

Role of information and communication technology (ICT) in agriculture sector

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The past decade is characterized by major changes in the Information and Communication Technology (ICT) environment in agriculture worldwide. It has changed from hand held calculators and batch processing of management data at central service centers to adoption of on-farm information management facilities, computer embedded process control devices, remote sensing with spatial data utilization, and more, with almost all of them endowed with communication capabilities.

Information is the key to democracy. With the advent of Information Technology (IT), it has become possible for common man to access global information. Information in a broader sense includes oral communication, voice in telephony, text in fax and newspapers, images in video and television broadcasting, and data in computers. All information can be digitized, transported, stored, retrieved, modified and then distributed. Emerging digital techniques, new network alternatives including intelligent networks, high bandwidth communication technology and state-of-the-art software for network functions and services, are the new technology trends evident in the development of electronic communication systems.

Information and communication have always mattered in agriculture. Ever since people have grown crops, raised livestock, and caught fish, they have sought information from one another. What is the most effective planting strategy? Where can I buy the improved seed or feed this year? How can I acquire a land title? Who is paying the highest price at the market? How can I participate in the government's credit program? Producers rarely find it easy to obtain answers to such questions, even if similar ones arise season after season. Farmers in a village may have planted the "same" crop for centuries, but over time, weather patterns and soil conditions change and epidemics of pests and diseases come and go. Updated information allows the farmers to cope with and even benefit from these changes. Providing such knowledge can be challenging, however, because the highly localized nature of agriculture means that information must be tailored specifically to distinct conditions.

Information communication technology can provide vital access to information makes by connecting the rural poor and marginalized to the world's information resources

and opportunities. However, not all persons have access to this information. The inequality in opportunities presented by ICT is widest between urban and rural groups, rich and poor, men and women and the educated and uneducated. Despite this, ICT use in rural areas is increasing, such as the internet and cell phones and the individual, community and national benefits they bring by making information available at the fingertips are forever emerging.

ICT in Agriculture:

– The application of Information and Communication Technology (ICT) in agriculture is increasingly important.

– E-Agriculture is an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. More specifically, e-Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (IT) in the rural domain, with a primary focus on agriculture. E-Agriculture is a relatively new term and we fully expect its scope to change and evolve as our understanding of the area grows.

– E-Agriculture is one of the action lines identified in the declaration and plan of action of the World Summit on the Information Society (WSIS). The "Tunis Agenda for the Information Society," published on 18 November 2005, emphasizes the leading facilitating roles that UN agencies need to play in the implementation of the Geneva Plan of Action. The Food and Agriculture Organization of the United Nations (FAO) has been assigned the responsibility of organizing activities related to the action line under C.7 ICT Applications on E-Agriculture.

– The main phases of the agriculture industry are: Crop cultivation, Water management, Fertilizer Application, Fertigation, Pest management, Harvesting, Post harvest handling, Transporting of food/food products, Packaging, Food preservation, Food processing/value addition, Food quality management, Food safety, Food storage, Food marketing.

– All agricultural extension and farmer-outreach programs face three major challenges *viz.*, ensuring cost-effective outreach, designing solutions tailored to needs of

individual farmers and cultivating an image that is farmer-friendly. Large sections of the farming community, particularly the rural folk, do not have access to the huge knowledge base acquired by agricultural universities, extension centers and businesses. However, internet and mobile networks have the potential to provide agro-information services that are affordable, relevant to needs (timely and customized), searchable and up to date.

- All stakeholders of agriculture industry need information and knowledge about these phases to manage them efficiently. Any system applied for getting information and knowledge for making decisions in any industry should deliver accurate, complete, concise information in time or on time. The information provided by the system must be in user-friendly form, easy to access, cost-effective and well protected from unauthorized accesses.

- Record text, drawings, photographs, audio, video, process descriptions, and other information in digital formats,

- Produce exact duplicates of such information at significantly lower cost,

- Transfer information and knowledge rapidly over large distances through communications networks.

- Develop standardized algorithms to large quantities of information relatively rapidly.

- Achieve greater interactivity in communicating, evaluating, producing and sharing useful information and knowledge.

The major applications of ICT in Agriculture sector:

- Application of office automation,
- Application of Knowledge Management System,
- Application of E-learning,
- Application of E-commerce,
- Application of ICT for Managing Agricultural Resources and Services,

- Application of CAM,
- Application of CAD,
- Application of RFIDs,
- Application of Wireless Technologies,
- Application of GPS,
- Application of GIS, and
- Application of Computer controlled devices (Automated systems).

Advantage of ICT in Indian agriculture: Some of the benefits of ICT for the improvement and strengthening of agriculture sector in India include timely information on

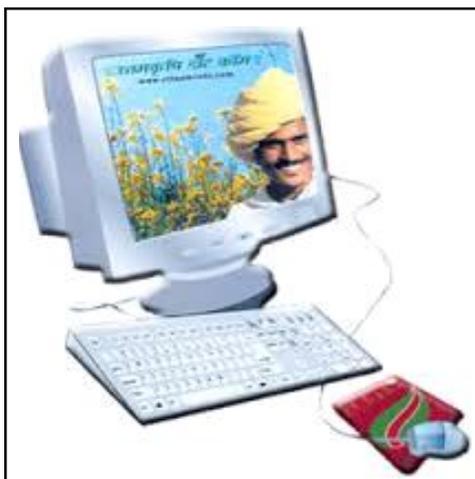
weather forecasts and calamities, better and spontaneous agricultural practices, better marketing exposure and pricing, reduction of agricultural risks and enhanced incomes, better awareness and information, improved networking and communication, facility of online trading and e-commerce, better representation at various forums, authorities and platform, etc. ICT in agriculture can play a major role in the increased food production and productivity in India.

Some successful ICT applications in Indian agriculture:

e-Choupal: Indian tobacco company (ITCs) international business division is one of India's largest exporters of agricultural commodities has conceived e-choupal has launched in June 2000 as a more efficient supply chain aimed at delivering value to its customers around the world on a sustainable basis. ITC's e-choupal is a unique example of using ITC's for agricultural development; e-choupal has already become the largest initiative among all internet based interventions in rural India. e-Choupal link rural farmers directly for the procurement of agricultural / aquaculture produce like soya, coffee, prawns etc. eliminating the role of the middleman. The principle of the e-Choupals is to inform, empower and compete.

aAQUA.org: aAQUA-which stands for almost All Questions Answered is a farmer-expert Q&A database supporting Indian languages. It is an online multilingual, multimedia agricultural portal for disseminating

information from and to the grassroots of the Indian agricultural community. The technology for Almost All Questions Answered (aAQUA) was developed by Developmental Informatics Lab, KReSIT, IIT B and was sponsored by Media Lab Asia and Development Gateway Foundation's R&D Center. aAQUA simultaneously addresses two major challenges in farmer outreach programs viz geographic reach and customized delivery. It answers farmers queries based on the location, season, crop and other information provided by farmers. An aAqua question is posted either by a registered user directly or through a telecenter/kiosk operator who has an account in aAqua. Usually the question is from a farmer whose profile information provides details such as crop, farm size, pesticides and fertilizers used dosage etc. The prices of various commodities along with their varieties are displayed spatially over a map. The user can decide where to sell his produce to get the maximum profit, depending on the prices and the distance of the market.



a AQUA makes use of novel database system and information retrieval techniques like intelligent catching offline access with intermittent synchronization, semantic-based search, etc. Agricultural content repositories (Digital Library), Agri-price information (Bhav Puchiye), farmer schemes and various operations- support databases (aAQUA-Q&S) have also emerged from the experience of aAQUA deployments. aAQUA's large scale deployment provides avenues for researchers to contribute in the areas of knowledge management, cross-lingual information retrieval, and providing accessible content for rural populations. Apart from agriculture, aAQUA can be configured and customized for Expert advice over mobile networks and the internet in education, healthcare and other domains of interest to a developing population. aAQUA is being spread geographically by building strategic partnerships with the state governments, kiosk network providers and Agricultural expert organizations. Additional services being considered for aAQUA as part of the scaling up effort include (i) weather reports (ii) database of populous villages and their location information, (iii) quality standards for exports. Apart from Agriculture, aAQUA, Bhav Puchiye and the Digital Library can be configured and customized for expert advice and content in education, healthcare, e-Governance esp. by organizations who are working in connecting farmers with experts.

Warana wired village: In the Warana Wired Village Project covering 70 villages in Maharashtra the existing cooperative structure has been used with state of the art infrastructure to allow Internet access to existing cooperative societies. The aim is to provide information to villagers by establishing networked booths in the villages. The villages in this sugarcane-growing region have computers that are linked to a central network that provides farmers access to essential pieces of information such as the ideal time for planting and harvesting sugarcane, the current market rates of their produce, and payments made by the factories. The Central and State governments together funded 90 per cent of the project.

The computer network has put an end to a major reason for anxiety at harvest time. Any delay in harvesting reduces its sugar content and, consequently, weight. Farmers are paid according to the crop's weight. The computer network provides each farmer with a share code. By punching the code into the system, the farmer gets details such as when the crop was planted and when it is due for harvesting. This gives the farmer sufficient time to organise workers to cut and transport the sugarcane.

The network also gives details of farmer's transactions with the local sugar and milk cooperatives and helps them

compare sugarcane prices in different parts of the country. The computer kiosk has made several tasks easy and less tedious for the sugarcane farmers. For instance, after sugarcane was weighed at the factory it took four days for farmers to know how much money they would get. Now, within two hours of the crop reaching the factory, farmers know how much they will be paid. The computers at the sugar factory's weighbridge feed the crop's weight into the farmer's file through his share code. A receipt is issued to the farmer or the transporter. The farmer can check his payment status at the computer booth.

The booths are located at the milk collection centres in the villages. The sugar factory pays Rs.150 every month for the use of the 12 foot x12 foot room that houses the computer. The service is free for farmers. Whenever farmers send sugarcane to the factory they go to the computer booth once in two days to check the prices and the details of his transactions with the cooperative. Farmers trust the system and know they cannot get cheated.

High-speed VSATs (very small aperture terminals) connected to the National Informatics Centre (NIC) in Pune and an electronic telephone exchange form the basic technology frame of the wired village project. The VSATs provide Internet access and the electronic telephone exchange provides dial-up facilities to the central hub located at the office of the Warana sugar cooperative. For the network the NIC has developed a software package based on an accounting programme. The programme supports the local language which is essential for the project.

Infosys' ICT initiatives for empowering Indian farmers: Infosys Technologies has partnered with ACDI/VOCA, a non-profit international development organization that promotes broad-based economic growth, to develop an ICT-enabled application that would improve efficiencies in the agro supply chain in India. The solution successfully minimizes inventory requirements, reduces waste and allows retailers and farmers to be better integrated. This application falls under ACDI/VOCA's Growth-Oriented Microenterprise Development Program (GMED), which is a \$6.3 million, USAID-funded initiative. GMED is an innovative program that develops sustainable and scalable approaches to job creation by fostering the growth of micro and small enterprises. Maintaining on-time, programmed delivery of fresh produce from a large and scattered production base is a complex and critical operation. This solution gives the organized retail sector access to a reliable small holder production base. It thereby decreases farm-to-market losses, currently estimated at 30% to 40% on certain products."

The application tackles supply chain management from

profiling of farmer clusters to crop planning, scheduling, tracking and forecasting. The application allows farmers to access technical information including database searches for data and images, access to region-specific weather updates and market information, *i.e.*, daily sales volumes and average prices. The application can handle several thousand concurrent users and yet ensures that data is secure through data-encryption mechanisms. There are 1,700 small holder farmers currently integrated into organized retail supply chains through this application, thereby bridging the urban-rural agricultural divide. Over the next five to eight years, the usage is expected to increase to a million farmers. The system is accessible across GPRS and CDMA devices, thereby increasing the effectiveness of the field force. It ensures that there is no loss of data if connectivity or power is lost. The application also gives farmers real-time access to agricultural experts, thereby improving farming technology at an overall level. This technology intervention in the agricultural sector in India will reduce rural poverty in the long run.

Infosys has built the solution consisting of wireless software applications that are accessible on handheld devices, enabling agents to address information gaps constraining vegetable and fruit farmers and enabling other supply chain participants to monitor and control the back-end and front-end supply chain functions. The application also enables wholesaler/retailer or other intermediaries to optimize cost by allowing large procurement, efficient transportation management and enabling intelligent crop production management. The solution is built on Infosys TruSync, a context-aware, client-server solution that is designed for situations with limited or no network availability and allows for peer-to-peer (p2p) synchronization between field agents without connecting to a central server.

Metrological Information by Ingen Technologies: Many farmers in Punjab and West Bengal are receiving messages on their cell phones about weather information specific to towns and districts and by 2009 these could be availed by farmers throughout India. Offered by a Kanpur-based company Ingen Technologies, the service updates farmers on temperature, humidity and rainfall with additional parameters such as atmospheric pressure, solar radiation, wind speed and soil moisture. The system is approved and certified by the Indian Meteorological Department. The company is also offering its services to a major soft drink company, which can better predict demand for its beverages based on these predictions and analytics software. For farmers Ingen provides agro-advisory services that include advice on sowing times, disease outbreaks and frost forecast, through SMS. On other hand,

Ingen has designed a decision support tool for utility companies and FMCGs, and have already supplied to some and are in talks with some other players.

Honey-Bee knowledge network: ICT can help empower the knowledge rich but economically poor people. Under the “Honey-Bee” knowledge network (of the IIM, Ahmadabad) implemented with the support from InfoDev division of World Bank the purpose is to augment grassroots inventors and overcome language, literacy and localism. The project has mobilized those creative and innovative farmers, artisans, mechanics, fishermen and women and labourers who have solved the problems through their own genius without any outside help, whether from state, market, or even NGOs. Such self triggered and developed innovations whether technological or institutional are scouted, supported, sustained and scaled up wherever possible with or without value addition, or linkage with formal science and technology institutions. Idea is to generate incentives and benefits for the innovators and traditional knowledge holders. The objective of this entire exercise was to create a clearing house, so that potential investors, venture capital or angle investors and entrepreneurs can link up with grassroots innovators, thus facilitating a golden triangle of innovation, investment and enterprise and thus build a bridge between formal and informal science.

ikisan portal: The Nagarjuna Fertilisers Company Limited (NFCL) is an agribusiness based at Andhra Pradesh. They are disseminating various farming information to the farmers at various places through ICT centers. Ikisan is a comprehensive agri portal addressing the information, knowledge and business requirements of various players in the agri arena such as farmers, trade channel partners and agri input/output companies. ikisan provides online, detailed content on - crops, crop management techniques, fertilisers and pesticides and a host of other agriculture related material. ikisan enable farmers to network with other farmers, suppliers and consumers across the world.

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