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e-Agriculture: A new paradigm, transforming agricultural practices in India

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ABSTRACT

In India, agriculture is the mainstay for the economy of India. Around 65% of the population earns its livelihood from agriculture. It is a great source of livelihood to the Indian people. This paper discusses about how Information & Communication Technologies (ICTs) are helping farmers of India on a large scale in which e-Agriculture is one of them. e-Agriculture is broadly defined as an emerging field focusing on the enhancement of agriculture and rural development through improved information and communication processes. More specifically, it involves the conceptualization, design, development, evaluation and application of innovative ways to use Information and Communication Technologies in the rural domain, with a primary focus on agriculture. The main aim of this paper is to aware the farmers about the e-Agriculture, its usage and application in their marketing habits and problems & prospects of e-Agriculture in rural development in Indian context.

Keywords: *e-Agriculture, Precision Agriculture, ICT, Kisaan Call Centre (KCC)*

INTRODUCTION:

Agriculture is a backbone and plays a crucial role in the mechanism of economic development of less developed countries like India. Besides providing food to nation, agriculture releases labour, provides saving, contributes to market of industrial goods and earns foreign exchange. Agricultural development is an integral part of overall economic development. In India, agriculture was the main source of national income and occupation at the time of Independence. Agriculture and allied activities contributed nearly 50 percent to India's national income.

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The population of India has alreadybeen crossed 1.37 billion and is still increasing alarmingly and that put a great pressure on the food grain production of India. On a rough estimation, it is an acceptable fact that India achieved a humongous success in food grain production from a bare 51 million tonnes in 1951-52 to 212 million tonnes in 2003 but India is still in insatiable condition. The Information and Communication Technologies (ICTs) can generate new opening to bridge the gap between information haves and information have-nots in the developing countries.

Indian Agriculture at a Glance:
- Agriculture continues to be the backbone of Indian economy.
- Agriculture sector employs 54.6% of the total workforce.
- The total share of agriculture & allied sectors (Including agriculture, livestock, forestry and fishery sub sectors) in terms of percentage of Gross Domestic Product is 13.9 percent during 2013-14 at 2004-05 prices. [As per the estimates released by Central Statistics Office]
- According to the Economic Survey 2019-20 Agriculture sector to grow at 3% in 2020-21.
- As per Second Advance Estimates for 2019-20, total food grain production in the country is estimated at record 291.95 million tonnes.

e-Agriculture in Brief

FAO proposes the following definition:

"e-Agriculture" is an expanding field in the intersection of agricultural informatics, agricultural development and entrepreneurship, referring to agricultural services, technology dissemination, and information delivered or enhanced through the Internet and related technologies. More specifically, it involves the conceptualization, design, development, evaluation and application of new (innovative) ways to use existing or emerging information and communication technologies (ICTs).

e-Agriculture aggrandizes the integration of technology with multimedia, knowledge and culture, with the aim of improving communication and learning processes between various actors in agriculture locally, regionally and worldwide. Facilitation, support of standards and norms, technical support, capacity building, education, and extension are all key components to e-Agriculture.

e-Agriculture Community constitutes of individual stakeholders such as information and communication specialists, researchers, farmers, students, policy makers, business people, development practitioners, and others. More specifically, e-Agriculture involves the conceptualization, design, development, evaluation and application of innovativeways to use information and communication technologies (ICT) in the rural domain, with a primary focus on agriculture. e-Agriculture is the Internet platform of this global initiative aimed at promoting sustainable agricultural development and food security by improving the use of information, communication, and associated technologies in the sector. In short e-Agriculture will connect all concerned persons starting from farmers to researchers together. Farmers can get the desired information at any instant of time from any part of world and they can also get the help from experts viewing their problem immediately by without moving anywhere [1].

LITERATURE REVIEW

A new concept about agricultural informatics has arisen following the rapid development in Information and Communication Technologies and of the Internet. Referred to as e-Agriculture, agricultural informatics is an emerging field which combines the advances in agricultural informatics, agricultural development and entrepreneurship to provide better agricultural services, enhanced technology dissemination, and information delivery through the advances in ICT and the internet. The e-Agriculture concept, however, goes beyond technology, to the integration of knowledge and culture, aimed at improving communication and learning processes among relevant actors in agriculture at different levels i.e. locally, regionally and globally. The dissemination of information to farmers has become increasingly integrated into ICTs [2].

The use of ICT in agriculture is increasingly growing. Information technology has long viewed as potential tool for improving decision making in agriculture. Various categories of users require information to carry out their activities effectively. The role of information technology is users need with the right information, in right form; in right time. Information technology can be defined as the science or practice of collecting, storing, using and sending out information, closely relevant to computer and telecommunications. The Information Technologies can generate new opening to bridge the gap between information haves and information have-nots in the developing countries. In agriculturally based developing countries like India cannot ignore agriculture in such transformation. Information technology refers to how we use information, compute and communicate information to the people.

ICT in agriculture is also known as e-Agriculture, is developing and applying innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. ICT in agriculture offers a wide range of solutions to some agricultural challenges. It is seen as an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. In this context, ICT is used as an umbrella term encompassing all information and communication technologies including devices, networks, mobiles, services and applications; these range from innovative Internet-era technologies and sensors to other pre-existing aids such as fixed telephones, televisions, radios and satellites. e-Agriculture continues to evolve in scope as new ICT applications continue to be harnessed in the agriculture sector. More specifically, e-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use ICTs in the rural domain, with a primary focus on agriculture.[3].

The task force on 'India as Knowledge Superpower' emphasized the need to harness ICT for community transformation. The agriculturally prosperous developing countries like India cannot overlook agriculture in such transformation. The emerging ICT have momentous role to perform in agricultural development. There are many possibilities of integration of ICT in agricultural, for the overall agricultural and rural development. What would happen if India needs to produce an additional 50 million tons of food grains to feed its increased population? This poses a major challenge not only for the policy makers but also more directly to the agricultural educationists, scientists and extension workers.

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 ICTs in the rural domain. The advancements in ICTs can be utilized 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.

The common problems in adoption of ICTs 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 [4].

The five key services proposed by Bhatnagar (2000) to analyse ICT application and their contribution to agricultural and rural development are:

1) Access to information through different typesof Agricultural Information Systems (AIS) e.g. village KIOSKS, e-Panchayat, Cyber Extensions.
2) Monitoring the situation of natural resources and impact through analysis of environment deterioration, soil erosion, deforestation etc. e.g. Geographical Information System (GIS).
3) Education and communication technologies that are playing a very important role in generating new approaches to learning and to knowledge management e.g. e-Library.
4) Networking where ICTs can contribute greatly in relating people or institution among them and facilitating the emergence of "virtual communication of stake holders" that generate and exchange information and knowledge among themselves.
5) Decision support system (DSS): Tools and practices through which data and information provide relevant knowledge inputs for informed decision making. e.g. expert system. [5]

RESEARCH METHODOLOGY

The paper is basically conceptual and descriptive, the data which has been used for the analysis, has been gathered from various secondary sources like research articles, published and unpublished scholarly papers, books, journals, speeches, annual reports, databases available on various websites. The analysis of the data has been done according to its nature.

OBJECTIVES OF STUDY

I. To study the role of information technology in agriculture sector.
II. To know how farmers or users get benefit from Information technology.
III. To know how information technology supports farmers to make decision.

Role of IT in Agriculture

In the context of agriculture, the potential of Information Technology (IT) can be assessed broadly under two heads: (a) as a tool for direct contribution to agricultural productivity and (b) as an indirect tool for empowering farmers to take informed and quality decisions which will have positive impact on the way agriculture and allied activities are conducted. Precision farming, popular in developed countries, extensively uses IT to make direct contribution to agricultural productivity. The techniques of remote sensing using satellite technologies, geographical information systems, agronomy and soil sciences are used to increase the agricultural output. This approach is capital intensive and useful where large tracts of land are involved. Consequently, it is more suitable for farming taken up on corporate lines. The indirect benefits of IT in empowering the Indian farmers are significant and remains to be exploited. The Indian farmer urgently requires timely and reliable sources of information inputs for taking decisions. At present, the farmer depends on trickling down of decision inputs from conventional sources which are slow and unreliable. The changing

environment faced by Indian farmers makes information not merely useful, but necessary to remain competitive. [6]

Need of Information Technology for Farmers

Farmers need of information on generated technology from the research system to apply them for agriculture production. This technology may include harvesting time, optimal planting, right method of diseases control, storage and processing methods, soil control methods, storage and processing methods and many more. Farmers also take decision about what and where to sell their farming products. Information not only help farmers to make beneficial decision in short period, it is also help to decide what will be produce.

Equipment of ICTs used in Agriculture

ICTs (information communication technology) includes any communication device or application as radio, computer, television, network hardware, cellular phones, software, and satellite systems etc., as well as the various services and applications associated with them, such as distance learning and video conferencing. It 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.

Indian Agricultural Web Sites

Here are some websites through which farmers are getting benefit to gain knowledge regarding their queries and they are also playing a vital role in awareness:

1. **www.indiaagristat.com** - It is a comprehensive source for Indian agriculture statistics which is regularly updated. It provides authentic statistical information on sectors like agricultural education, agricultural export, agriculture census, agriculture prices, agricultural insurance, animal husbandry, agricultural marketing, horticulture production, agricultural wages and all other relevant agricultural statistics of India. It also provides the agriculture related news.

The statistics available on this web site is widely used by Indian agriculture research institutes, Indian agriculture sector, agricultural economists and Indian agriculture universities for Indian agricultural information, agriculture research and agricultural production data.

2. **www.isapindia.org** - The site is all about the Indian society of agribusiness professional (ISAP) which works for helping the farmers' community and address the rural- urban income divide. It is a network of agriculture and allied sector professionals in India and developing countries.

3. **www.carrittmoran.com** - This site provides, information regarding tea and coffee-statistics (on production and sale), catalogues (of area- wise sale of different varieties of tea and coffee in India), market reports and TASI.

4. **www.fciweb.nic.in** - This is the site by Food Corporation of India. It works for effective price support, food security, price stabilization and distribute food grains through public distribution system for the benefit of both farmers and consumers.

5. **www.fredisurti.com** - Fredisurti is a flower company specializing in flower seeds. This site offers garden consultancy and distributor for all kinds of seeds.

6. **www.indiancommodities.com** - Information on cotton, rice, wheat, oilseeds, pulses, spices, coffee, and tea. This site requires registration, login and payment.

7. **http://www.isapindia.org** - Indian society of agribusiness professionals (ISAP) is a non-government, non-profit organisation. It is a network of agriculture and allied sector professionals in India and developing countries. Its vision is to instil economic security and stability among farming community particularly small and marginal farmers through holistic development of agriculture and rural sector.

8. **http://agricoop.nic.in/**- This website on agriculture will lay stress on the agricultural sector, employment, opportunities, industrial sector and infrastructure. The site also displays the plant protection information network, Rashtriya Krishi Vikas Yojana, and National Food Security Mission.

9. **http://www.apeda.com**- agricultural and processed food products export development authority (APEDA) is mandated with the responsibility of export promotion and development of the scheduled products like: floriculture, fruits and vegetables, processed foods, organic foods, animal products and cereals. In addition to this, APEDA is also responsible to monitor export of some non -scheduled items such as basmati rice, wheat, and coarse grains and also import of sugar.

10. **http://fert.nic.in**- The website Department of fertilizers, Govt. of India, gives information on different aspects of fertilizer.

11. **http://mofpi.nic.in/** - Ministry of food processing industries, is the main central agency of the Government responsible for developing a strong and vibrant food processing sector; with a view to create increased job opportunities in rural areas, enable the farmers to reap benefit from modern technology, create surplus for exports and stimulating demand for processed food.

12.**http://www.nationalfertilizers.com/**- National fertilizer ltd. is the second largest producer of nitrogenous fertilizers in the country. They produce urea and fertilizers which are beneficial for all types of crops.

13. **http://www.fertindia.com/** - This website gives in detail about fertilizer statistics in India, fertilizer prices and fertilizer marketing in India.

14. **http://www.upagriculture.org/**- This agricultural site shows new schemes related to farmers, facilities given to them, latest techniques, new agri-policies, quality control, useful machines, insects/diseases of crop and many useful information's related to agriculture.

15. **http://www.krishi.net/GovtLinks.asp#IO**- This website has a collection of various sites related to agriculture and have links to Govt. institution, agricultural universities, state links, and international organizations.

16. **http://www.indg.in/agriculture/**- aims to disseminate useful information about improved technology to the farming community and service providers in the rural areas. It aims to create a platform for different levels in the rural agricultural landscape - farmers, cooperatives and professional bodies, farm machinery vendors, fertilizer and chemical companies, insurance regulators and agronomists, consultants, and farm advisors.

Global Trends in e-Agriculture

Technology-based Solutions

ICTs (Information Communication Technology) includes any communication device or application as radio, computer, television, network hardware, cellular phones, software, and

satellite systems etc., as well as the various services and applications associated with them, such as distance learning and video conferencing. This is the case in precision agriculture in which farmers are harnessing computer and satellite technologies to cut costs, improve yields and protect the environment; and e-commerce (or e-marketing) in which the marketing and sale of agricultural products is conducted over electronic networks such as the Internet and extranets. On the other hand, in many developing countries farmers' access to information is improved through grass root level initiatives of using ICTs as well as distance education modalities to enhance the knowledge base among service providers.

Precision Agriculture

In precision agriculture or site-specific farming, farmers are using ICTs and other technologies to obtain more precise information about agricultural resources which allow them to identify, analyze, and manage the spatial and temporal variability of soil and plants for optimum profitability, sustainability, and protection of the environment [6]. Precision agriculture is described as: "A system to manage farm resources better. Precision farming is an information technology-basedmanagement system now possible because of several technologies currently availableto agriculture. These include global positioning systems, geographic information systems,yield monitoring devices, soil, plant and pest sensors, remote sensing, and variable ratetechnologies for application of inputs"[8].

Precision agriculture is an advanced e-Agriculture application. It makes use of five major components of technology:
1. Geographical Information Systems (GIS) for analysis and management of spatial data and mapping;
2. Remote Sensing (RS) to identify and
3. Global Positioning Systems (GPS) to locate and define spatial features or activities that contributes to the quality of site-specific practices;
4. Variable Rate Technology (VRT) allowing targeted, site-specific input applications; and
5. Yield monitoring for recording crop productivity as an historical database for crop management [9].

e-Commerce in Agriculture

Improved productions and high yields result in the need to look for profitable markets beyond local communities, and electronic markets are providing an opportunity to farmers to market and sell their produce to buyers at the global level. Electronic commerce (e-Commerce), simply defined as the general exchange of goods and services via the Internet, is already having a significant impact on agriculture. For example, by 2000, one in 25 U.S. farms had already bought or sold agricultural products on the Internet and Goldman Sachs had estimated that 12% of all agricultural sales in the U.S. would be conducted over the Internet in 2004, compared to only 4% in 1999. Further, a study conducted by Rockwood Research on Internet use by commercial farmers in the US found that farmers were primarily using the Internet to access information on commodity prices, weather, farm chemicals, and machinery. The study also showed that farmers were migrating quickly toward Web-based transactions such as purchasing seed, crop chemicals, and farm equipment on the Internet.

Kisaan Call Centre

Asymmetry of Information between farmer and farmer, village and village, region and region and the country as a whole versus other countries is a big challenge for Indian Agriculture sector and ICT is the feasible solution. More than 5 lakhs Indian villages are

already under the coverage of telecommunication network. To make the best utilization of the fast-growing ICT sector Department of Agriculture and Cooperation appointed TCIL, a Govt. of India Company to start the Kisaan Call Centre (KCC). KCC scheme is operational since 21st January 2004. These KCC can be accessed on a common toll-free number 1551 anywhere in India**.** There are 13 KCC; each centre is allocated a cluster of states. 116 Agriculture Graduate are posted in these call centers. The quarries received from farmers attended by these call centre executives (Agriculture Graduate) are replied in the local language. The quarries/problems which could not be cleared at level-I (call centre executives) are forwarded to 123 experts located in different parts of the country at State Agriculture Universities, ICAR institutes, almost sufficient to meets the local requirement.

CONCLUSION:

e-Agriculture is broadly defined as an emerging field focusing on the enhancement of agriculture and rural development through improved information and communication processes. More specifically, it involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (ICTs) in the rural domain, with a primary focus on agriculture. The techniques of remote sensing using satellite technologies, geographical information systems, agronomy and soil sciences are used to increase the agricultural output. This approach is capital intensive and useful where large tracts of land are involved. Consequently, it is more suitable for farming taken up on corporate lines. The indirect benefits of IT in empowering the Indian farmers are significant and remains to be exploited. The Indian farmer urgently requires timely and reliable sources of information inputs for taking decisions. ICTs (information communication technology) includes any communication device or application as radio, computer, television, network hardware, cellular phones, software, and satellite systems etc., as well as the various services and applications associated with them, such as distance learning and video conferencing. ICTs (information communication technology) includes any communication device or application as radio, computer, television, network hardware, cellular phones, software, and satellite systems etc., as well as the various services and applications associated with them, such as distance learning and video conferencing.

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