcane information systems had been developed by the NIC, Pune.

Network Connectivity

Central Hub

The Central Hub, which is the main server station of "Wired Villages" is situated in Tahasaheb Kore Institute of Engineering Technology at Warna Nagar.This is equipped with servers based on Pentium II with 64 MB RAM, 4.1 GB hard disk and 32x CD-ROM drive. The 64 kbps bandwidth VSAT connection has been established as a gateway WAN link to NIC, Pune for connecting into their network and into global network. This enables the main computer center to down load information from NIC, Pune or the global network for latest information. The router is used to establish a WAN link to remote computer booths from the main computer centre. Presently the router supports 10 simultaneous connections i.e. 10 users can access information at a time.

Computer Booths

The Computer Booths are serving as information centers for the farmers in their villages. The computer booth is operator by the booth operator and he is the main linkage between the farmers and information gateway center. The information sought relates to crops cultivation practices, land development, pesticides, diseases control details, marketing details, bills payments positions of sugarcane and dairy etc. Currently forty-six computer booths are functioning in Kolhapur and meeting the information needs of the farmers. In remaining 24 villages of Sangli district, computer booths and hardware was setup, and are waiting to link to Central Server Station.

Apart from information retrieval, there are two client-based applications, to serve the farmers needs. They are (1) Dairy Information System (2) Sugarcane Information System.

In Dairy Information System, the information on all the farmers, who are part of the dairy system, is maintained. Other details available to members of the dairy cooperatives include the quantity of milk supplied by each farmer, fat content, their billing information and credit details etc. This information is maintained and updated at the central database on daily basis.

In Sugarcane Information System, information on shareholders is maintained to provide guideline for sugar cane crop to about 200-350 shareholders in each village. This system maintains the details of the cultivation schedule, quantity harvested and supplied to the society, deductions effected by the Society towards credit, net income due to the farmers is available with respect to each shareholder.

Every village is also linked with the Directorate of Marketing in Pune, which facilitates farmers in getting information on rates of vegetables, fruits and other crops.

The computer booths are provided with a Pentium II computer having 64 MB ram, 2 GB hard disk, printer and a UPS power backup system. Dial-up connectivity with a modem and telephone line has been used to connect the main computer center to retrieve the information, send the queries, grievances to the central server station. The speed of dial-up connection is around 19200 BPS to 28000 BPS and average connectivity time is about 10 seconds.

Telephone charge of around Rs. 350/-, is paid by village level society.

Indian Space Research Organization's Project:

One-way video, two way audio teleconferencing interactive networks have been used for education and training by Indian Space Research Organization. The major application of the network in rural development was for training extension staff from various departments of the state governments. In addition, a large number of women, Panchayati Raj elected officials, primary school teachers, and child development workers spread over large distances have been trained.

Grameen Suvidha Kendra" (GSK)

In order for the farmers to benefit from a holistic point of view, MCX on its part had initiated the "Grameen Suvidha Kendra" (GSK) model in four places of the country in collaboration with the Indian postal department. This provides various facilities such as price/market information, addressing technical queries regarding farming, providing scientific warehousing facilities, warehouse receipt issuance and access to finance, quality inputs, and bank loans. This also provides for flexibility in terms of adding more such services that provide value to the rural economy and service its needs. While the entire motive behind this initiative has been to reach the exchange discovered prices to the farmers, it was planned to add more value-added services not only to enrich the rural economy but also to make this initiative a self-sustainable one such that the rural entrepreneurs can help GSKs to scale up across 120,000 plus post offices, some of them in remote areas. This runs on a 'hub and spoke' model supported on the hub by a kiosk set-up and aided at the back end by the physical structures of post offices. Post offices disseminated the price information through black boards and acted as service providers for other services through the hubs, and at the same time helped the initiative to overcome difficulties such as connectivity and power availability.

While kiosks such as the GSK initiative serve as community-based tools for providing value addition to the farming community that accesses them, mobiles have become personalized tools to deliver information and services that could add value to the farming community. Keeping this in mind, MCX had strategically tied up with the government-owned service providers, BSNL and MTNL, covering the entire geography of the nation to provide its real spot and futures prices on the mobile platform. MCX also went a step ahead to tie up with Tata Indicom to provide this price information on their Interactive Voice Response (IVR) platform on a toll-free basis. While trading in futures on mobile phones is a possibility today, its high cost of access prevents this personal communication tool from becoming an enabler in India. In this case, it would be worthwhile to note the example of Africa where farmers have moved forward from no phones to mobile phones. Particularly in Kenya, the measures taken up by Kenya Agricultural Commodity Exchange (KACE) are a good case in point. KACE allows trading on spot markets for agricultural commodities through its internet-based auction exchange, and sends the price information on mobile phones through a branded service – SMS Sokoni in partnership with a leading mobile phone service provider (Safaricom Ltd.) in Kenya. Farmers can access market information such as commodity prices in different markets, who is buying or selling what commodity, at what prices, where and when. Taking a step further, the export promotion center of Bolivia (CEPROBOL) offers an e-commerce platform to link small export companies and producers via the Internet. These are innovative uses of ICTs for dissemination of market information and providing access to markets.

MANAGE's efforts:

The National Institute of Agricultural Extension Management, MANAGE, Hyderabed, has taken-up a number of "Cyber Extension" initiatives, across the country. District level Web Sites are being hosted, Information Kiosks are being established at block/ Mandal and village levels and technical and other need based information is being collected, digitized and hosted on the Internet.

Extension on the Web:

The web was first used to deliver agricultural content to rural US farmers almost ten tears ago. The problem is that this use of the web remains at an early stage around the world. It is likely that the Web will expand gradually to many more rural areas of the world because farmers demand it, needed technologies are getting better, and economies of scale are lowering costs. But in the absence of other changes, the web in the short-term will not reach most farmers. There are many variables that impact farming that we cannot control; we can control the creation of information banks to help farmers deal with the variables. There is no global agricultural library in a strong sense, and there could be.

The cost of computers and availability of Internet connections for rural farmers is the big problem. This is the Access issue, but is not the only one. Extension services and other content providers face high costs to develop and maintain web resources. Content might be kept offline to protect print sales or it may be posted only at a fee. When content is online and free, its posting is often uncoordinated with other providers, making it harder to find and utilize. Full text content, databases and decision tools remains relatively rare. There is no global agricultural library in a strong sense, and there could be. The content side of the farmers' digital divide must be addressed as well as the access side. One can argue that this puts the cart before the horse, but we have to prepare for the time when access is there. Bolstering the content side might even speed solutions on the access side.

What can be done to speedup needed changes to reach farmers sooner? The possible answer for this question is creation of ideal websites by key policy makers for extension through involving its real users in planning, implementing and sustaining this modern satellite based extension system.

Production of Ideal Web for extension:

The WWW is often referred to as the 'Web' and provides users with easy access to information resources and services on the Internet. It supports a variety of media formats: text, graphics, images, animations, sound, and video. The Web can be viewed as a multimedia subset of the Internet. Web

pages contain multimedia information, hyperlinks and scripts for non-linear navigation. The web pages not only provide users with access to information but also are increasingly being used for communication and collaboration. The 'Web Browser' is a software application that enables users to access resources on the Internet. The first generation of browsers was limited in their functionality and supported only text files. Later generations of browsers are very sophisticated and support multimedia capabilities. They are designed with a graphical interface and are very easy to use.

Satellite Krushi Gosthi:

Like all other State Agricultural Universities, Gujarat Agricultural University also performs triple functions of teaching, research and extension education. The research generates technologies, which can be utilized by farmers and rural people. The present system of the transfer of technology from Gujarat Agricultural University (GAU) to extension functionaries of the development of the State and in turn to the ultimate users consumes considerable time. Looking to this reality the GAU has prepared a major plan under the name of "GAU Satellite Krushi Gosthi" to apply modern tools like satellite linkage for agriculture sector. The GAU is the first in all SAUs, where such kind of facility has been installed. The GAU satellite Krushi Gosthi for transfer of technology can reduce the time lag to a considerable extent the system helps for large area coverage as well as noticeably reduces the distortion in message transfer. Such facility provides facility for two-way conversation. It helps farmers to get on the spot solutions of their questions and queries regarding the live programmes while watching it at the classroom end. This facility makes possible to keep a live contact between the scientists of the university and the farmers of the state.

Features of the System:

A satellite based distance interactive education system normally consists three elements, first TV studio from where scientists deliver the talk through live programme, second a number of remote classrooms or Direct Reception Centres (DRSs), with the facility of TV set and STD telephone, from where farmers can watch the live programme on TV sets and third satellite linkage to transmit live programme given by scientists from the TV studio to farmers at DRSs.

The Gujarat SATCOM Network has full capability for one-way video and two way audio. RESCO has established SATCOM Network consisting of TV studio at the capital city of Gujarat. The video and audio from TV studio are digitally transmitted to the classroom ends (DRSs). The return audio at classroom (DRSs) is available through STD lines. This facility is used to keep a live contact of the scientists of the university delivering a talk from the studio with those farmers who are watching live programme at the classroom ends. At present more than hundred Direct Reception Stations (DRSs) to receive transmission are already established throughout the state with the collaboration of different departments of Government and NGOs. GAUSATKRU has vital linkage with them. This system helps farmers to receive information regarding inputs as well as markets. This latest satellite based communication facility is also useful to the students of the university to interact with the dignitaries or experts of agriculture field. To reduce time lag to a considerable extent, such type facility can be also installed in other State Agricultural Universities. Such facility needs to be strengthened at village level with the collaboration of NGOs, schools, co-operatives and Government organizations.

Opportunities of Information Delivery

A strong need has been felt regarding the informational needs of the farmers throughout agricultural value chain. (Table1). The farmer lacks information regarding mandis, commodity prices at various mandis thus delinking him from markets and consumers and making him prone to exploitation in the hands of intermediaries. Information is needed by farmers at every stage, right from sowing the seeds to selling his produce in the mandis. Farmers lack awareness about domestic/international markets as well as alternative market channels. They must have information about what varieties are preferred by the consumers and how the agricultural as well as post harvest management practices can be employed in order to fetch better prices for their produce. They also need information on Government schemes and funds available to them for adopting new technologies/processes. Besides the needs to obtain information, farmers also have an inherent desire to interact with various peers and experts in order to discuss problems related to agriculture. This can be possible only when they are connected through an informational network specifically designed according to their needs. For a company marketing information through internet as well mobiles, there are a lot of opportunities existing at both the ends.

Web based agricultural services In India

Reuters Market Light (RML) has about 1 million unique users in more than 40,000 villages, and has been successful in delivering quality information about weather, crops, commodity prices and projections; the farmers are able to make "informed decisions on whether [they] should sell [their] products or wait." In fact, some farmers waited for messages from RML before selling their stock, however it was found that there wasn't much of a difference in the prices received by farmers who used RML and those who didn't. Farmers estimate the impact of the service on their income to be around 5% to 25% of the income, and one family was able to increase profit by 1 lakh after having subscribed for a year. Customer satisfaction ranges from 70% to 80%. Further, the SMS format may make it easier to share and store information, however voice messages may be preferable due to literacy concerns. RML has a toll-free service line for complaints and suggestions but awareness of this is low.

IFFCO Kisan Sanchar Limited (IKSL) has 5 million users and made Rs. 184.78 cr. in revenue in FY 11-12. The IKSL service has been described as lacking in relevance to farmers' needs, but is piloting recording the characteristics and interests of subscribers, and sending 90 focused communities (e.g. fishermen, vegetable growers) voice

messages related to their area of interest. IKSL has also created a database for its help line which it uses as source material for the five daily voice messages, however this database is closed to public access. IKSL's helpline allows farmers to talk directly with experts, and it receives around 3,500 calls with feedback monthly.

Lifelines is used by more than 150,000 farmers in more than 2,000 villages. Farmers report a high level of satisfaction and estimate the impact of the service on their productivity to be about 20%. The Q&A format tries to ensure content relevance, however it is difficult for knowledge workers to provide appropriate answers based on a few minutes of voice recording. Quality checks are performed by auditors who are more qualified than the knowledge workers. Answers are delivered as voice messages, which is helpful for illiterate farmers. Also, by storing FAQs in knowledge databases, Lifelines reduces its reliance on experts, but as with IKSL, farmers don't have access to the databases themselves.

aAqua is used by about 70,000 farmers (50,000 use the phone, and 20,000 use the internet) and has around 18,000 registered users. 32,000 questions, of which 11,000 have been answered, were posted by 4,000 users in 445 districts in 26 states. User feedback from 2009 to March 2011 shows that the "crops" and "animals" forums/applications are used the most, followed by "farmer schemes" and "KVK recommendations". Most of the users rated the information as being "excellent". Profiles of the 50,000 phone users show a mix of low-income, mid-income, and high-income farmers with an average listening time of 72%. Half of the questions relate to pest control and disease management.

Digital Green has created more than 1,900 videos and is used by more than 75,000 farmers. Digital Green uses community service providers (CSPs) to present and discuss the videos, which are made by the partnering NGO and feature local farmers. In this way, Digital Green focuses on human interaction to increase the impact of the information, and in a test run, 85% of the farmers in Digital Green villages adopted at least one new agricultural practice, as opposed to 11% in control villages. Digital Green also builds upon farmer feedback: farmers view videos and request additional or different information, which is used to create new and relevant videos. Digital Green is also the only initiative to allow open access to its information; all of the videos are uploaded to YouTube and field data (e.g., adoption rates of video contents, level of farmer participation) is uploaded to COCO, an open source website.

e-Sagu has been tested on 5,000 farms in 35 villages and is different from the other services because it monitors the farmers' fields to provide timely, context-specific advice. The expertise required to grasp various problems faced in the farmers' fields differs depending on the experience of the graduates. e-Sagu has standard operating procedures to ensure quality photos from which advice is given. Farmer interest is low, and it has been difficult to get them to pay for the service. Also, e-Sagu has not made its data and pictures available to the public, and does not directly involve farmers for feedback.

Efforts needed by Policy makers:

For extensive use of satellite based Web extension there is a need to bring some changes in policy are identified and argued here.

1. Collaboration between Content-Providers

Extension services around the world will better reach and help farmers if government, NGOs and Agribusiness collaborate to contribute content. All too often however, extension staff seeking needed content face recurring problems.

2. Infrastructure for Web Delivery to Rural Areas

Many agencies and funding entities have been slow to adopt the Web and have continued costly projects that could be better spent on Web delivery. Sustainable models are out there such as M. S. Swaminathan's Pondicherry project and N-Logue's new Chiraag model for community kiosks, in India. Broadband access is also a question; the most challenging issue that faces web-based extension is the need for affordable broadband access for the rural world.

3.Coordination between Funding Agencies

Agencies that fund agricultural extension and related missions must better coordinate short-term efforts. The World Bank, FAO, UNESCO, USAID and private foundations like Ford and Rockefeller do great things to aid rural development but too often independently. Redundant programs are created, efficiencies are not exploited and potential synergies are lost. Examples of successful coordination are there, but many times reported collaborations do not appear substantial. Thus, proper coordination between funding agencies are needed looking to the needs of small farmers are more important than the benefits of competition.

Table 1: Informational Needs of Farmers

Pre-sowing	Pre-harvest	Post-harvest	Market Information
Information on agri inputs such as seeds, fertilizers, pesticides Credit Weather Soil testing	Good agricultural practices, Pest management Time and Techniques of harvesting Packaging	Post harvest management Storage Grading and standardization Logistics Market Information	Alternative market channels, Commodity prices Mandi information Consumer behavior

Critical Success Factors for Implementation of ICT Projects

Despite the efforts of the information delivering agencies, these projects have a long way to go because of the challenges being faced at implementation level. These challenges are mainly related to three areas as shown in Table 2.

Table 2: Critical Success Factors for ICT-Based Information Delivery

Institutional	Infrastructural/ Operational	End-user level
Revenue-cost Sustainability Collaborations Technology Leadership	Technology Electricity availability Power-backup Connectivity Capacity building of stakeholders Information collection, validation and dissemination	Product-service mix User-friendly technologies/operations User training Need identification for information delivery Mode of delivery Value-added services Awareness

Creation of web site

- Web site: All your pages, images, and other files make up your "Web site."
- Home page: The first page you want people to see in your set of pages is called the "home page." Other pages are just "pages.
- Web Pages: The documents you see on the Web are called "pages." They contain text, images, and "links" that let you jump to other pages.
- URL: The strings of characters (like http://www.gauanand.com/) you keep seeing in advertisements are locations on the Web called Uniform Resource Locators or "URLs". You can pronounce this as "you-are-els" or "earls".

To accelerate use Internet facility by the farmers, agencies involved in satellite-based extension should also create effective Web sites for the farmers. Here hints are given based on recommendations on nine years managing of a small web development lab at the University of Illinois.

Conclusion and Policy Implications

Information technologies can be the best way for farmers to update themselves on information related to agri-inputs, credit, markets, weather, extension advisory and other e-governance services, etc. Both mobile as well as Internet based models can gain popularity among farmer folk as each of these offer advantages. Internet can provide a range of services through an interactive, web-based interface and multimedia to a large number of beneficiaries at a minimal cost; however Internet connectivity, electricity availability and capacity building are some of the challenges before it. Mobiles, on the other hand are capable of providing customized services and ensure speedy and timely delivery of information. Hence the challenge is how both types of communication technologies can be used based on region, crop, type of infrastructure availability, and cost of infrastructure development. For empowering the farmers through ICTs, there is a need to first have infrastructural and operational modules, user friendly mode of delivery and right product-service mix. However, the most important strategic issue before these models is how these can be made sustainable on their own? Whether to charge farmers or have alternate source of income generation for sustainability remains the important question? Whether farmers are willing to pay and for what services also needs to be answered through further research studies in this area.

Summery

The role of Information Technology to develop agriculture and quality of life in rural area is well established. IT can help an average Indian farmer to get relevant information regarding agro-inputs, crop production technologies, agro processing, market support, agro-finance and management of farm agri-business. The agricultural extension mechanism is becoming dependent on IT to provide appropriate and location specific technologies for the farmers to furnish timely and proficient advice to the farmers IT can be a best mean not only to develop agricultural extension but also to expand agriculture research and education system.

A silent revolution is taking place in the communication systems in rural India. Government has taken up a number of satellite based “cyber extension” initiatives, across the country. District level websites are being hosted, Information kiosks are being established at block/mandal and village levels & technical & other need-based information is being collected, designed & hosted on the Internet. Quick dissemination of technological information from the agriculture research system to the farmers in the field and reporting from farmers’ feedback to the research system is one of the critical inputs in transfer of agriculture technology. To reach over 110 million farmers, spread over 500 districts & over 6000 blocks is an up hill task. The diversity of agro ecological situations adds to this challenge further. Farmers’ needs are much more diversified and the knowledge required to address them is beyond the capacity of the grass root level extension functionaries. Today it is possible to find a solution to this situation by using the potential of satellite based Internet based technologies to meet the location specific information needs of the farmers. Information and communication networks are expanding very fast. Internet connectivity has touched almost all the districts in the country and is moving down to the village levels. Many pilot projects to connect rural community to cyber-space are in progress at various locations. The initial response of rural people, particularly women, has been very encouraging. The experiences of these projects have shown that rural people have been using the Internet in innovative ways. Rural people are looking for weather forecasts, market prices, job appointments and news on the net regularly. They have also started to charge for some of these services selectively. Farmers are also using the Net for getting technical advice online from various sources. Rural people have created their own E-mail accounts and are using this facility for faster communication.

The IT based agricultural information on Net is building up slowly but surely. There is still a lot of work to be done by policy makers to understand and act on this issue because the satellite-based extension through the use of Internet facility still has a long way to go to be "user friendly" for rural people. People who work in the field of satellite based

extension should have proper understanding that extension through satellite based communication in rural areas is not impossible but it requires unique administrative, participatory and organizational efforts. Many organizations are supporting a number of SAUs to digitize their technical information on the Web. At the same time research and training organizations, both in public and voluntary sectors are being supported in building their capacity to digitize the rural and agricultural information and make it available on the WWW. Efforts are also being made to connect various districts of our country on the Internet so that the farmers can get all the technical information on the Web sites. If Cyber connectivity will be made available to all India Villages to take benefits of satellite based information and communication technology, the positive change in the face of rural development will be definitely possible.

References

1. Meera, S.N., Jhamtani, A., & Rao, D.U.M. (2004). Information and Communication Technology in Agricultural Development: A Comparative Analysis of Three Projects from India. Agricultural Research and Extension Network, 135, 13-27.
2. Yogisha, G.M., Ramappa, K.B., Mahajanshetti, S.B., & Vijayakumar, H.S. (2008). Information and Communication Technologies (ICTs) in India: An insight into progress of rural economy. A National Journal of Agriculture and Rural Development, 40(1), 34-36.
3. GOI (2001) 'Report of Prime Minister's Task Force on India as Knowledge Superpower'. Planning Commission, Government of India, New Delhi.
4. Jones, G.E. (1997) 'The history, development and the future of agricultural extension' in B.E. Swanson,
5. R.P. Bentz and A.J. Sofranko (1997) Improving agricultural extension – a reference manual. Rome:
6. FAO.McConnell, S. (2001) 'Connecting with the unconnected: Proposing an evaluation of the
7. impacts of the Internet on unconnected rural stakeholders.' Mc Connell International. http:// mcconnelinternational.com/evalnation.html
8. Meera, S.N. (2002) A Critical analysis of information technology in agricultural development: Impact and implications. Unpublished PhD thesis, IARI, New Delhi-110012.
9. Richardson, D. (1996) The Internet and rural development: recommendations for strategy and activity – final report.
10. Rome: Sustainable Development Department of the Food and Agriculture Organization of the United Nations. http://www.fao.org/sd-dimensions.
11. Swaminathan, M.S. (1993) (ed.) Informationtechnology: Reaching the unreached.Chennai: Macmillan India.
12. Zijp, W. (1994) Improving the transfer and use of agricultural information – a guide to Information Technology. Washington DC: World Bank
13. Ghose, A., Dey, J. and Dwary, P., 2008, Application of GIS on Small Farm and Dairy Management: Sarasa Green, Durgapur West Bengle. In: Extension of Technologies from Labs to Farm. Ed. Anandaraja, N., Chandrakandan, K. and Ramasubramanium, M., New India Publishing Agency, pp.391.
14. Govt. of India, 2000, Ministry of Information Technology. Working group on Information Technology for masses. Planning Commission. New Delhi.
15. Govt. of India, 2001, Ministry of Information Technology. Report of Task Force on India as knowledge super power. Planning Commission. New Delhi.
16. Gulati, A.G., 2009, Unleasing Rural India's Economic Potential- the Role of ICT, Kuruksetra, 57(12):8 10.
17. Gullick, A., Sinha, R.K. and Singh, R., 2005, Use of Information Technology in Education. Indian Psychological Review, 64:179-184.
18. Gunawardana, A.M.A.P.G. and Sharma, V.P., 2007, Information Seeking Behaviour of Tribal and Non-tribal farmers in Udaipur District of Rajasthan. Indian Journal of Social Research, 48 (4): 377-382.
19. Gupta, A.K. and GHOSH, C.K., 2008, Literacy, Elementary Education and Teacher's Training in the State of Madhya Pradesh by Effective Use of ICT. University News, 46(40):11-15.
20. Hattangdi, A. and Ghosh, A., 2009, Enhancing the quality and accessibility of higher education through the use of Information and Communication Technology. Strategy Learning: 1-14.
21. Hedjari, Y., Rezaee, R. and Zamani, N., 2006, Factors Affecting the Use of ICTs by Iranian Agriculture Extension Specialists. Journal of Extension, 22:1-15.
22. Huda, S.S.M.S., Tabassum, A. and Ahmed, J.U., 2009, Use of ICT in the Private Universities of Bangladesh. International Journal of Educational Administration, 1(1): 77-82.
23. Intsiful, J., Okyere, P.F. and Osae, S., 2003, Use of ICT for Education, Research and Development in Ghana: Challenges, Opportunities and Potentials. Round Table on Developing Countries Access to Scientific Knowledge: 1- 4.
24. Kar, G., 2001, Remote Sensing for Sustainable Watershed Management. Kurukshetra 49(6):23 24.
25. Krishnan, M.S., 2005, Experiences in Effective Utilization of ICT Tools for Developing Scientific Content for e-Learning: A Case Study. ELELTECH India: 30-31.
26. Kumar, B. and Dabas, D. S., 2008, Google Scholar: An Internet Search Services for Academic Contents. University News, 46(8): 17.
27. Kumar, K., Hundal, D.S., Dhillon, D.S. and Kaur, P., 2008, Constraints Faced by Agricultural
28. Development Officers in Transfer of Agricultural Technology to Farmers of Punjab. Indian Journal of Social Research, 49(4):395-400.
29. Kumari, R., Goel, R. and Kaushik, S., 2008, Utilization of Computer Based Information Technology by Undergraduate Students.Indian Journal of Social Research,49: 93-97.
30. Maniar, A., 2002, A Study on Internet Usage for Educational Purposes by the Female Post-graduate Students of the Maharaja Sayajirao University, Baroda in the Year 2001-2002. Journal of Educational Research and Extension, 39(4): 1-34.

31. Massey, S. and Dhillon, S., 2005, Prevalent Trends of Embroideries in Machine Embroidered Articles. International Journal of Family and Home Science, 1(2): 87-90.
32. Meera, S.N., 2003, A Critical Analysis of Information Technology in Agricultural Development: Impact and Implications. Journal of IARI Post Graduate School, 26:323-324.
33. Mehera, P. and Mital, M., 2007, Integrating technology into the teaching-learning transaction: Pedagogical and technological perceptions of management faculty.International Journal of Education and Development using ICT, 3(1): 265.
34. Michailidies, A., 2007, Adoption of Internet in Agriculture. Journal of Extension Systems, 23(1):1-13.
35. Mishra, R., 2008, Evolutionary and Revolutionary: Information and Communication Technology. University News, 46(1):17-20.
36. Mohansundaram, K. and Jebaraj, P.G., 2007, Integrating Mobile Phone Technology in Teaching-Learning Process at Higher Education Level. University News, 45(46): 8-12. Mohideen, M.M., 2001, Role of Internet. Kisan World, 28(3):61.
37. Murahari, B. and Kumar, V.V., 2008, New Technologies for Teaching and Learning in the Information Age. University News, 46(40):1-8.
38. Murali, G.V.and Venkataramaiah, P., 2008, Relationship between Profile Characteristics of Students with their Exposure to Agricultural Websites. Indian Psychological Review, 70(2):91-94.
39. Narender, K. and Anandaraja, N., 2008, Information Communication Technology for Women Experience of Women Managed Internet Kiosks at Melur, Tamil Nadu. In: Extension of Technologies from Labs to Farm. Ed. Anandaraja, N., Chandrakandan, K. and Ramasubramaniam, M., New India Publishing Agency, pp. 453.
40. Ommani, A.R. and Chizari, M., 2007, Appropriatenessof E- learning-based Information Technology to Improve the Productivity of Crops. Journal of Extension Systems,23 (1):70-80.
41. Pandey, R. and Mehta, S., 2002, Awareness of Educational Technologies in Open Learning System by Target Group. Indian Journal of Social Research, 43(3):183-189.
42. Pandey, R. and Mehta, S., 2003, Extent of Use of Educational Technologies by Distance Learners-A Study. Indian Journal of Social Research, 44(4):341-345.
43. Pandey, R. and Mehta, S., 2003, Utilization Patternof Educational Technologies in Open Learning System by Target Group. Indian Journal of Social Research, 44(4):313-321.
44. Parikh, V., Pandya, R. and Mathu, A., 2008, ICT Tool to Reach the Unreached. Indian Journal of Adult Education, 69(2):85-92.
45. Patel, J.M.A. and Rajendran, K., 2007, Socio-Demographic Study on E-culture. Journal of Community Guidance and Research, 24(3):253-261.