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Information and Communication Technology (ICT) for Sustainable Agricultural Development

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Abstract : ***Indian Agriculture contributes 16 % of our GDP, and approximately 60% Indians derive their livelihood from the agricultural sector. The performance of agriculture basically means the performance of small holder farming. It is only by empowering small and marginal farmers to overcome their handicaps that, they can become instruments of evergreen revolution and growth in agriculture sector. The limiting factors of farmers in maximizing their farm incomes are access to technology, government endeavour, resources, markets, institutions and services. Farming community is facing lot of problems in maximising the crop productivity. In spite of successful research on new agricultural practices, the majority of farmers are not getting upper bound yield due to several reasons. One of the reasons is that expert scientific advice on crop production and marketing is not reaching the farming community in a timely manner. There is a concern that the gap between the information rich and information poor is getting wider. The farmer proceeds for farming on the basis of experience. Generally farmers follow the advice of local shopkeepers/agents who sells him seeds, fertilizers, insecticides, pesticides etc. The information need of Indian farmers across the country is varied. Introduction of Information and Communication Technology (ICT) enables the dissemination of requisite information at the right time. This revolution in information technology has made access to the information easy and cost-effective.***

Keywords: (ICT, Farming community, Dissemination, Information)

1. Scope and Significance of the study

Indian government emphasizes on "Digital India" programme. This scheme aim to empower citizens with e-access to government services and livelihood related services. By the end of 2019 the Digital India programme envisages that 2,50,000 Indian villages will enjoy broadband connectivity and universal phone connectivity. Government of India began to adopted information concept in route to development during 1980s during the Prime Minister Rajiv Gandhi. The study has focused the use of ICTs to access agriculture information. The study has focused how the stake holders use ICTs as access and utilization tools. The study focuses on use of ICTs by information providers and how they diffuse information to access utilisation of agriculture the rural farmers of Hisar district of Haryana State and also how farmers of Hisar in rural area to access information and utilize the benefit of ICTs in agriculture development.

Information and Communication Technology?
Information and Communication Technology (ICT) consists of three main technologies. They are: Computer Technology, Communication Technology and Information Management Technology. These technologies are applied for processing, exchanging and managing data, information and knowledge.

Unique Feature of Information and Communication Technology

- Access to the astounding store-house of information is free
- The information is available instantaneously round the year and twenty four hours a day,
- Communication can also be interactive
- The information is available from any point on the globe
- The communication is dynamic and ever growing.

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. (ICT) can play a significant role in maintaining the above mentioned properties of information as it consists of three main technologies.ICT is an integration of the technologies and the processes to distribute and communicate the desired information to the target audience and making the target audience more participative in nature.

Need of ICT in Indian Agriculture
ICT in agriculture is an emerging field focusing on the enhancement of agricultural and rural development in India. It involves application of innovative ways to use Information & Communication Technologies (ICT) in the rural domain. The advancements in ICT can be utilised for providing accurate, timely, relevant information and services to the farmers, thereby facilitating an environment for more remunerative agriculture. Given the development scenario in Indian Agriculture, ICT movement is still evolving. However, all the ICT initiatives are not uniform with disparities between regions in the level and quality of telecommunications, information and the effort of individuals, public and private organizations, and differentiated nature of demand of the farmers in different areas. As a result, there have been many successes, failures, lessons learned and experience gained, so far. While these initiatives are intended to address the needs of the farmers through ICT, their actual usage and their ability to bring significant impact on the farm productivity and socio-economic development of the intended beneficiaries is to be understood. It is relatively unknown as to whether the ultimate beneficiaries actually use the facilities provided for them meaningfully to meet their needs. The common problems in adoption of ICT in rural segments are ICT

illiteracy, availability of relevant and localized contents in their own languages, easy and affordable accessibility and other issues such as awareness and willingness for adoption of new technologies among the rural peoples etc. One critical aspect in the usage of ICT's for farmers and their groups, as seen in some of the ICT driven initiatives, is the involvement of human interface at the last mile indicating that there is a human dependency in transmission of Information/Knowledge to farmers.

Thus, there is a need to understand as to how far the ICT initiatives are able to address the farmers need so that better solutions can be developed to address those unmet needs. The proposed research aims to study the past and present major ICT initiatives in agriculture in India, the extent of their success, the factors affecting the success as well as failure of such initiatives. Based on this study, the project will develop and suggest appropriate ICT models to meet farmer's information needs for different selected scenarios considering the infrastructural and social-economic constraints with some field testing within the existing infrastructure. The ICT models generated in this project can be expected to provide a framework for various stakeholders in agriculture in design and implementation of effective ICT based solutions for agriculture.

Role of ICT in Agricultural Extension

Three important roles in which can play are i) enhancing agricultural production, ii) improving market access, and iii) capacity building and empowerment for better agricultural extension.

Enhancing Agricultural Production: Farmers (especially small ones) often face threats from many threats like poor soils, drought, erosion and pests. Key areas where ICT can help improve this is by providing up-to-date information about pest and disease control, early warning systems, new varieties, new ways to optimise production and regulations for quality control.

Improving Market Access: Providing up-to-date information on the market prices of commodities, inputs and consumer trends. This can improve a farmer's negotiating position and their livelihood, while enabling farmers to make better decisions about future crops and commodities, and also the best time and place to sell and buy goods.

Capacity-building and empowerment: ICT technologies can be used to strengthen communities and farmer organizations strengthen their own capacities and better represent their constituencies when negotiating input and output prices, land claims, resource rights and infrastructure projects. Rural communities are able to interact with others via the use of ICT which reduces social isolation that they would otherwise be facing. Besides that, ICT technologies are able to make processes like law-making and land-title approvals more transparent.

Potential of ICT's in agriculture sector

ICT enables vital information flows by linking rural agricultural communities to the Internet, both in terms of accessing information and providing local content. New information and communication technologies are generating possibilities to solve problems of rural poverty, inequality and giving an opportunity to bridge the gap between information rich and information poor and support sustainable development in rural and agricultural communities. As farming is becoming highly knowledge intensive, commercialized, competitive and globalised against traditional resource based approach, the need to adopt right means to bring in all players of agribusiness, cannot be over emphasized.

Innovations in ICT are of great help in offering a communication platform circumventing all traditional physical barriers and backwardness with its wider reach out and neutrality to social and gender bias; and it's inclusive nature of public and private sectors and its innate strength of offering a reliable, good and cost effective communication platform to various management agencies involved in the extension to and from to the farmers. With these features, ICT will definitely strengthen the current ongoing extension reforms in bridging gaps in access and in bridging rural economy with globalised markets.

Delay of Agricultural Information in Rural Areas:

The main purpose of extension is to transfer the agricultural advanced technology and research to the farmer, and feedback of field problems to the research system. Latest information and knowledge on the subject play a major role to full fill this purpose.

Reasons for delay

There is an information delay between farmers and agriculture researcher in India because:

- Media, Information Management and ICT are not properly used
- Lack of sufficient extension workers
- Lack of Agricultural information literacy in India
- Lack of updated agriculture information with the farmers and most of the extension workers
- Poor technological knowledge of farmers and village level extension personnel
- Economic problems of rural people
- The top-down approach is adapted for extension activity. So the linkages between research- extension and farmer remained weak etc.

Trends of Agricultural Extension in India

The use of information technology and electronic mass media is high priority channel for agriculture extension and dissemination of information to the farming community. Under World Bank funded project i.e. National Agriculture Technology Project (NATP), Innovations in Technology Dissemination (ITD) was started in 1998. The project is currently operational in 28 districts of seven states (four districts in each) namely – Andhra Pradesh, Bihar, Himachal Pradesh, Jharkhand, Maharashtra, Orissa and Punjab. The project focuses on restructuring public extension services and testing new institutional arrangements for technology transfer. Under the project Agriculture Technology Management Agency (ATMA) has been set-up in each of the 28 project districts of seven States. ATMA is a registered society of key stakeholders involved in agricultural activities for sustainable development in the district by integrating research-extension activities and decentralizing day to day of

Public Agricultural Technology Dissemination System. All the research, training, development and extension activities run by public, private and other organizations in the district are integrated under ATMA. A State Agriculture Management and Extension Training Institute (SAMETI) is also supported to meet training and capacity building requirement under the Project. The National Institute of Agriculture Extension Management (MANAGE) provides training and capacity building to the Project. The model of ATMA is now being implemented in 252 district of the country. There is intensive use of information technology and media back up. All the research, training, development and extension activities run by public, private and other organizations in the district are integrated under ATMA.

ICT Initiatives for Agriculture and Rural Development

Under NATP, ICT infrastructure is created in NARS by ARIS in order to bring information management culture. More than 400 ARIS cells have been created in NARS. These cells and their campuses house PC (Personal Computer) workstations, servers, UPS (Uninterrupted Power Supply) and all major network equipment such as switches, hubs, routers, network management, LAN cabling, Internet etc. The basis infrastructure required for linking all ICAR Institutes and SAUs has already been created. These cells are expected to promote the use of information technology in agricultural research, education and extension all over the India. Libraries of NARS are improved with ICT (Hardware, Software, LAN, Internet, Digitization, On-line/Off-line resources etc), under the Library Improvement and Networking of NATP. ICT has been implemented for agriculture extension activity under ATMA. Under NATP, e-Extension by connecting 200 selected KVKs and 8 Zonal Coordinating Units (ZCUs) through an Intranet and Internet has been taken-up by ICAR to strengthen these selected KVKs to enable them to deliver extension services through Internet. These KVKs will be developed as Information hubs. Village information kiosk is supposed to be an Internet connecting node with minimum facilities to link to Internet and provide access to information sources. These kiosks may run on paid basis like STD/ISD telephone booths. Some of the states viz., Andhra Pradesh, Maharashtra, Karnataka, Madhya Pradesh, Kerala, Tamil Nadu etc. have already established such kiosks which are growing at fast pace. Use of ICT for rural development and transfer of agriculture technology has been done by Government and private organizations (including NGOs). The Ministry of Communication and Information Technology of the Government of India and the Telecom Regulatory Authority of India (TRAI), as well several state governments, have already developed strategies for accelerating the growth of the Internet and broadband connectivity in rural India. Bharat Sanchar Nigam Limited (BSNL) has laid fiber cables capable of reaching nearly 70 per cent of villages. Government of India and State Governments have been working in various e-Governance projects in India.

Till date, the available Indian ICT public service delivery models in Agriculture sector are very few and are mostly in private sector viz., knowledge centres and several others are adopting ICT in their business. The Private sector initiatives are very critical and essential given the strong presence of the corporate in Agriculture sector. In Cooperative sector the often quoted old examples are Dairy Information Services Kiosk (DISK) of NDDB and wired village WARANA. Amongst civil society, GRASSO of West Bengal is pioneering the ICT access in farm sector. Increased realization of rural markets potential has become a driving force for the interest of corporate.

In government the major ICT based service delivery initiative is limited to

(i) ASHA (www.assamagribusiness.nic.in) initiative of Assam SFAC (Government of Assam) with its networking with large ICT infrastructure (CICs) spread all over the state.
(ii) Kerala is coming up with two different initiatives kissan kerala (www.kissankerala.net) and e-Krishi (www.e-krishi.org/web/main/).
(iii) The Government of Andhra Pradesh is providing agribusiness services through Rajiv Internet Village Centres in partnership with ikisan. The IIIT Hyderabad is experimenting with e-Sagu (http://agriculture .iiit. net /esagu / esagu2004).
(iv) The Uttaranchal state is planning for Kisan Soochna Kendras in private partnership while the Haryana state recently inaugurated its first Agribusiness Information Centre.
(v) The Tamilnadu and Maharashtra are pursuing comprehensive Agrisnet. Several state agricultural universities launched telephonic help lines
(vi) Related to land records the Bhoomi Project of Karnataka state has been one of the highly successful public sector initiatives in the country having direct impact in improving health of agriculture sector and is being replicated in several other states.

ITC e-chaupal

Effort driven by a company involved in grain trading

- 4000 Internet chaupals (kiosks) in villages to aid grain procurement, support agriculture
- Grain trading pays for ICT

n-Logue

Partner with a Local Service Provider to connect every village in a district using terrestrial wireless

- Village kiosks
- No subsidy, possible bank loans
- Video-conferencing is key
- Focus on education, health and livelihood
- Operation in 40 districts, 2000 villages

Other Initiatives

Grant / aid driven

- MS Swaminathan Center (in Pondicherry focussed on agri and fishery applications)
- Tara-haat (focus on rural enterprises)
- Akshaya (in Kerala with Government support)
- Gyaandoot* (in MP with focus on e-governance)
- Rural E-seva* (in east Godavari in AP with focus on e-governance)
- Warana* Wired village (in Maharashtra by NIC)
- These projects are now operated by n-Logue

For profit initiatives

- Drishtee (uses existing telecom infrastructure)

There are several models of ICTs in Indian agriculture, which have made a significant difference in the delivery of services in Indian agriculture like, the establishments of Kisan call centers, Gyandoot project, Bhoomi project, Village knowledge centers, AGMARKNET etc,..

Kisan Call Centers (KCCs)

KCCs were launched on January 21, 2004 by the Department of Agricultural and Co-operation. The main technologies involved in Kisan call centers are:

- Desktop computer system with Internet connectivity.
- High bandwidth telephone line (preferably 128 kbps ISDN line).
- Telephones with headphones and teleconferencing facility (if required).

The 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, 1551, and the agricultural graduates provide the initial enquiry. If the queries handled by the agriculture graduates are not satisfactory to the farmers or the farmers want more information, the call is forwarded to level II and level III executives.Thus, KCCs are the important information gateway for farmers. The cost to the farmers is almost zero, and they get the response in their local languages. If needed, the agricultural scientists also visit the field to resolve any further queries.

Village Knowledge Centers (VKCs)

Village knowledge centers of MS Swaminathan research foundation were launched in 1998 in Pondichery. The main aim behind the establishment of VKCs was to provide sustainable food security in rural areas of Pondichery. To fulfill this aim, it provides technical information related to agricultural inputs. It helps in procuring quality seeds, in providing information about the daily marked priced 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 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.

AGMARKNET

AGMARKNET, (Agricultural MarketingInformation 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 an destination. These timely information data are helpful to producers, traders and consumers.

How does AGMARKNET get the Information?

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.All of these softwares are maintainedby the National Information System .APEDA (Agricultural and Processed Food Products Export Development Authority),NAFED (National Agricultural Co-operative Marketing Federation of India Ltd), Food Corporation of India, Central Warehousing, SFAC (Small Farmers Agri-Business Consortium) are the main users of the AGMARKNET portal. The food processing units, traders and different village kiosks, to help the farmers in taking the right decisions, mainly use these portals.

Strategies and policy options

Each initiative is a unique model in the application of ICTs to agriculture and has merits and constraints of its own. The study also helped in learning lessons from these initiatives for up scaling ICT-based initiatives.

Accordingly, the following suggestions would be useful in framing appropriate strategies for greater use of ICT in agriculture sector.

- Involve local people in content development as in village knowledge centre' to assess information needs and collection of indigenous knowledge, which can be synthesized, with information from experts/institutions
- Prepare user-friendly content in the regional languages also with visuals
- In kiosks, supplement the digital information with public address system, vernacular print media, and bulletin boards for wider dissemination
- Use alternative technologies to substitute electricity (batteries and solar panel) and telephone connectivity (wireless network), use space in rural institutions (*Panchayat* office, school, temple) to overcome infrastructure barriers (e.g. Soya-choupal, Village knowledge centre)
- Appoint facilitators exclusively for information service; they should be motivated and accountable, well qualified with adequate knowledge on subject matter and computer operation
- Support these initiatives by other quality services and rural infrastructure (extension expert's advice, market access, transport service, roads, development schemes etc.) to translate knowledgebased decisions into actions without bottlenecks
- Encourage networking of institutions and public-private partnership for improving rural tele density, information generation and delivery, capacity building of the facilitators etc
- Public sector institutions have to play a greater role in synthesizing information while private sector institutions and NGOs disseminate it through information centres.

2. Conclusion

Agriculture is one of the indispensable sectors in our country. It is well known fact that ICT can revolutionize agriculture in many ways. ICT projects are yet to make any breakthrough in agricultural information dissemination and other areas. Deployment of ICTs needs to be stressed more.ICT for agricultural projects needs to be compared and

evaluated precisely. It is need of hour to obtain apposite information through ICTs and to deploy advanced ICTs in agriculture. Having reviewed and analyzed current ICT-based information service models, the following suggestions that are relevant to government organizations and ICT developers can be provided for future development and research: Evaluation of the effectiveness of existing strategies and policies to run ICT projects in agriculture based on the feedback of grass root level workers/officers working directly with farmers in rural regions. Transforming agriculture sector into the modern digital agriculture to further improve social and economical benefits. Improving the digital access by farmers with technological advances and skills improvement. Adopting more advanced ICT tools in agriculture such as GPS, GIS, RFID, Remote sensing, Smart device for precision agriculture, sustainability, environment, food safety, etc. Analysing and managing Big Data in agriculture.

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