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Role of ICTs in Agriculture Knowledge Management

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Introduction

Agriculture is an important sector of Indian economy. More than 80 per cent of the population depends upon agriculture and allied fields. It has been widely recognized that transfer of relevant knowledge plays an important role in its growth and productivity. Transfer of relevant knowledge to small and marginal farmers can help them to improve their yields and get better market prices (patil et al. 2011; and Kukreja, A., & Chakrabarti, B. 2013). Given that natural resources like land and water are almost reaching their limits, "knowledge resources" and technological innovations are required to achieve food security (Saravanan, 2012). Management of agricultural knowledge takes place at different levels: individual, within communities, within organizations or institutions and networks. In agriculture there exists two types of knowledge: explicit (experts knowledge created through experiment) and tacit knowledge (local knowledge created through experience). However, the knowledge for agriculture development is more often than not created, documented or disseminated by one single source or organization (Rafea, 2009). Moreover, different types of organizations produce different kind of knowledge and the lack of co-ordination between public-private agricultural research and extension institutions (Saravanan, 2012) are often cited as reason for ineffective knowledge transfer to farmers. In the Indian context, the main agencies engaged in creating knowledge resources for agriculture can be classified into three broad categories - Public, Private and Non-Profit Organizations (NGOs). Public-sector organizations include the Indian Council for Agricultural Research (ICAR) and State Agricultural Universities (SAU). In addition to these, there are non-agriculture universities and research organizations working in agriculture. Private sector companies engaged in the production of seeds, fertilizer, pesticides, export and import of agriculture products are also engaged in knowledge activities via research and development. NGOs including co-

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operatives working in agriculture domain often have a focus on dissemination of best practices and documentation of local knowledge.

Knowledge sharing, exchanging and dissemination are elements in a broader theme which is knowledge management. The central purpose of knowledge management is to transform information and intellectual assets into enduring value (Metcalfe, 2005). Agriculture Knowledge Management is often put forth. Agriculture Knowledge Management refers to the process of creating knowledge repositories, improving knowledge access, sharing and transfer and enhancing the knowledge environment in the rural communities (Patil et al. 2011). Information and Communication Technologies (ICTs) enable communication and exchange of information between individuals and organizations across geographic location (Mukerji, 2013). ICT in Agriculture Knowledge Management aims to increase the competitiveness of Indian agriculture by providing affordable, relevant, searchable and up-to-date agroinformation service (Warren, 2002)

Information and Communication Technology (ICT) in agriculture is an emerging field focusing on the enhancement of agricultural and rural development in India. ICT is affecting all spheres of life. Due to the advancement in technologies, high-speed reliable computers are available with huge storage capacities at an affordable cost. Database and data warehousing technologies can be used to store and retrieve large amount of information and also can be coupled with Mobile & Internet Technologies to deliver information instantaneously to the community. Development in ICTs has enabled the maintenance of huge and variety of information (text, image, voice and video) repositories with negligible downtime that can be quickly extracted by millions of users concurrently. Data mining technology is being used to extract useful knowledge from huge databases. Now the research challenge, here, is to identify the areas in agriculture where progress in ICT could be used to improve the performance of farmers and farming technologies, and build efficient ICT-based model / system that improves the living standards of farming communities.

Objective of the study: To studyt the role of ICT in Agriculture Knowledge Management

Details of Sub-Topic:

Different theory of Role of ICT on Agricultural Knowledge Management was found from the study of Kale et al. (2015).

Knowledge Management in Agriculture (KMA):

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Knowledge Management in Agriculture (KMA) is the process of generation, processing and creation of database, dissemination and effective utilisation to meet current and emerging challenges in agricultural development. Knowledge is considered as the fourth production factor after labour, land and capital (AFAAS, 2011) and is particularly crucial factor for the agricultural development. Right knowledge, at right place and right time accessible to the farming community helps to improve production, productivity and brings higher income. If the agricultural sector is not backed up by modern agricultural knowledge and information, farming community in the developing countries are likely to remain trapped in low productivity, food insecurity and poverty. In this context, KMA is an important in promoting sustainable livelihoods and reducing rural poverty.

Various players are present in the process of knowledge management in agriculture ranging from the scientist working in the research laboratories, extension functionaries to farmers and rural poor. The knowledge management process involves following stages:

Knowledge Generation: The scientific knowledge is generated by the scientific community (scientist & researchers in the State Agricultural Universities (SAUs), national and international agricultural research centres) and farming community by their own traditional knowledge generated over the period of time, consistent with the culture and socio-economic status. This huge scattered information and knowledge must be integrated according to the specific domain of requirement.

Knowledge Storage: Knowledge and information is stored in the knowledge repositories like various research publications, internetbased digital repositories, computer-based KIOSKs, audio video CDs, DVDs and so on. Knowledge repository consists of universal meta-models and localized content developed for open learning and sharing of information related to agriculture. Agropedia is such internet-based agricultural knowledge repository developed with knowledge-models for localized content for a variety of users with appropriate interfaces built in collaborative mode to support information access in multiple languages. Some of the institutional digital repositories initiatives in Indian agriculture, like Eprints@IARI, developed by Indian Agricultural Research Institute (IARI), E-Repository@IIHR of Indian Institute of Horticultural Research (IIHR), Eprints@CMFRI developed by Central Marine Fisheries Research Institute (CMFRI), are contributing significantly in agricultural knowledge management in India.

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Knowledge Dissemination and Use: The knowledge and information is disseminated to researchers, extension workers, experts, farmers and the public at large through publications, mass media (radio and TV), internet, field day, exhibitions and interviews. In practice, field days, demonstrations, radio, and TV programmes are the major tools usually used to share the information with the farming community while internet and other modern ICT tools are emerging as the new avenues for the knowledge dissemination in agriculture. The expert system (EXOWHEM, ES-Seed spices, RiceCrop Doctor) in agriculture became the decision support system (DSS) for the agricultural extension professionals, which can collect, store, retrieve and disseminate information needed by the farmers and getting them transformed into 'knowledge workers'.

Value of Icts in Agricultural and Rural Development

ICTs can play a crucial role in the overall development of agriculture vis-a-vis rural development. It contributes significantly in the efforts for development at various levels through managing information and knowledge flow. It has capability of transforming the conventional research, education and extension, marketing, agribusiness and women empowerment.

ICT in Agricultural Research and Extension: The impact of ICT in agricultural research is quite significant. The changing nature of agricultural information systems is having a profound impact on how research results are communicated and disseminated. With the development of web-based information systems, the possibility of accessing databases and information online has increased dramatically and is leading to the development of meta-databases (Nnadi et al., 2012). In this context, ICAR has opened up Directorate of Knowledge Management in Agriculture (DKMA) at it's headquarter. The other initiatives of Indian National Agricultural Research System (NARS) like, agropedia, Consortium for e-Resources in Agriculture (CeRA), E-Granth, National Information Systems on Animal Experiments (NISAE) provides easy access to research project and findings, thus restricted the duplication of the research. ICT allows information generated by the researcher to be more efficiently accessed by the extension worker to be more effectively transferred to and applied by the farmer (Flor, 2002). Virtual KVK (vKVK) and KVK-Net initiated by ICAR are a means to connect extension scientists and farmers, based on its web platform which hosts information on agriculture and rural livelihood. vKVK makes use of existing vast

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extension network of Krishi Vigyan Kendras (KVKs) or Farm Science Centres (FSCs) in the country and allows the extension officers to send SMSs and voice-based agro-advisories in local dialect to the farmers' mobile phone.

ICT in Rural and Agricultural Education

ICTs are a potentially powerful tool for extending educational opportunities, both formal and non-formal, to previously underserved scattered and rural populations, groups traditionally excluded from education. Radio and TV have been used widely as educational tool to provide direct class teaching, where broadcast programming substitutes for teachers on a temporary basis. School broadcasting, where broadcast programming provides complementary teaching and learning resources not otherwise available, general educational programming over community, national and international stations provide general and informal educational opportunities (Mehata et al., 2011). Web-based video conferencing, teleconferencing also provides new opportunities for interactive distance learning. ICTs can benefit rural education in four important ways (Nnadi et al., 2012), each requiring progressively more support in infrastructure and human capacity building. ICTs provide teaching material and curriculum support in agriculture. ICTs offer an additional skill or subject matter for students in the classroom. ICTs also provide enrichment for existing courses, offering new pedagogical approaches. ICTs serve as a platform for rural distance education. Community Radios (CRs) and information KIOSKs are the important emerging sources of the ICT-based agricultural education in the rural areas. Education institutions have also started the use of ICTs in the education for the younger generation of rural area.

ICTs in Marketing and Value Chain Management: It provides timely information on what, when, where, why and how to produce and sell the agricultural products. ICTbased market information systems have a proven track record for improving the rural livelihoods in middle income developing countries where they have been introduced. However, these systems are generally limited in scale and have not been effectively replicated beyond the local level (Mehata et al., 2011). The impact that ICTs have in improving the competitiveness of food chains is very promising. Issues such as traceability, process control, transparency in market information, reduction in transaction costs, and identification as well as tracking of consumer needs are only a few examples that illustrate its importance. The e-Chaupal is one of the successful initiatives by ITC in marketing of specified agricultural product. The other

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mobile based initiatives like m-krishi, e-sagu, aAQUA, IFFCO Kisan Sanchar Limited (IKSL), Reuters Market Light (RML), Nokia life tools, Digital Green, Warana Unwired and so on are engaged in providing mobile-based information system to the farmers in their respective areas. It can contribute in strengthening of relations between stakeholders in the value chain and promoting the 'culture' of the 'e-learning' (Policy Brief, 2010).

ICT and Women in Rural India

Empowerment of women in the context of knowledge societies entails building up the abilities and skills of women to gain insights into the issues affecting them and also building up their capacity to voice their concerns. ICTs provide channels that facilitate the distribution of agricultural information and contribute to increasing productivity and yields, but gender equality must be taken into consideration throughout the planning and implementation of ICTs initiatives in agriculture (FAO, 2012). Information needs of rural women as well as their ICTs use vary widely. However, there is no ideal ICT that fits in all situations. Though women are engaged in multiple roles in agriculture, they are keen to have information on other aspects, such as child health, nutrition, prevention and cure of common ailments, employment opportunities and so on. Those trying to deploy ICTs for women empowerment should build their strategies based on ICTs use pattern and varied information needs of rural women. There is evidence, though limited, to reasonably conclude that ICTs have the potential to contribute towards economic, social and political empowerment of women (Sulaiman et al., 2011).

Challenges of Icts in Akm in India

The public and private sector ICT initiatives are being able to disseminate knowledge for agriculture and rural development, but these are still in nascent stage in India and evolving as an emerging trend. The benefits of these efforts are not being reaching equitably to all the categories of farmers. So to trap this knowledge and utilize full potential of ICT, there are still many challenges as discussed below:

- Access to the internet as well as the telecommunications is confined mainly to the urban areas in India and the rural areas remain beyond the ambit of new technology. Hence, connecting rural areas is a bigger challenge, because subscribers are geographically dispersed, sparsely populated and economically weak, which limit to furnish potential benefits of ICT-based knowledge to farming community.

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- Shortage and unstable power supply and high cost of alternative power source as well as hardware and software are high in relation to average income levels of rural India.
- The poor mechanisms and infrastructure for sharing and exchanging agriculture knowledge generated from research at national and regional levels is a big challenge, which leads to unnecessarily repetition of work. Researchers can find research papers published in international journals and conferences more easily than finding research papers published nationally in local journals, conferences, theses and technical reports (Rafea, 2009).
- Most research studies are found in the English literature in journals as well as on internet and websites, which is not useful to the farmers until it is present in local language. Very little efforts have taken to provide online internet-based locally relevant content in local language.
- The ITKs are not considered in scientific knowledge domain due to the problem of its validation and commercialization.
- Scattered nature of ICT-based models, which tends to exclude poor farmers and those living in remote areas (Mittal, 2012). No coordinated attempt to integrate different small scale models at national/state level on priority basis at mass level.
- Lack of e-literacy among the grass-root extension functionaries. Therefore, to reap the fruits of the ICT, it is important to provide necessary ICT skills.

Opportunities for ICT to Promote AKM in India

ICTs are playing a pivotal role in agricultural extensions information delivery system. It has made the agricultural research and development processes more inclusive, with enhancing the communication among different stakeholders. It leads to vertical and horizontal integration of knowledge among different stakeholders and increasing the likelihood of collaboration. ICT has improved capabilities to create and store data and information, gaining rapid access to it (Ballantyne et al., 2010). In fact, there have been some very significant efforts taken by Indian Council of Agricultural Research (ICAR) in this direction to connect agricultural research and extension institutes virtually like digitalisation of libraries and vKVK and so on. This will facilitate communication and information sharing among the experts which would, eventually, broaden their knowledge base. ICAR has also taken the initiative in national knowledge network that aims at sharing of knowledge

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resources for collaborative research and development work. So far, 20 ICAR institutes/SAUs have been connected and remaining institutes will be connected steadily (DARE Report, 2011–2012).

After introduction of telecom policy in 1998, the telecom sector has shown an exponential growth in India. The growth of tele-density was very low during 1948–1998 (1.92%) and recorded abrupt growth from 1999 to March 2012 (78.66%). In 2011 alone, 142 million mobile cellular subscriptions were added in India – twice as many as in the whole Africa, and more than in the gulf countries, Common Wealth of Independent States (CIS) and European Union together (ITU, 2012). Penetration of internet in rural India has seen a significant growth from 2.6% in 2010 to 4.6% in 2012. Internet users in rural India, which counted 38 million, would reach 45 million by December, 2012, according to a recent I-Cube report on Internet in Rural India by Internet and Mobile Association of India (IAMAI) and IMRB. The faster expansion of mobile and internet networks in the rural areas of India presents an unparalleled opportunity to give rural farmers access to information that could transform their livelihoods and eventually help them to get rid of poverty. Considering the importance of mobile phone penetration in rural India, Kisan Mobile Advisory was initiated during 2010–2011 to provide timely and need-based farm advisory to farmers. A mobile advisory is operational through KVK system. Under this activity, short text messages (SMSs) of information on weather, market and farm operations on various aspects of agriculture, horticulture and animal husbandry, besides weather forecast, and pest and disease control are given to farmers (DARE Report, 2011–2012). Many private sectors' ICT-based initiatives like e-chaupal, aAQUA and others are making the significant impact in the process of dissemination of agricultural knowledge at grass root level. Now, it is up to development planners, the administrators and policy makers in Agriculture Ministries to take cognizance of these technologies and make full use of the same to provide low cost telephone and internet connectivity to the rural population on a large scale. Thus, the opportunities are enormous and there is a strong need to take a holistic look at strategic planning to use the available resources – infrastructure of agriculture research and education institutions, availability of high quality agriculture graduates, availability of appropriate communication technology, highly trained ICTs manpower and of course highly receptive and information-hungry rural sector (Sharma, 2003). All we need to do is, to put all the scattered and small

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scale initiatives in the integrated framework to provide the much-valued information and knowledge connectivity network in the agricultural community.

Strategies for Efficient Use of Icts in Akm

ICTs can help in development of agriculture sector; become a more dynamic instrument of a continuous knowledge management among the various stakeholders. A considerable effort has been made to test and validate this hypothesis. Now there is a need to grab the emerging opportunities and launch countrywide projects to capture and digitize the huge agricultural research knowledge and make it available to the farmers at their door-step in the best possible way. To overcome the challenges, there is need to frame the sound strategies for making the most optimal use of the ICTs in AKM:

- The governments (central and state both) should play the role of facilitator for the nationwide integrated programme to connect various stakeholders in agricultural development by harnessing the experiences and expertise gained by the existing ICTs initiatives across the country.
- Information kiosks must be promoted at village and block levels on public–private partnership (PPP) mode. This will improve the ICTs infrastructure and leads to dissemination of updated information to the farmer on early warning of disease and pest problems, question and answer services, information on cropping systems and planning, packages of practices for commercial crops, weather-forecasting, soil testing and sampling, post-harvest technology, input prices/availability, farm business information and crop insurance and so on.
- Institutional networking and formation of consortiumbased approach to integrate the national agricultural knowledge database with the government departments like agricultural marketing data from marketing boards, weather-based data from meteorological departments and others.
- The shifting/transfer of administrative personnel of district and block level, the priorities may get changed. Hence, convert the e-governance and e-government initiatives/services in the business model for its long-term availability and sustainability.
- The reforms need in the development of agriculture universities curriculum with the changing demands of agricultural education and development. The subjects like ICTs

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for development, gender sensitisation, entrepreneurship development and others may be incorporated at under-graduate level.

- To grab the advantages of the Indigenous Technical Knowledge (ITKs), which is wealth of heritage for the future generation, its documentation and dissemination by using ICTs in the local language as well as in English is need of the hour for purposeful use among researchers and farming community.
- Creating awareness among the various stakeholders about the use of ICTs for the educational and gathering agricultural knowledge purpose, capacity building through training of farmers, agricultural extension functionaries and scientists to win their trust in the system and ensure continuous updating on latest technologies.
- The popularity of music, videos, songs of artists can be encouraged in our agricultural extension activities. The extension worker should experiment on inserting agricultural technology messages in entertainment programs and music videos.

Review of literature:

ICTs in extension can lead to the emergence of knowledge workers that will result in the realisation of a bottom-up, demand-driven paradigm for technology generation, assessment, refinement and transfer (Meera, 2003; Meera et al 2004). The information technologies that together make knowledge management available throughout an organization are referred to as a knowledge management system (KMS) (Santosus and Surmacz, 2001; Smith and McKeen, 2003.)

Aker (2008) found that cell phones reduced the grain price dispersion across markets by a minimum of 6.4 per cent and reduced intra-annual price variation by 12 per cent.

De Silva and Ratnadiwakara (2008) have stated the possibility of dramatic reductions of transaction costs with the use of ICT. This was due to the reduction in information search costs to enable greater farmer participation in commercial agriculture as opposed to subsistence farming that continue to force so many farmers in developing countries in to poverty.

Labonne and Chase (2009) reported that, purchase of mobile phones in Philippines increased the growth rates of the incomes in the range of 11-17 per cent significantly as evident from the World Bank study. This is due to the stronger bargaining position of the farmers in the existing trade relationships in addition to being able to seek out to other markets. Another

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study found that purchase of mobile phones in Morocco increased the average incomes by 21 per cent (Ilahiane, 2007).

Mittal et al. (2010) reported that the broad categories of information required were common to all of them, irrespective of their location and crops. These information categories were: know-how which provides a farmer with such fundamental information as what to plant and which seed varieties to use; contextual information such as weather, best practice for cultivation in the locality; and market information such as prices, demand indicators, and logistical information. It was found that small farmers prioritized information on weather, plant protection, seed variety and market prices as most important. In Uttar Pradesh and Rajasthan, close to 90 per cent of farmers reported information on seed as their highest priority, while over 70 per cent cited market prices as the most important category. Although farmers were also interested in other categories of information, like best cultivation practices, crop choice, etc., only a small sample prioritized them.

ICT can help us meet the demand for food, by collecting and sharing timely and accurate information on weather, inputs, markets, and prices; by feeding information into research and development initiatives; by disseminating knowledge to farmers; by connecting producers and consumers, and through many other avenues (Anonymous, 2011b). ICT services provide critical access to the knowledge, information and technology that farmers require to improve the productivity and thus improve the quality of their lives and livelihoods. (Nandeesha, 2016).

Casaburi et al. (2014) reported that sending SMS messages with agricultural advice to smallholder farmers increased yields by 11.5 per cent relative to a control group with no messages. Enabling farmers to report input provision delays to the company reduces the proportion of delays in fertilizer delivery by 21.6 per cent.

Syiem and Raj (2015) reported mobile as the most frequently used ICT. According to them, the Mobile phones were widely used by the farmers for social communication, contacting middle men for the marketing of produce and contacting experts on real time basis for getting agricultural advisories. Major problems in the use of ICTs by the farmers were lack of confidence in operating ICTs, erratic power supply, low network connectivity and lack of awareness of the benefits of ICTs. (Syiem and Raj, 2015)

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Tetty (2013) examined the usage of the mobile phone in the business of farmers within AkuapemNorth District in the Eastern region of Ghana with a sample of 100 farmers. It was found that the use of the mobile phone has improved customer relation, enhanced communication with suppliers, extension officers and customers, and it has also increased farmers profit. The study proved challenges such as inability to have access to calling cards regularly, fluctuation in network receptions and constant energy to charge their mobile phone for rural agriculturalists.

Singh et al (2015) reported that Agriculture Information System (AIS) is a computer based information system which contains all the interrelated information which could really help farmers in managing information and policy decision making. The ICT devices that help facilitating farming activities encompassed applications like radio, television, cellular phones, computers, tablets and networking, hardware and software, satellite systems (Munyua and Adera 2009; Pande and Deshmukh 2015). In the same way, (Yimer, 2015; Munyua and Adera 2009) reports that radio is extensively used to inform users on agricultural topics, including new and upgraded farming techniques, production management, and market information. This shows that farmers may take advantage of using radio in the absence of technology especially rural farmers. The Internet and web-based applications are extensively used in sharing and dissemination of agricultural knowledge, marketing of goods and services. The study conducted by (Ramli et al, 2015) have shown evident that ICT is an effective solution to problems that militate against the development of agricultural industry, such as weak marketing linkages, poor information management, low productivity, low income and lack of diversity. Singh et al, (2015a) noted that the importance of ICT in agriculture by sharing agricultural information system to farmers at all level. But the major drawback of this research its references did not follow the format of the international standard.

Analysis supplemented with case illustration

Agriculture Technology Information Center (ATIC)

The importance of an appropriate information package and its dissemination as an input has assumed added emphasis in this “information age”. The kind of information and the way it is to be used are critical factor to the growth of agriculture. It is also worth noting that it is no longer enough for research to generate information alone. The required information is also to

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be delivered to the end user at one place. This information must be direct, clear and easily understandable and without any room for distortion. The facility of a 'single window' approach at the entrance of the ICAR Institute/State Agricultural Universities will enable the farmers to have the required information for the solution to their problems related to the areas in which the concerned institute is involved.

The rationale for establishment of ATIC are:

1. To provide diagnostic services for soil and water testing, plant and livestock health.
2. To supply research products such as seeds and other planning materials, poultry strains, livestock breeds, fish seed, processed products, etc, emerging form the institution for testing and adaptation by various clientele.
3. Providing information through published literature and communication materials as well as audio—visual aids.
4. Providing an opportunity to the institutes/SAU/s to generate some resource through the sale of their technologies.

ICAR-ICT efforts for KVKs: The future strategy

ICAR has to focus on development (KVK Portal) of situation specific (district wise) virtual repository of information thus taking farmers technological contributions on a world/ national platform. Sharing farmers' experiences from region to region through internet/intranet, online availability of advisory services and integration of PC and mobile services also has to be initiated in all the KVKs. This can be achieved through development of situation specific content/ information, ensuring satisfactory connectivity, adequate training to all SMS, developing static multimedia content, developing ethics, codes and standards for content hosting, registering exclusive common domain and web space for KVKs for web hosting.

Accessibility of e-information in Indian Languages

Accessibility of e-information in various regional languages is also important. Chennai based Lastech Systems Private Ltd has launched e-mail Software called 'Indomail' in 12 Indian languages. Indian Operating System called Bharatbhasha for use in computers in Indian and South Asian languages is also developed. Bharatbhasha gives freeware fonts in Bangla, Hindi, Marathi, Gujarati and Gurmukhi. Other Indian language software products

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include 'Lingua Indica' and 'SRD Akruti' of Bangalore, 'Cirrus Software' of C-DAC, Modular Systems and Seacom of Pune.

ICT and Livelihood Security

The most important role of ICT in development is fostering a knowledge intensive sustainable livelihood security system in rural areas. Since ICT can enable us to reach the unreached and include the excluded information, knowledge and skill empowerment, communication and information hold the key to development in the 21st century. An inclusive knowledge society requires the effective harnessing of ICTs to combat poverty and foster development.

I-Kisan

I-kisan portal (www.i_kisan.com) is developed by Nagarjuna fertilizers. The portal provides agriculture information about 20 crops, online chatting with experts, market information with respect to products & services of Nagarjuna group, weather forecasting, current events in agriculture and directory of input and output suppliers. I – kisan information kiosks presently operates in Andhra Pradesh and Tamilnadu. It provides a CDROM database which covers the topics of crop disease and pest management, soil and water management, agricultural equipments, agricultural inputs, market information, animal husbandry and insurance and policy information.

E – Choupal

This was started by international business division of ITC Ltd in June 2000. Six states namely AP, Karnataka, MP, Maharashtra, Rajasthan and UP are under this and its popular in Madhya Pradesh with 900 kiosks.

Information Village and Village Knowledge Centers (VKCs)

Village knowledge centers of MS Swaminathan research foundation were launched in 1998 in Puducherry. The main aim behind the establishment of VKCs was to provide sustainable food security in rural areas of Puducherry. To fulfill this aim, it provides technical information related to agricultural inputs. It helps in procuring quality seeds, in providing information about the daily market price from the government as well as private bodies, and advices farmers on rotation of crops as well as about the use of fertilizers and pesticides. VKCs receive information by voice mail, and disseminate it through any public address

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system. It has also identified 13 districts in Pondichery, where there is a huge potential for agriculture business, and where the government will invest Rs. 170 cr.

Warana Wired Village (WWV) Project

Warana Wired Village Project was launched in 1998 as a collaboration of NIC, Govt. of Maharashtra with collaborative attempt of Warana Vibhag Shikshan Mandal (WSM), Education Department and Warana Group of Cooperatives. The project aims to provide information about agriculture, market and education to 70 villages around Warana Nagar. Information dissemination is by web based and intranet based model. The project has developed a GIS based map of 70 villages

The Gyandoot Project

The Gyandoot project was started in the Dhar district of Madhya Pradesh, which covers five lakh people of 311 gram Panchayats, 600 villages and 26 Soochnalayas. Soochnalayas are nothing but information centers at the village level set up by the Government of India in collaboration with local bodies. This center is operated by unemployed rural youth (Soochaks), who is thereafter trained. A committee called Gyandoot samiti manages it. The district collector is the president of this soochnalayas, and the sarpanch of district panchayat acts as the secretary of the committee. The service covers to provide information about the agricultural produce, auction center rates, copies of land records, on-line registration of applications, village auction sites and more. The Village Auction Site project was started in June 2002, which allows farmers and villagers to advertise and sell land, agricultural machinery, equipment, and other durable commodities. Minimum user fees are charged by the information centers to provide information. Likewise, information about a commodity on sale is provided for a charge of Rs. 25 for three months, and Rs. 10 is taken for finding the list of salable commodities.

Kisan Call Centers (KCCs)

KCCs were launched on January 21, 2004 by the Department of Agriculture and Co-operation. The main technologies involved in Kisan call centers are: he main aim is to deliver the extension services to the farming community in the local languages. The farmer dials the help line, a toll free number, 18001801551, and the agricultural graduates provide the initial enquiry. If the queries handled by the agriculture graduates are not satisfactory to the farmers

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or the farmers want more information, the call is forwarded to level II and level III executives.

AGMARKNET

AGMARKNET, (Agricultural Marketing Information Network), is a joint venture of the Directorate of Marketing and Inspection (DMI) and the National Informatics Center (NIC). DMI and NIC are the sponsoring agency of AGMARKNET. It has increased the efficiency in marketing activities by establishing a nation-wide information network, which provides details about market functionaries, sold and unsold stocks, as well as the sources of supply and destination. These timely information data are helpful to producers, traders and consumers. AGMARKNET has been connected to 670 agricultural produce markets and 40 State Agricultural Marketing Boards & Directorates. Each AGMARK portal of wholesale market provides daily information to AGMARK portals of its respective states, and then each state's AGMARK portal sends the information to the AGMARKNET portal.

Kiosks

Kiosks are a computer terminal or touch screen displays that runs customized software which serves the functions for which it is programmed to, while, at the same time, preventing users from accessing system functions. ICTs such as email, www and computer kiosk promise to provide innovative solutions to the problems of poverty and inequality by accelerating development introducing transparency to the systems and operations.

Summery and Conclusion:

India is a country with over 1 billion population and 5 million computers. 80% of the 5 million computers used in offices and hardly, 20 per cent are available for use in development work. Despite all the barriers, the Indian agriculture is bound to adopt and implement ICT to double the agricultural production. This aim can be achieved only when there is proper utilization of ICT and more investment in it. As ICT helps in information dissemination in less time with effective ways of communication, its implications cannot be ignored by KVKs. There is a great scope to implement ICT in order to communicate and integrate the complete agri-food supply chain, as the e-choupals are doing in Madhya Pradesh to procure soyabean. The other beneficiaries of ICT can be food-processing companies, and suppliers within the agri-food sector. On the other hand, the need to market the agricultural produce at reasonable prices will also change the farmers' attitude, and they will be more

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dependent on ICT. ICTs will, thus, definitely help the KVKs in sustaining the Indian agriculture. There is no dearth of knowledge in the agriculture sector. The real challenge is the documentation, management and transfer of huge knowledge database to the farmers, that is, ultimate consumer. ICTs are playing the key role in the process of AKM and have proved its worth through the different small scale projects. There is need to develop an integrated policy framework to link the ICT based initiatives for faster dissemination of agricultural information and knowledge among the various stakeholders in agriculture sector. ICT is a promising option in the agriculture sector to maximize crop production and productivity. The awareness of the importance of the various information and communication technologies among the people plays a key role in regards to access and use of reliable information for agricultural operations. The effectiveness to understand its implication on the ground is utmost essential for the smallholder farmers of India. The young people are using the technologies however the extent of its use is not broad in addressing the issues in agriculture. Hence, effective and simplest communication mechanisms should be explored and capacity building training should be provided to the farmers which ultimately helps to generate skills and knowledge to access information from various sources

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