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ICTs in Information Management and Networking- New Tools and Trends

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It is an unequivocal proposition that, Indian Agriculture has now entered a post-Green revolution stage. Demands for agricultural technology are changing and diversifying. The demands for Information are changing, from information on crop-technology and packages cf practices in 1960s and 70s to the focus shifting to market prices in national and international markets and value-addition opportunities. The main objective of farmer's concern has shifted from high production to high returns, and hence issues like quality, timeliness and postharvest technology are gaining prominence in the farmers' queries. One of the areas where there is a consensus emerging, is that the existing extension system is unable to cope with the challenges facing the agricultural sector. At the same time extension is recognized as a key imperative in achieving the objectives of enhanced rural farm income. An average farmer in India is deprived of the information regarding latest farming technology and markets. This information is available in disconnected packets across the country. However, the people possessing the information have no cost effective means to reach the rural masses. The farmers too do not have an easy and affordable access to this information. Farmers in developing countries get much of that know-how from family, friends and input dealers. Public and private extensions are additional sources of information for farmers.

We know that the 'Information' is crucial in agricultural production, in addition to land and capital. Faster transmission of improved farm technologies can revolutionize agriculture. Matching the speed of technology transfer with that of farmer's acceptance can bring prosperity among farm families.

Let's look into the essence of what ICT is. Information and Communications Technology (ICT) is the hardware and software that enables data to be digitally processed, stored and communicated. ICT can be used to access, process, manage and present

information; model and control events; construct new understanding; and communicate with others. ICT, an interdisciplinary domain, focuses on providing learners with the tools to transform their learning and to enrich their learning environment. The knowledge, skills and behaviours identified for this domain enable students to:

- develop new thinking and learning skills that produce creative and innovative insights
- develop more productive ways of working and solving problems individually and collaboratively
- create information products that demonstrate their understanding of concepts, issues, relationships and processes
- express themselves in contemporary and socially relevant ways
- communicate locally and globally to solve problems and to share knowledge
- Understand the implications of the use of ICT and their social and ethical responsibilities as users of ICT.

Learning in this domain enables learners to focus on the task to be accomplished rather than on the technology they are using to do the work. Through the selection and application of appropriate equipment, techniques and procedures, they process data and information skillfully to create information products in forms that are meaningful for themselves and their audience. These products effectively demonstrate their knowledge and understanding of the concepts, issues, relationships and processes that are the subject of the task.(www.introduction to information and communication Technology.com)

In the present context, ICTs or Information and Communication Technologies are emerging as an important tool for the development of societies and are the driving forces in economies world-wide. These new technologies are no longer confined to assist high-end research and development, but have made significant improvements in the life-styles and the efficiency-levels in all sectors of economy. New businesses like "Business Process Out-sourcing (BPOs)", Banking and Insurance, the entertainment industry and other industries and organizations, are all taking maximum advantage of the ICT revolution

The Agriculture sector is gearing itself to make optimal use of the new information and communication technologies. At the Government of India Level, a number of important initiatives have been taken to provide IT Hardware and connectivity to all organizations involved in Agricultural education, research, development and dissemination. Simultaneously, agricultural content development initiatives have been taking by Ministry of Agriculture, in collaboration with National Informatics Centre (NIC), to provide marketing information of various agricultural commodities to the farming community. Another content-creation and aggregation initiative is being supported by Indian Council of Agricultural Research (ICAR), under its World Bank aided project - National Agricultural Innovations Project (NAIP), where in leading ICT institutions like IIT Kanpur, IIT Mumbai, IITKM, Kozhikode, NAARM, Hyderabad and International Crops Research Institute for Semi-Arid Tropics (ICRISAT) have been roped in to guide National Agricultural Research

System to design, develop and implement Knowledge Management Systems (KMS) in Agriculture. ICTs are thus emerging as very important tools for Agricultural Extension.

Changing Agricultural Scenario and Information Needs

It is a truth that so far, we are adopting traditional systems such as pamphlets, posters, radios, and television to disseminate agricultural information to the farmers. In this system, there is a time gap in transferring the information to the farmers. It is important that accurate information reaches the farmers at the right time. The rapid growth of Information Technology and Communications Systems has changed the scenario entirely. Now linking two computers from anywhere in the world is an easy task. The emergence of an internet and E-mail system has changed the inter-relations of personal contact. Various ICT projects have been initiated by the Government, NGOs and private companies. The result has been linking of villages with wired network in many parts of the country.

Practically, Agricultural extension played a very vital role in achieving the targets of green revolution. The post green revolution scenario is witnessing emergence of new paradigms like sustainable agriculture, agri-business & contract farming. The advances in Information Communication Technology (ICT) are poised to compliment extension efforts for transfer of technology. Farmers have specific information needs. The main focus of ICT in agriculture is meeting the farmers' needs for information. The following are some vital needs of farmers that seem to be imperative for the growth and development of agriculture.

- Market information: Market information including price updates of agricultural commodities of surrounding districts on a daily basis. For farmers, the price updates of markets outside their villages have a higher priority so that they can compare the prices and choose to sell at the appropriate place.
- Information on latest techniques and technologies: Continuous advancement in technology brings up gradation to agricultural machinery and techniques too. Up to date information regarding latest technologies in agriculture and animal husbandry is of immense importance for growth.
- Information about rural development programs and subsidies: Provision of detailed information on Government initiatives for rural development for those the programs are addressed. The areas that suffer from droughts, floods or other natural disasters frequently receive grants and subsidies from the Government. Information related to these programs is particularly important to small and marginal farmers.
- Weather forecasting: Updated information on weather such as temperature, humidity, forecasts on rains.
- Latest (best) packages of practices: Information on "best practices" of cultivation is important need of the farmers. Information regarding drought resistant varieties of certain crops can be important for farmers to withstand longstanding droughts in some areas.
- Post-harvest technology: Education on post-harvest technology and storage is as vital as pre-harvest. Farmers are getting aware of the value addition of food processing.

- General agricultural news 4: General news and information related to various agricultural events in villages and districts.
- Information on insurance/claim processing: Detailed information on crop insurance schemes, the type of damage covered and compensation offered premiums to be paid, etc.
- Input prices and availability: Information relating to the availability of agricultural inputs like seeds, fertilizers, manures, etc. and prices.
- Early warning and management of diseases and pests: In the areas of continuous droughts, pests and diseases do not generally pose a major threat. However, in other areas this information is useful. Also, early warning in case of some crops like sugarcane is important.
- Soil testing and soil sampling information: Information related to testing of quality or nature of soil is very important for farmers as the soil directly relates to productivity of crops. If this information is easily available to the farmers, it prepares farmers to get the best produce given the resources.

They need locally relevant information for better farming. Farmers' operations have numerous characteristics: different soil types, crops, weather, pest complexes and marketing arrangements etc. Relevant information on these aspects will help the farmers to achieve the maximum profits. The extent and rate of change now occurring in the development of ICTs have opened the way for significant change in crop production management, agricultural decision-making and information dissemination.

The farmers depend on extension personnel to get the proper advice to cultivate the crop. The information needed may relate to different schemes, crops, technologies, seeds, fertilizers, pesticides, availability of fertilizers, seedlings, biopesticides, soil fertility, pest and disease diagnosis and many more. Agricultural marketing information is essential for farmers to increase their profits, Information such as price details of seeds, fertilizers, pesticides and availability of these products in the market enables the farmer to take decision in choosing right seed, fertilizer and pesticide required for the better farming. Vital information, that flows from the agricultural policy maker's desk, such as fixation of procurement price, procurement targets and policy relating to exports helps to farmers to get maximum profits.

Similarly, weather forecasting is one of the important requirements of farming and it helps the farmers to take the right decision at the right time. The research is advancing rapidly with the advent of high performance computing and communications systems to predict weather forecasting. There are a few key areas for action by the systems (both in public and private domain), to enable enhanced income for farmers and the rural community. These are:

- Reform in food laws
- Improving cropping practices and efficiency
- Improving infrastructure

- Creation of a common Indian market by removing barriers in movement of agriculture produce.

One of the areas where there is a consensus emerging, is that the existing extension system is unable to cope with the challenges facing the agricultural sector. At the same time extension is recognized as a key imperative in achieving the objectives of enhanced rural farm income. An average farmer in India is deprived of the information regarding latest farming technology and markets. This information is available in disconnected packets across the country. But the people possessing the information have no cost effective means to reach the rural masses. The farmers too do not have an easy and affordable access to this information. Farmers in developing countries get much of that know-how from family, friends and input dealers. Public and private extension services are additional sources of information for farmers. Information is crucial in agricultural production, in addition to land and capital. Faster transmission of improved farm technologies can revolutionalise agriculture. There are several pockets of excellence in both knowledge and practices, and ICT offers the promise of overcoming this. More investment in ICT applications for agriculture development in India is the need of the hour, not only to redress the growing imbalance in information, but also to reduce property, increase participation, improve governance, manage natural resources and improve opportunities for women. These information needs cannot be addressed by one department or Agricultural scientists alone. There has to be an on-line network of multi-stakeholders in the Agriculture-value-chain to address farmers' current and emerging information needs. There are many other information needs of the farmers. ICT enabled systems are more suitable to address the information needs of the clientele groups.

Traditional Information Access Mechanism

We are aware that the traditional information access mechanism of farmers was mostly influenced by the respective state government/agriculture University' information delivery mechanisms. In early fifties, the Gramsevak/VLW's served as a key-man in Community Development Programme. In early fifties, the Gramsevak/VLW's served as a key-man in Community Development Programme. The National Extension Scheme launched in 1953, was the first scheme to have specific focus on Agricultural extension. In early sixties and seventies the department of Agriculture at district level was the sole information provider on the crop varieties, package of practices and also on pest an, disease control measures to be taken. Their efforts were complemented be the farmers and Agriculture input dealers, by the farmers and Agriculture input dealers, by canvassing these messages to the fellow farmers. The launching of Training and Visit system (T&V), under National Agricultural Extension Projects I, II and III, during 1970s and B0 gave a great fillip to information delivery mechanism of State Agriculture departments, as it introduced a system of regular and crop/ season specific interaction among Agricultural research scientists, State Agriculture departments and farmers. The fortnightly workshops were a novel concept to have a regular interaction among the scientists and the extension functionaries. The establishment of KVKs (in almost all rural districts, and support of mass-media particularly the All India Radio and Doordarshan have played a very important role in the diffusion of new Agricultural technologies. The print media, the vernacular press also

supplemented the extension efforts at local levels. The private T.V. channels are a new entry, and have got tremendous positive feedback from farmers. The other traditional extension mechanisms included demonstrations, farmers meetings and krishi-melas at district, state and national level.

Looking into the traditional roles of agricultural extension since its formation and discovery, it shows that single commodity focused extension, top-down approach, farmers as passive learners, extension agent doing it alone, technology transfer of inputs, training farmers and prescriptive form of extension are the traditional roles of Extension with responses above 70%. Other roles are improving farm productivity only, provision of market information, and fixed/uniform approaches to extension delivery. Looking at these roles, one could find out that they no longer fit into our changing technological and fast moving era. According to Anadajayasekaram *et al.,* (2008), extension services were traditionally assumed to be the conducts for transferring technologies developed by the research system to the farmers. The system however, has been under severe attack for not being able to contribute to desire developmental impacted in developing countries. With changing circumstances of agriculture and increasing trends of globalizing, commercialization and drive towards sustainability, extension is being looked upon to play an expanded role with a diverse set of objectives to actually impact on people lives. Over the past two decades, the agricultural research and development system has undergone drastic transformation and societies have moved towards an accelerated agricultural modernization and macro-economic reduction of public services. This is due to the entrants of numerous extension service producers and the changing nature of time. At present agricultural extension is undergoing critical and objective reform. These findings are in line with Anadajayasekaram *et al.,* (2008), that the policy and institutional context in which agricultural research and innovation occurs has changed dramatically. Rapid changes continue to take place in the structure and authority of governments the global economy, the structure of the farming sector and in the global and local food industries and retract business. The institutional landscape is also changing dramatically. The civil society, farmers' organization and NGOs are increasingly playing an important role in agricultural research and development. The cross cultural linkages between agriculture and other sectors (such as water, health, energy and education) are becoming very important. (http://www.sciencepub.net/researcher)

Information and Communication Technologies (ICTs) in simple terms

ICT or Information and Communications Technology in simple terms, can be defined as the basket of technologies, which assist or support in storage, processing of data/ information, or in dissemination/ communication of data/ information, or both. ICT thus includes technologies such as desktop and laptop computers, software, peripherals and connection to the Internet that are intended to fulfill information processing and communication functions, According to Wikipedia (2008), the term ICT is the broader term of Information Technology (IT), to explicitly include the field of electronic communication, in addition to IT. The term IT is defined as "the study design, development, implementation, support or management of computer based information systems, particularly software

applications and computer hardware.' IT deals with the use of electronic computers and computer software to convert, store, protect, process, transmit and retrieve information, securely.

Farmers who have better access to ICT have better lives because of the following:

- Access to price information – farmers will be informed of the accurate current prices and the demands of the products. Hence, they will be able to competitively negotiate in the agricultural economy and their incomes will be improved.
- Access to agriculture information – according to the review of global and national agricultural information systems done by IICD with support from DFID in 2003, there is a need for coordination and streamlining of existing agriculture information sources, both internationally and within the developing countries. The information provided is usually too scientific that farmers cannot comprehend. Therefore, it is vital that the local information to be relayed to the farmers must be simplified.
- Access to national and international markets – Increasing the level of access of farmers is very vital in order to simplify contact between the sellers and the buyers, to publicize agricultural exports, facilitate online trading, and increase the awareness of producers on potential market opportunities including consumer and price trends.
- Increasing production efficiency – due to several environmental threats such as climate change, drought, poor soil, erosion and pests, the livelihood of farmers are unstable. Thus, the flow of information regarding new techniques in production would open up new opportunities to farmers by documenting and sharing their experiences.
- Creating a conducive policy environment – through the flow of information from the farmers to policy makers, a favorable policy on development and sustainable growth of the agricultural sector will be achieved.
  (Source**:**http://en.wikipedia.org/wiki/information and communication technology).

ICT is thus used as an umbrella term that includes any communication device or application, encompassing radio, television, cellular phones, computer and network hardware and software, satellite systems various and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. The importance of ICT lies less in the technology itself, than in its ability to create greater access to information and communication among the hither to un-reached geographies and populations. Appropriate ICT interventions are yielding positive results in developing and underdeveloped economies. The "Grameen Phone" initiative in Bangladesh, Kothamale Radio project in Srilanka, and ITC's e-Chaupals in India, are examples of such innovations. Many countries around the world have established organizations for the promotion of ICTs, because it is feared that unless less technologically advanced areas have a chance to catch up, the increasing technological advances in developed nations will only serve to aggravate the already existing economic gap between technological "have" and "have not" areas.

The relevance of ICTs for Agricultural Development in general and for Agricultural Extension in particular is extremely high for a country like India. ICTs are most natural allies to facilitate the outreach of Agricultural extension system in the country. Despite a large, well-educated, well-trained and well organized Agricultural extension manpower, around 60% of farmers in the country still remain un-reached (NSSO, 2005), not served by any extension agency or functionary. Of the 40%, who has some access to Agricultural Information, the major sources of this information are Radio and Television. The telephone has just started to make its presence felt on this scenario. During last four years of its operations, the Kisan Call Centres (KCC) helpline 1551, has registered over 2.4 million (24 Lakh) calls. Internet supporting Information-Kiosks are also serving the farming community, in many parts of the country. Hence ICTs are highly relevant for Agricultural Extension scientists, researchers, functionaries and' organizations.

Cyber Extension: Use of ICTs in Agricultural Extension

In reality, the 'Agricultural Extension Services' is the backbone of the Agricultural Development of a country. Earlier, Krushikarma Viyapathy Sevaka Niladari (KVSN: Agriculture Extension Service Officer) were the grass root level extension officers providing face to face extension services, which facilitated the smooth transfer of technologies and information to the community. The ICT initiative; 'Cyber Extension' mechanism has been implemented in Sri Lanka in the year 2004 as an appropriate information exchange mechanism affordable to rural farmers to satisfy their information needs. The project established 51 Cyber Extension Units (CEU) at Agriculture Instructors offices, Govijana Kendra (Agrarian Services Centres) and district Agriculture Training Centres (DACTs) during the period of 2004-2007. Each Cyber units equipped with a technically high end multimedia computer, scanner, laser printer, digital camera, uninterruptible power supply unit (UPS) and required furniture.

Information and Communication Technologies (ICTs) have opened a whole new set of options for the Agricultural Extension scientists, Extension officers in the research and extension system to improve the speed, accuracy of the communications at relatively lower costs. ICT tools like Internet, e-mail, on- line Expert Systems, Call Centres and information portals on Agricultural marketing information, packages of practices and subject specific discussion groups on Internet have enhanced access of Extension personnel to the latest information within and outside the country. Communication is the Central mechanism of Extension process. ICTs provide new dimensions to Communication as a process. These include:

- Global access to Information resources, beyond state and national boundaries (improved reach).
- Most of the time access is free (less cost).
- Instant access to important resources -people and literature. Extension
- Journals, newsletters (less time).
- Facilitates two-way communication -e-mails, chat Groups, discussion forums

- Information is available any time. Little or virtually no chance for Information-distortion, as the communication is between the user and communicator directly
- Easy documentation as all the communication is in digital form, including e-mails, audio and video exchange.

All the above dimensions of proper use of ICTs have generated a lot of interest among the Agricultural Extension scientists and extension functionaries. This whole new field of interest and application- "Use of ICTs in Agricultural Extension" is emerging as a body of knowledge, popularly known as "Cyber Extension".

Defining Cyber Extension.

Actually, cyber extension is an agricultural information exchange mechanism over cyber space, the imaginary space behind the interconnected computer networks through telecommunication means. It utilizes the power of networks, computer communications and interactive multimedia to facilitate information sharing mechanism (Wijekoon, 2003). It includes effective use of ICT, national & International Information Networks, internet, expert systems, multi-media learning systems & computer based training systems to improve information access to the farmers, extension workers, research scientists & extension managers. **(**http://en.wikipedia.org/wiki/cyberextension). Cyber - According to Oxford Dictionary the word Cyber means, "relating to Information Technology, the Internet, and virtual reality, the "*Cyber Space*". 'Cyber Space' is the imaginary or virtual space of computers connected with each other on networks, across the globe. These computers can access information in the form of text, graphic, audio, video and animation files. Software tools on networks provide facilities to interactively access the information from connected servers. The cyber space thus, can be defined as the imaginary space behind the interconnected telecommunications and computer networks, and the virtual world. Extension stands for "the action or process of enlarging or extending something". It could be extension of area, time or space. Cyber Extension can be defined as the "Extension over cyber space". As the word extension is subject-neutral, so is cyber extension' But in the applied context of agriculture, cyber extension means "*Using the power of online computer networks with the help of communication channels to deliver the content in the form of text, graphics, audio and video either passively or interactively to facilitate dissemination agricultural of technology*". Cyber Extension includes effective use of Information and Communication Technology, national and international information networks, internet, expert systems, multimedia learning systems and computer based training systems to improve information access to the farmers, extension workers, research scientists and extension managers. The same concept is being promoted under the titles like e-Extension, tele-Extension, and e-Agriculture by various national and international organizations/universities.

Cyber Extension Tools

As Cyber Extension is "*Extension over Cyber Space*" all the tools of Internet Used for browsing Agricultural Information from the basket of Cyber Extension tools. The major Cyber Extension tools are:

- E-Mail
- Interactive Expert Systems on Crop Pests and Diseases.

- INTERNET browsing for Extension Information.
- Video Conferencing.
- Call Centers; SATCOM Networks.
- Discussion Groups and News Groups

E-Mail

Let's now see the most conspicuous mailing system i,e. the Electronic Mail, most commonly referred to as email or e-mail since 1993, is a method of exchanging digital messages from an author to one or more recipients. Modern email operates across the Internet or other computer networks. Some early email systems required that the author and the recipient both be online at the same time, in common with instant messaging. Today's email systems are based on a store-and-forward model. Email servers accept, forward, deliver, and store messages. Neither the users nor their computers are required to be online simultaneously; they need connect only briefly, typically to an email server, for as long as it takes to send or receive messages. **(**http://en.wikipedia.org/wiki/email). E-mail is the most often used communication tools in the new age. In all sectors- education, business, services, e-mail has replaced letters, faxes and even telephone calls in the new generation working culture. In Agriculture sector the use of e-mail is limited by the non-availability of connectivity to the cutting-edge functionaries in the State Departments of Agriculture. This limitation is being overcome very fast and most of the state governments have initiated projects to connect all their departments, and also field level offices to provide on-line connectivity to the officers and staff. The mission modes projects under Government of India's National e-Governance plan also all the central government offices working under the Ministry of Agriculture are being given high bandwidth connectivity. Once all this system is in place (which is likely to be within the 11th Five Year Plan itself), e-mail should become the most powerful extension communication mechanism among the Agricultural scientists, extension functionaries, agricultural processing and supply-chain companies and the farmers. Even now some KVKs like KVK Babaleswar in Ahmednagar and Baramati in Pune (Maharashtra) are using email mechanism highly effectively to send extension messages to innovative farmers.

Interactive Expert Systems on Crop Pests and Diseases

In Agriculture, applications of expert system are mainly found in the area of disease diagnosis and pest controls. Many domain specific expert systems are being used at different levels. This system is developed for the purpose of identifying diseases and pests with control measures, fertilizer recommendation system, water management system, and identification of farm implements for leading crops. The expert system was developed with rule-based expert system, using ESTA (Expert System for Text Animation). This designed system is intended for the diagnosis of common diseases occurring in the rice plant. The ESTA programming is based on logic programming approach. It contains knowledge about symptoms and remedies of diseases in the rice plant appearing during their life span.

In the Interactive Expert module, domain specific expertise is acquired from human experts. The acquired knowledge is analyzed and then processed to obtain the best conclusion for the problem. The knowledge is then transferred to the IS experts to verify for converting into expert system program. Once the knowledge acquired from domain experts or domain resources is verified by the IS experts, it is transferred from the Interactive Expert module to the expert system program module for converting into expert system program. For ESTA system, expert knowledge has been acquired from standard literature related to the rice plants. "Illustrated guide to integrated pest management in rice in tropical Asia." (Source:
http://www.cscjournals.org/csc/manuscript/Journals/IJAE/volume1/Issue1/IJAE).

It can be stated that expert systems are the programmes written to solve problems or give advice in specific subjects. In the Agricultural context the subject specific knowledge of a particular expert or a number of experts on crop-pest or disease is organized in a computer program in such a way that a user (farmer or extension worker) can indicate the symptoms in text form, data form or digital image (with color), the computer assists the user to diagnose the problem- the pest or disease and then depending on its extent and stage of problem suggests preventive as well as curative measures for the same. The additional information on pest life-cycle favourable conditions for their growth may also be indicated. Expert systems can be used both in on-line and offline mode. In on-line mode, the users can interact with the research organizations expert systems to diagnose the field problems and can offer advice to farmers and fisherman. A number of ICAR institutions are working on development of crop-specific Expert systems to assist the field functionaries. The expert-systems are thus very important tools for Cyber Extension.

INTERNET Browsing for Extension Information

Simply browsing the World Wide Web for the required information is the most often used "Information Access" method on the Internet. The agricultural scientists, students, extension functionaries, traders and farmers, all can access required information in a very short time, if the same is available on the Internet. The information on crop-science and package of practices being hosted and up-loaded by ICAR institutes and State Agriculture Universities (SAUs), and the information on Government programmes projects, schemes are being hosted by concerned state government or central government departments/agencies. For example all the relevant information on Government of India centrally sponsored schemes on '-support to the State Extension Programmes for Extension Reforms", "Mass Media Support to Agriculture Extension" and "Agri clinics and Agribusiness Centres" are available on MANAGE (National Institute of Agricultural Extension Management) web-site-www.manage.gov'in. The mega-portal of "dacnet.nic.in" provides information all divisions, schemes, of the Ministry of Agriculture, government of India. Similarly information on major state government supported projects is available on their web-sites. This information is extremely helpful for the farmers, extension functionaries and the agricultural scientists and students. The demand for information on price of agricultural produce has been growing, as more and farmers are asking for the prices of their produce in near-by markets. A number of web-sites are providing the Agricultural produce prices on on-line basis. The important websites giving the Agricultural market price information are: www.agmarknet'nic.in, www.agriwatch.com, market.ap.nic.in, emandi.mla.iitk.ac.in etc.

Web-browsing for finding the required information is growing at rural information kiosks as well. In remote villages of Pondicherry, MSSRF has reported that number of farmers visit the Village Information Kiosks to find see and read the Newspapers on-line.

Similarly, the 'fish watch' web portal of the Central Marine Fisheries Research Institute (CMFRI) is another example. CMFRI has been conducting fishery survey along the Indian coast and estimating marine fish landings and effort expended. Gear wise, species wise, quarter wise fish landing data from the year 1962 for each maritime state of the country are being populated periodically at the Data Centre of CMFRI. This unique collation of first hand data based on the FAO approved sampling design has been the backbone of many a scientific endeavor carried out by avid fish researchers across the country and other parts of the globe. Having blazed an illustrious trail for more than six decades, CMFRI has initiated a new system of field information dispensation on a near real time basis. As the first phase of this effort, the raised landing figures and the landing centre price range of important resources of six major fishing harbours of the country are being published here. The landing figures (in kg) indicate the quantity of selected resources which were brought to the respective harbours during a 24 hours period starting from 12:00 noon of the first calendar day to 12:00 noon of the subsequent day. These figures are updated at 1600 Hrs every working day on as and where available base.

Video Conferencing

Now let's see the video conferencing method. Videoconferencing is the conduct of a videoconference (also known as a video conference or videoteleconference) by a set of telecommunication technologies which allow two or more locations to communicate by simultaneous two-way video and audio transmissions. It has also been called 'visual collaboration' and is a type of groupware. Videoconferencing differs from videophone calls in that it's designed to serve a conference or multiple locations rather than individuals.[1] It is an intermediate form of videotelephony, first deployed commercially in the United States by AT&T Corporation during the early 1970s as part of their development of Picture phone technology. With the introduction of relatively low cost, high capacity broadband telecommunication services in the late 1990s, coupled with powerful computing processors and video compression techniques, videoconferencing has made significant inroads in business, education, medicine and media. Like all long distance communications technologies (such as phone and Internet), by reducing the need to travel to bring people together the technology also contributes to reductions in carbon emissions, thereby helping to reduce global warming. (Source: http://en.wikipedia.org/wiki/Videoconferencing).

Video conferencing (VC) is remote meeting between two or more individual present at geographically dispersed locations. National Informatics Centre (NIC), in India has established Video Conferencing studios at 490 places in the country (as on 15 September 2007, source: www.vidcon.nic.in). These studios provide state-of-the-art 2-way video-conferencing facility among 2-4 sites at one point of time. As 15 State Agricultural

Universities including-Assam Agricultural University, Jorhat (Assam), Anand Agricultural University , Anand (Gujarat), Acharya N.G. Ranga Agricultural University, Hyderabad (Andhra pradesh), University of Agricultural Science, Dharwad (Karnataka), Mahatma Phule Krishi Vidyapeeth, Rahuri (Maharashtra), CCS Haryana Agricultural University, Hissar (Haryana), Punjab Agricultural University, Ludhiana (Punjab), Maharanapratap Agricultural University, Udaipur (Rajasthan), Sher-Ke-Kashmir, University of Agriculture Science and Technology, Jammu (J & K), G.B.Pant University of Agriculture Science and Technology, Pantnagar (Uttarakhand), Rajender Agriculture University, Samistipur (Bihar), Birsa Agriculture University, Ranchi (Jharkhand), West Bengal Agricultural University, Kalyani (West Bengal), Allahabad Agricultural Institute, Naini (Uttar Pradesh), CS Azad University for Agriculture Science and Technology, Kanpur (Uttar Pradesh), along with a number of State Level Agricultural Extension and Management Training Institutions (SAMETIs) of Himachal Pradesh, Orissa, Maharashtra, Andhra Pradesh, Jharkhand and Bihar are having video conferencing facilities, this infrastructure provides a huge opportunity for two-way interaction among the scientists, extension workers and farming community of the concerned states. This facility is being extensively used for interaction among resource persons and training. Participant in training programmes being conducted at SAMETIs. Still there is a lot of untapped potential, the video conferencing offers to the farming community. At the village kiosks level, the VC facility is being used very effectively by Tamilnadu University of Veterinary and Animal Sciences (TANUVAS), to interact with the farmers at village information kiosks having two-way VC facility in the Madurai district of Tamilnadu.

Call Centres and SATCOM Networks

Call Centres play an inevitable role in ICT ventures. A call centre is a centralized office used for the purpose of receiving or transmitting a large volume of requests by telephone. An inbound call centre is operated by a company to administer incoming product support or information inquiries from consumers. A call centre is operated through an extensive open workspace for call centre agents, with work stations that include a computer for each agent, a telephone set/headset connected to a telecom switch, and one or more supervisor stations. It can be independently operated or networked with additional centres, often linked to a corporate computer network, including mainframes, microcomputers and LANs. Increasingly, the voice and data pathways into the centre are linked through a set of new technologies called computer telephony integration (CTI). Call centre technology is subject to improvements and innovations. Some of these technologies include speech recognition software to allow computers to handle first level of customer support, text mining and natural language processing to allow better customer handling, agent training by automatic mining of best practices from past interactions, support automation and many other technologies to improve agent productivity and customer satisfaction. Automatic lead selection or lead steering is also intended to improve efficiencies, both for inbound and outbound campaigns, whereby inbound calls are intended to quickly land with the appropriate agent to handle the task, whilst minimizing wait times and long lists of irrelevant options for people calling in, as well as for outbound calls, where lead selection allows management to designate what type of leads go to which

agent based on factors including skill, socioeconomic factors and past performance and percentage likelihood of closing a sale per lead. (http://en.wikipedia.org/wiki/callcentre).

So far, the call centres have proved to be an extremely effective mechanism for customer service support in a number of services and industries. Almost all Banks, Consumer Appliances Manufacturing Companies, Automobiles and Railways, etc, have made use of call centers to provide online, 24X7 (round the clock on all seven days) information services to their customers. In India the Kisan Call Centres (KCC) were established on January 21, 2004, Providing online agriculture advice and information to the farmers, across the whole country, using a toll free telephone number 1551. The farmers can make a call from anywhere in the state, the call lands at the concerned state call centre and the farmer gets the response in his/her own language from the agriculture graduates at the call centre or the experts at identified agriculture university or research centre in the state. Over 20 lakh calls were answered within first three years of KCC. Thus Kisan Call Centres are an important cyber extension tools to provide two-way communication mechanism between the agricultural scientist and the farmers. Some of the states (e.g. Andhra Pradesh) and a few State Agricultural Universities (e.g. CCSHAU, Hissar) are running their own call centres in addition to Kisan Call Centre.

SATCOM Networks

SATCOM (which stands for "satellite communication") is an artificial satellite that is used to help telecommunication by reflecting or relaying signals into space and back down to earth. It is the most powerful form of radio and can cover far more distance and wider areas than other radios. It can also communicate with words, pictures and other forms of information. The Satcom system passed to General Electric with its purchase of RCA in 1986. RCA Americom became GE American Communications (GE Americom) and the satellite construction division became GE Astro Space. GE Astro Space was sold to Martin Marietta (now Lockheed Martin Space Systems) in 1993. In 2001 GE sold GE Americom to SES Global, creating SES Americom. (http://en.wikipedia.org/wiki/satcomnetworks). Satellite Communications (SATCOM) provide another option for one-way or two-way communication on audio as well as video. Development Education and Communication Unit (DECU) of Indian Space Research Organisation (ISRO) has established a number of communication studios to provide one-way video and two-way audio facilities to support development communication. These SATCOM studios offer excellent services to agricultural scientists to communicate with farming community on video. One-way video and two-way audio sets are highly economic (within a price range Rs.50, 000/ - to Rs.60, 000/-) and have been set up at more than 3000 locations in the country, under various projects. This infrastructure is being used optimally some of the agricultural universities, The Anand Agricultural University (AAU), Gujarat, runs a programme called Gujarat Satellite Krishi Gosthee (GAUSAT-KRU), providing one-way video and two-way audio Communication among the scientists of AAU and the farmers of the state. The scientists of AAU, come to the SATCOM studio of Gujarat at Gandhinagar, and the farmers interact with them from the sardar smriti Kendras (SSKs) having SATCOM facilities at various districts.

The SATCOM is thus one of the important tools of Cyber Extension to facilitate two-way interaction among the stakeholders.

Success Stories of Cyber Extension

Success Case studies in Cyber Extension do have a pivotal role. There are several Cyber Extension initiatives in place in India, each addressing a part of the needs. The role of extension machinery should therefore be to harness each of them so that the complete package is available to the target-population. The expectation is that Cyber extension will facilitate the country to bridge the divide between expertise and the recipients. Several organizations/ agencies have tried various models fueled by this promise and now time may be appropriate to sit and analyze, in order to see what is likely to work better for farmers in rural areas.

The broad classification of ICT initiatives, currently in place include:

- Central Government initiatives to provide connectivity to Extension system - NATP-ITD component, ICAR- Extension component under NATP, NIC initiative in Kolhapur, Sangli Districts of Maharashtra (Warna wired Villages).
- State initiatives: Maharashtra Government initiative to promote Information kiosks, Kerala Government (Akshaya project) to connect all village panchayat etc.
- NGOs projects: Information Villages project in Pondicherry by MSSRF, Chennai
- Rural connectivity and allied services providers such as Drishtee, n-logue etc.
- Private and co-operative sector transaction related initiatives such as those of ITC, Mahindra, and EID parry, NDDB, etc.
- Pure information services providers such as Kisan, community India, Agriwatch, India agronet, etc.
- Multiple rural services, which include agriculture extension such as Warna, Gyandoot, Tarahaat etc.
- Knowledge networks and knowledge banks such as Honey Bee Network, Harit Gyan, and Indian Society of Agri-Business professionals etc.

In addition to these, there is another entity involved – entrepreneurs operating as partners in the form of kiosk owners, franchisees, in the districts and taluks. Most of the initiatives work with entrepreneurs as partners (at village level). These entrepreneurs are the final links in the chain. The sustainability of all these initiatives is critically linked to the sustainability of these entrepreneurs.

Success Stories

Akshaya project: E-krishi project of Kerala Government

An innovative project implemented in the State of Kerala named as 'Akshaya', aimed at bridging the digital divide, addresses the issues of ICT access, basic skill sets and availability of relevant content. Quality ICT dissemination and service delivery facilities ('Akshaya Centres') are set up within a maximum of 2 kilometers for any household and

networked leveraging entrepreneurship. Today, Akshaya is acting as an instrument in rural empowerment and economic development. The project is a catalyst in creating massive economic growth and creation of direct and indirect employment in the State by focusing on the various facts of e-learning, e-transaction, e-governance etc. Thus, the project is having a long-standing impact on the social, economic and political scenario of the State. The 'Akshaya' project, first started in the rural Malappuram district of Kerala, India, and is now spread over to seven more districts in the state was the- first district-wide e-literacy project in India and one of the largest known Internet Protocol (IP) based wireless networks in the world. In November 2002, the state government of Kerala put into place a project, piloted in Malappuram that aimed for one person in every family to be computer literate in Kerala, to be familiarized with the basic use of computer and empowered to access innumerable services that Information and Communication Technology offers. (Source:http://www.akshaya.kerala.gov.in/index.php/platform-for-services/184)

Malappuram is now known as India's First E-literate District. The mission continues to make Kerala the First E-literate state in India" In Malappuram district alone, Akshaya has conducted one of the world's largest computer literacy drives, claiming to reach over 6,00,000 households, representing more than 3.6 million people, in less than 6 months. The project has created a unique brand of state-funded computer access centers, and simultaneously led to a massive wireless infrastructure, providing a wide range of services and making way to many future opportunities. The project involves setting up around 5000 multi-purpose community technology centres called Akshaya e-kendras across Kerala. Run by private entrepreneurs, each e-Kendra set up within 2-3 kilo metres of every household, will cater to the requirements of around 1000-3000 families to make available the power of networking and connectivity to common man. Akshaya is a social and economic catalyst focusing on the various facets of e-learning, e-transaction, e governance, information and communication. The major objective of the "Akshaya project" is to make at least one person in each of over 6 million families in the state, e-literate and Delivery of public service and e - governance applications through e-kendras. The specific objectives include:

- To enhance the quality of available IT infrastructure in the state, and also by providing facilities for rural connectivity infrastructure.
- To accelerate the development of local content relevant to the population.
- To enable e-transaction and e-governance services through the centres.
- Generate over 50,000 employment opportunities in 3 years.
- To bridge the gap between the 'Information poor and the Information Rich'.
- Akshaya Centres to work as social and economic catalysts for the overall development of the society
- To empower individuals and communities through enhanced access Information, education and communication facilities.
- To integrate communities through creation of e-networks and development of the core sectors like Agriculture, Health, Education, Industry and Resources.

Access Points

The project has already connected 634 villages through e-centres in Malappuram District in the phase I. The second phase of the Akshaya Project was rolled out in seven districts such as Kasargod, Kannur, Kozhikode, Thrissur, Ernakulam, Pathanamthitta and Kollam in 2004, establishing 133 more e-centres. Further the state Government has decided to implement project in remaining six more districts namely Thiruvananthapuram, Alappuzha, Kottayam, Idukki, Palakkad and Wayanad. Thus Kerala will become the first Indian state to have a comprehensive e-Governance Project.

Key Services

Akshaya works on a 5+ 8+ 5 model towards achieving sustainability. The first five are core services that are offered by all the Akshaya Centres. Eight services are more related to industry and are offered by Selected Akshaya Centre's. There are also five ways to maintain good relation and to update with community. The core services include:

a) Training centre

A very important service, at Akshaya Centre is imparting programmes to citizens. All the courses are approved by the Government and a certification for merit will also be provided through an online certification mechanism. Some of the courses offered are the following- Basic Computer Literacy Package, e-vidya-MS office Package, Spoken English course programme, Arabic Typing Tutor, Multimedia Training Programmes, Hardware Assembling and Maintenance and Computer Courses/e-tuition for Students. All these courses have a common fee structure, and govt certification through an online package. The Govt is providing assistance to faculty training, course module development, continuous training support and certification.

b) Information Kiosk

Actually 'Akshaya' is envisaged as a one stop information centre. All kinds of information will be made available through the centres. Content has been already generated in five core areas including, Health, Agriculture, Career, Education and Laws and regulations. Govt also digitized all applications forms, govt schemes and delivered through Akshaya network. Encouragement for digitizing and updating locally relevant content is also given to Akshaya Centres.

c) E-Transaction centre

Extension of friend's services through Akshaya centres is implemented through this initiative. Presently KSEB and BSNL bills are collected through this package. Entrepreneurs can collect Rs.5 per bill customer for offering this service.

d) e-governance cell

Government already had taken decisions to convert Akshaya Centres as the last mile units for e-governance services to the public, which include, Public Grievances Redressal System, Decision Support systems, Online processing of applications, information dissemination services, digital extension of various campaign/awareness programmes, telemedicine, agriculture intervention etc. Many initiatives like e-parathi (District Collector's Public Grievance Redressal Mechanism, e-krishi, etc has been started).

e) Communication hub

Akshaya centres will also be developed as a Communication hub, which will have all ICT based communication facilities to the common man. In Malappuram all the Akshaya Centres are connected to wireless Internet which enable the centres for various connectivity based services. Intranet based services are also initiated through the network. This initiative is very important in Kerala as Kerala has lot of population living outside the country. The next category under Akshaya Business Development has identified eight services. These include-Digitization and Data Management, Hardware Sales and Maintenance, Financial kiosk, Travel and Tourism, Multimedia, Animation and Designing centre, IT enabled Vocational Training, Health Care and product Selling Division. In addition,the Akshaya project has identified 5 ways to maintain good relations with the community. These are important steps to keep community informed and interested in new developments. These are- 'shradha' - The Kids club, 'Mithra'- Club for the unemployed, 'Sakthi'- The women's club, 'Bhoomi', - The Farmers club and Friends of Akshaya.

Warana Wired Village project

A cluster of 70 villages in Maharashtra named as Warana Nagar, is an eye of the "Wired Villages" project. In 1960, a visionary shri 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 cooperative bodies, working under this main society viz.; Warna Dairy Development society, Warna cooperative Bank, Warna Foods, Warna Women's Co-operative society etc. Sugarcane is major crop of this area and 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 present Chairman of the Warna Co-operative Society in 1996, the actual implementation began in April 1998. The- Project has been jointly Implemented by GOI through National Informatics centre (NIC), Government of Maharashtra and Warna Co-operative Society with the share of financial support being in the ratio of 50:40:10. The manpower and maintenance cost are 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 webpage designing, database designing and client based applications used by the farmers such as dairy, sugarcane information systems had been developed by the NIC, Pune.

The Central Hub, which is the main server station of "Wired Villages" is situated in Tahasaheb Kore Institute of Engineering Technology at Warana Nagar. This is equipped with servers based on Pentium II with 64 MB RAM, 4.1 GB hard disk and 32 x CD-ROM drives. 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 download 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

For the farmers their villages, the Computer Booths are serving as information centers. 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 computers. Booths are functioning in Kolhapur and meeting the information needs of the farmers. In remaining 24 villages of Sangli district, computer booths a 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 co-operatives 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. There are about 200-350 shareholders in each Village for sugarcane crop. 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 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 an 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.

Information Technology Centre

As much as six Information Technology Centres have been established to give training to staff, students and farmers of the village. These centers also function as computer booths and are maintained by a booth operator. The Centers have been provided with six Pentium II computers with configuration of Pentium II, 64 MB RAM, 2GB hard disk and a dot-matrix printer. Dial-up connectivity with modem and telephone line has been used to connect the central server station to retrieve information, send the queries, grievances to the main center. NIC, Pune has developed a Computer Based Question Bank, in the local language "Marathi" which will be used to test the Computer knowledge awareness of the students of 5th to 10th standard. These students are being trained to get acquainted with the computer systems. Testing will be in subjects covered in the school like mathematics, science etc. and a certain percentage of marks will be awarded from this test to the final marks of the students. A batch consisting of 5 students will be examined for 1 hour. This center also serves as a computer booth. NIIT is engaged in helping create CDs on different topics which when available will be used at these centres for interactive coaching.

Farmers' Feedback

An interaction with a few farmers in villages of Paragoam, Kuralap and Bhariwadi etc. indicated that farmers like the concept. They believe that the information from Wired Computers (WAN) is major source of getting information on crop technology. The ranking given by the farmers for source of information on crop technology, ranks wired computers as the best source followed by field officers and staff, radio &TV, print media and company sales persons. They agree that WAN provides all necessary information on cultivation technology and market situation etc., information is timely; the language is understandable as it is in the local Marathi language, information is reliable and it's not costly. They also agree that it is beneficial not only for big farmers but also for marginal and small farmers. The farmers are expecting some more features to be added like processing of all loan, legal documents etc. from their village wired computers. The farmers are also ready to learn operating computers, if any training is given and are ready to contribute any marginal amount necessary for the maintenance and up-keep of the system. Booth operators of paragoam, Bhairwadi, Kuralap and Panhala informed that an average of 20-25 farmers visit the computer booths every day for information on crop cultivation practices and disease control, marketing, dairy and sugarcane billing details etc.

(Sources: Case Study done by Bhaskar, G.Assistant Director (IT) and Venkateshwar Rao. K., Programmer, MANAGE, Hyderabad, in 2002, MANAGE. 2012. Information and Communication Technologies in Agricultural Information Management and Networking, Training module. pp1-30

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