INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN AGRICULTURAL AND RURAL DEVELOPMENT-INITIATIVES BY GOVERNMENT OF INDIA

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ABSTRACT

E-Agriculture is an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. The main phases of the agriculture industry are: Crop cultivation, Water management, Fertilizer Application, 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, marketing. ICT can play a significant role in maintaining the different properties of information as it consists of three main technologies- Computer Technology, Communication Technology and Information Management Technology. There are different applications of ICT in Agriculture sector such as Office automation, Knowledge Management System, E-learning, E-commerce, ICT for managing Agricultural Resources and Services, CAM, CAD, RFIDs, Wireless Technologies, GPS and GIS. There are certain initiatives taken by the Central Government for the development of agriculture. The Central Ministry of Agriculture and National Informatics Centre (NIC) emphasized Informatics for Agricultural Development. Its main aim is to create an environment conducive for raising the Farm productivity and income through provision of relevant information and services to the stakeholders Department of Agriculture and Cooperation

Keywords: Role of ICT, applications, components, Government initiatives, implications.

1.1 Introduction

Information is the most valuable input in this new millennium for every sector. Therefore, accurate and timely information is needed for correct decision making process in present era. Access to information is a crucial requirement for sustainability of agriculture sector as well as industrial sector. It will help in sharing and cooperating information among interested parties with mutual understanding could bring the sustainable agricultural productivity and fair trade balancing the supply and demand. Information within the hands of the farmers means empowerment through control over their resources and decision-making processes. An effective and efficient delivery system of essential information and technology services, it
facilitates the clients’ critical role in decision-making towards improved agricultural production, processing, trading, and marketing.

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 (ICT) in the rural domain, with a primary focus on agriculture. The main phases of the agriculture industry are: Crop cultivation, Water management, Fertilizer Application, Pest management, Harvesting, Post harvest handling, Transporting of food/food products, Packaging, Food preservation, Food processing/value addition, Food quality management, Food safety and Food storage.

Near future it would be the major form of technology dissemination system of the agriculture sector. Therefore, the policy makers of the developing countries like India should pay attention to employ the ICT in transferring of agricultural technology for benefit of the small scale rural farmers.

ICT is facilitating faster sharing of information and innovations and acting as a key agent for changing agrarian situation and farmers’ lives by improving access to information and sharing knowledge.

2.1 OBJECTIVE OF THE STUDY

The objective of this paper is to examine agricultural extension programs within the public, private, and third sectors in India by focusing on the programs’ ability to meet farmers’ information needs. The paper also analyses the main challenges and constraints each agricultural extension approach faces in its operation in order to identify opportunities for increasing its effectiveness and efficiency in reaching farmers.

2.1.1 THE SHORTCOMINGS OF TRADITIONAL METHODS OVER ICT

The better the selection of information and communication channels, the more the effectiveness of extension programs in agriculture. Numerous studies have highlighted the shortcomings of traditional print- and library-based methods of providing information to rural farmers and rural community who are generally illiterate and relatively remote from formal sources of information.

2.1.2 SOME OF THESE SHORTCOMINGS ARE

(1) Irrelevance of the delivered information: At a time, only a few crops are being considered. Therefore, for the other farmers, the same information is irrelevant.

(2) Lack of coverage: The system is out of reach to the majority of the farmers who are illiterate or having little literacy.

(3) Lack of avenues to improve performance: It is a one-way process. The information is pushed to the farmer in one direction. Moreover, if a farmer complaints, there is no effective way to improve the service.
(4) **Unaccountability:** There is no way to fix the responsibility for the advice given by the system. It is a top-down approach.

(5) **Lack of focus** on location specific needs of regions, disadvantaged areas and target group requirements.

### 2.1.3 THE MAIN FOCUS OF AGRICULTURAL INFORMATICS DEVELOPMENT IS ON

- Improving Information Access and Delivery of Services for sustainable agricultural growth and livelihood.
- Adopting Global best practices.
- Empowering Farming Community & other Stakeholders.
- Promoting Informatics led Resource Planning and Management at grass root level.
- Strengthening Research and Education, Training, Extension and Development linkages.
- Achieving Agriculture Online.

### 3.1 LITERATURE REVIEW

The emergence of Information and Communication Technologies (ICT) in the last decade has opened new avenues in knowledge management that could play important roles in meeting the prevailing challenges related to sharing, exchanging and disseminating knowledge and technologies. Several past studies have examined Agricultural communication Research such as William and Woods (2002) studied agricultural research published in journal of applied communications between 1992 and 2001. Most of their studies focused on communication aspects such as radio or information technology. Rogers, (1962) provides a general framework, user acceptance of ICT is discussed by Venkatesh et.al. (2003) and the economics of specific agricultural technologies are reviewed by Griliches, Z, (1957, 1988) and Gelb, Kislev, Voet (1996). A long sequence of studies evaluates and quantifies various aspects of past and current farmer ICT Adoption and uptake constraints - International Conference (1983), NASS (2007), Taragula, et.al., (2008) Warren (2004), Kuhlmann (2005) and World Bank (2008).

### 4.1 ROLE OF ICT IN AGRICULTURE

ICT can play a significant role in maintaining the above mentioned properties of information as it 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.

### 5.1 THE TOOLS PROVIDED BY ICT ARE HAVING ABILITY TO

1. Record text, drawings, photographs, audio, video, process descriptions, and other information in digital formats.
2. Produce exact duplicates of such information at significantly lower cost.
3. Transfer information and knowledge rapidly over large distances through communications networks.
4. Develop standardized algorithms to large quantities of information relatively rapidly.
5 Achieve greater interactivity in communicating, evaluating, producing and sharing useful information and knowledge.

6.1 THE MAIN APPLICATIONS OF ICT IN AGRICULTURE SECTOR ARE LISTED BELOW

- Application of office automation

There are many government, private and non-government organizations involving in agriculture sector and rural development. They all have to work together to give better service to farming community. Therefore, application of office automation is one of the solutions to enhance the efficiency and interconnectivity of the employees work in all above mentioned organizations.

- Knowledge Management System (KM System)

It refers to a (generally IT based) system for managing knowledge in organizations for supporting creation, capture, storage and dissemination of information. It can comprise a part of a Knowledge Management initiative.

- E-learning

E-learning is essentially the computer and network-enabled transfer of skills and knowledge. E-learning applications and processes include Web-based learning, computer-based learning, virtual classroom opportunities and digital collaboration. It can be self-paced or instructor-led and includes media in the form of text, image, animation, streaming video and audio.

- Electronic commerce

It is commonly known as e-commerce, consists of the buying and selling of products or services over electronic systems such as the Internet and other computer networks. The use of commerce is conducted in this way, spurring and drawing on innovations in electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange (EDI), inventory management systems, and automated data collection systems.

- Computer-aided manufacturing

CAM is the use of computer software to control machine tools and related machinery in the manufacturing of work pieces. This is not the only definition for CAM, but it is the most common; CAM may also refer to the use of a computer to assist in all operations of a manufacturing plant, including planning, management, transportation and storage. Its primary purpose is to create a faster production process and components and tooling with more precise dimensions and material consistency.

- Computer-aided design (CAD)

It is also known as computer-aided design and drafting (CADD), is the use of computer technology for the process of design and design-documentation. Computer Aided Drafting describes the process of drafting with a computer. CADD software provides the user with input-tools for the purpose of streamlining design processes; drafting, documentation, and manufacturing processes

- Radio-frequency identification (RFID)
It is a technology that uses communication via radio waves to exchange data between a reader and an electronic tag attached to an object, for the purpose of identification and tracking. Some tags can be read from several meters away and beyond the line of sight of the reader. The application of bulk reading enables an almost parallel reading of tags.

- **Wireless communication**

  It encompasses various types of fixed, mobile, and portable two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking.

- **Global Positioning Systems**

  It used a constellation of five satellites and could provide a navigational fix approximately once per hour. In 1967, the U.S. Navy developed the Timation satellite that proved the ability to place accurate clocks in space, a technology required by GPS. In the 1970s, the ground-based Omega Navigation System, based on phase comparison of signal transmission from pairs of stations, became the first worldwide radio navigation system. Limitations of these systems drove the need for a more universal navigation solution with greater accuracy.

- **Geographical Information Systems (GIS)**

  A geographic information system (GIS), geographical information system, or geospatial information system is any system that captures, stores, analyzes, manages, and presents data that are linked to location.

### 7.1 FULFILLMENT OF AGRICULTURE SECTOR’S INFORMATION NEED BY THE APPLICATION OF ICT

#### a) Pre-cultivation: For this Information is required for the selection of the best crop according to their land, access to input and credit, market (Cost-Benefit), etc

- **Crop selection:** Decision Support System (DSS), modeling software, e/m-learning, e/m-consulting, Knowledge Management Systems (KMS)
- **Land Selection:** DSS, GIS, Remote sensing, e/m-consulting, KMS, sampling devices connected to networking tools
- **Calendar Definition:** KMS, e/m-consulting, e/m-learning, GPS, GIS

#### b) Crop cultivation and harvesting: For this Information is required for the sound management of the whole cropping activities, including the resilience to natural (e.g. weather) and anthropogenic shocks

- **Land preparation:** KMS, e/m-learning, e/m-consulting, GPS, GIS, computer controlled devices, machine2machine communication and sensor networks
- **Sowing:** GPS, GIS, e/m-learning, e/m-consulting, computer controlled devices, m2m communication, sensor networks
- **Input management:** DSS, MIS, GPS/GIS, e/m-learning
• **Water management**: DSS, GIS, MIS, sensor networks, m2m communication
• **Fertilization**: DSS, GIS, MIS, sensor networks, m2m communication
• **Pest management**: DSS, GIS, management information system, sensor networks, m2m communication.

c) **Post harvest**: For this Information related to post-harvest techniques and tools, marketing and transportation infrastructures, etc.

• **Marketing**: Networking tools (mobile phones, lo-fi technologies) for broadcast
• **Transportation**: GPS, GIS, MIS, DBMS, tracing devices, m2m communication
• **Packaging**: Tracing devices, KMS, e/m-learning, e/m-consulting, GPS, GIS
• **Food processing**: Farm to fork tracing tools – GPS, RFID, GIS, DBMS, MIS, KMS, e/m-learning, e/m-consulting, machine2machine communication

8.1 **THE MAIN COMPONENTS TO STRENGTHEN/PROMOTE THE AGRICULTURAL INFORMATION SYSTEM ARE AS FOLLOWS**

- DACNET: IT Apparatus in the field offices and Directorates of DAC
- DAIC: Development of Agricultural Informatics and Communication
- Knowledge Portal on Rain fed farming System (RFS) and Watershed Development
- Farm Mechanization

• National Bamboo Mission
• Mass Media Application in Agricultural Extension through AIR and Doordarshan Infrastructure
• Data Warehouse

1. **E-Governance Initiatives in Agriculture**

The Central Ministry of Agriculture and National Informatics Centre (NIC) emphasized Informatics for Agricultural Development through their National Conference on “Informatics for Sustainable Agricultural Development (ISDA-95). As a follow-up action, the following major informatics network services initiated to provide information access and services:-

<table>
<thead>
<tr>
<th>Major Informatics Network Services</th>
<th>Their Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRISNET</td>
<td>An Infrastructure network up to block level agricultural offices facilitating agricultural extension services and agribusiness activities to usher in rural prosperity</td>
</tr>
<tr>
<td>AGMARKNET</td>
<td>With a road map to network 7000 Agricultural produce wholesale markets and 32000 rural markets</td>
</tr>
<tr>
<td>ARISNET</td>
<td>Agricultural Research Information System Network</td>
</tr>
<tr>
<td><strong>SeedNet</strong></td>
<td>Seed Informatics Network</td>
</tr>
<tr>
<td><strong>CoopNet</strong></td>
<td>Agricultural Primary Credit Societies (PACS) and Agricultural Cooperative Marketing Societies to usher in ICT enabled services and rural transformation</td>
</tr>
<tr>
<td><strong>HORTNET</strong></td>
<td>Horticultural Informatics Network</td>
</tr>
<tr>
<td><strong>FERTNET</strong></td>
<td>Fertilizers (Chemical; Bio and Organic Manure) Informatics Network facilitating &quot;Integrating Nutrient Management&quot; at farm level</td>
</tr>
<tr>
<td><strong>VISTARNET</strong></td>
<td>Agricultural Extension Information System Network</td>
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<tr>
<td><strong>PPIN</strong></td>
<td>Plant Protection Informatics Network</td>
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<tr>
<td><strong>APHNET</strong></td>
<td>Animal Production and Health Informatics Network (Networking about 42000 Animal Primary Health Centers).</td>
</tr>
<tr>
<td><strong>FISHNET</strong></td>
<td>Fisheries Informatics Network</td>
</tr>
<tr>
<td><strong>LISNET</strong></td>
<td>Land Information System Network linking all institutions involved in land and water management for agricultural productivity and production systems; which has now evolved as</td>
</tr>
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</table>

| **APFINET** | "Agricultural Resources Information System" project during the Tenth Plan |
| **ARINET** | Agricultural and Rural Industries Information System Network to strengthen Small & Micro Enterprises (SMEs) |
| **NDMNET** | Natural Disaster Management Knowledge Network |
| **Weather NET** | Weather Resource System |

### 9.1 ICT AND DEVELOPMENT GOALS

Following are the achieved impact and implications of ICT applications:

<table>
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<tr>
<th>ICT Applications and development goal</th>
<th>Achieved impact</th>
<th>Further implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health information systems</td>
<td>Some evidence of limited progress in particular states</td>
<td>Disjunctur e between macro-level policy and micro-level implementation.</td>
</tr>
</tbody>
</table>
### 10.0 CONCLUSION

At last we may conclude that ICT plays a major role in the increased food production and productivity in India. It helps in the improving and strengthening the agriculture sector in India by providing certain benefits such as information on weather forecasting and calamities, better agricultural practices, better marketing exposure and pricing, reduction of agricultural risks and enhanced incomes, better awareness, better networking and communication, facility of online Trading, better representation of
various forums, etc. Indian Government has taken several initiatives to provide information access and services in the rural areas in the agricultural sector and these follow up actions have really proved effective in delivering accurate, complete, concise information on time. But as each coin has two sided similarly there are certain loopholes in the system of government which may be reduced by further modifications in the policies in the area of agriculture.

11.0 REFERENCES

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