

UNIT 55 – UPSC - E-technology in the aid of farmers

Agriculture is major sector in the enhancement of economy of any country. Information has the potential to improve efficiency in all spheres of agriculture. Agricultural practices and advancements differ internationally since plants have their own differences and the location plays a role on their progress as well. But through the exchange of knowledge from different agriculturally-involved individuals from all over the world, improvement of techniques can be experienced as well. It has made an impact on how information is shared, and being able to use this information for the progression of the agricultural sector and gives a great positive impact that is helpful for everyone. The main phases of the agriculture production include crop cultivation, water management, fertilizer application, pest management, harvesting, post-harvest handling, transport of food products, packaging, food preservation, food processing /value addition, quality management, food safety, food storage, and food marketing. All stakeholders of agriculture industry need information and knowledge about these phases to manage them efficiently. Any system applied for getting information and knowledge for making decisions in any industry should deliver accurate, complete, concise information in time or on time. The information provided by the system must be in simple form, easy to access, cost-effective and well protected from unlawful accesses. It include:

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



In Indian context, farmers in India are recommended to use Information and Information Technology for agricultural. India's food production and productivity can be increased by proper

use of Information Technology for farming purposes. Indicators in agriculture development in India includes Green revolution, Evergreen revolution, Blue revolution, White revolution, Yellow revolution, Bio technology revolution and the most recent one is Information and communication technology revolution. Information Technology supports new techniques for precision agriculture like computerized farm machinery that applies for fertilizers and pesticides. Farm animals are fed and monitored by electronic sensors and identification systems. Business operations such as Selling or buying online began to become popular in the world. However, its most important role remains communication, and the Internet has provided us with perfect opportunity to do so.

In India, Organizations and governments that care about farming can apply the agriculture model that proved successful in states like Odisha. It offers a unique opportunity to support small farmers in developing countries and potentially increase food security, create jobs, and support long-term economic growth. Information Technology has a major role to play in all facades of Indian agriculture. Additionally, Information technology brings qualitative improvement through facilitating farmers to enhance the efficiency and productivity of agriculture and allied activities. The employees who work for the welfare of Indian farmers, such as extension workers, do not have access to latest information which hinders their ability to serve the farming community successfully.

The advanced nations regularly apply laser technology instead of tractors to plough lands. This helps in optimising the use of various inputs such as water, seeds, and fertilisers. The agriculture situation all over the world is undergoing speedy change particularly after WTO agreements came into existence. In the context of agriculture, the potential of IT can be assessed broadly under two heads. As a tool for direct contribution to agriculture productivity, and as an indirect tool for empowering farmers to take informed and quality decisions which will have favourable impact on activities of agriculture. Information technology can initiate new agriculture and rural business such as e-commerce, real estate business for satellite offices, and rural tourism. Information technology can improve farm management and farming technologies by effective farm management. Therefore, Information technology can take an important and vital role for industrialization of farming or farm business enterprises by combining the above role. E-agriculture in India can put India on the higher base of Green Revolution that makes India self-sufficient in the area of food grains. Introduction of information technology have become as a strategic instrument for agricultural development and welfare of rural. The rapid changes and downward trend in prices in various constituents of IT makes it feasible to target at a large scale of IT penetration into rural India.

Role of IT in Agriculture:

In the framework of agriculture, impact of information technology can be evaluated broadly under two categories. First, Information technology as a tool for direct contribution to agricultural productivity and secondly, it is an indirect tool for empowering agriculturalists to take informed and quality decisions which will have positive impact on the agriculture and allied activities conducted. Precision agriculture which is popular in developed countries, broadly uses information technology to make direct contribution to agricultural efficiency.

The indirect advantages of information technology in empowering Indian farmer are significant and remains to be exploited. The Indian farmer instantly requires timely and reliable sources of

information inputs for taking decisions. Currently, farmers depend on dropping down of decision inputs from conventional sources which are slow and unreliable. The changing environment faced by Indian farmers makes information not just useful, but necessary to stay competitive.

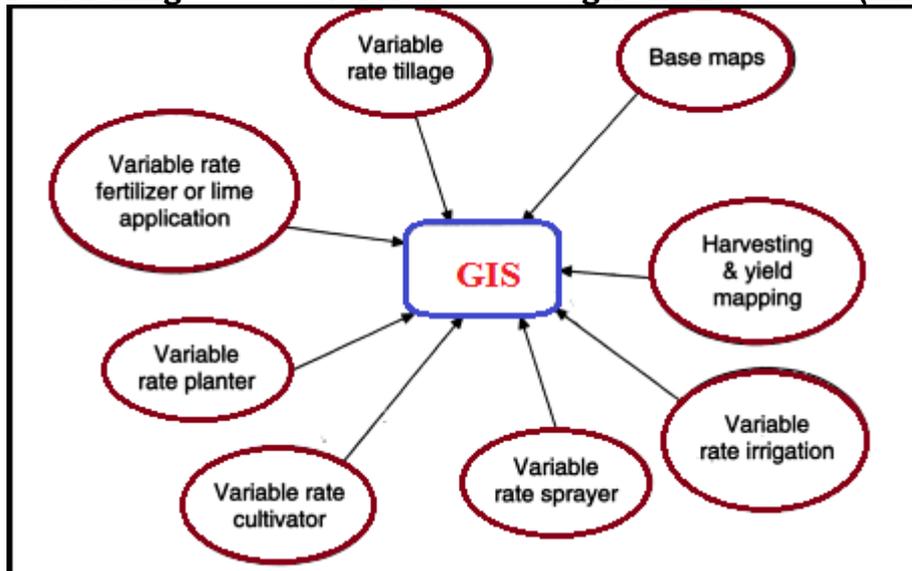
It is well recognized that E-Agriculture is a developing field focusing on the augmentation of agricultural and rural development through better information and communication processes. More precisely, e-Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies in the rural area, with a primary focus on agriculture.

Information technology can aid Indian farmer to get significant information regarding agro-inputs, crop production technologies, agro processing, market support, agro-finance and management of farm agri-business. The agricultural extension tool is becoming dependent on Information technology to provide appropriate and location specific technologies for the farmers to provide timely and proficient advice to the farmers. Information technology can be a best means not only to develop agricultural extension but also to expand agriculture research and education system. Internet can bring revolution in agricultural education management through smart exposure of agricultural teachers and educational planners, class rooms, virtual class as well as dropout agricultural learners. For agricultural extension management, role of Information technology can be encouraged for future resource documentation, as methods of extension and linkage between research and extension.

Information technology in agricultural research management for textual and non-textual documentations and deciding prioritization of research areas needs to be reinforced. The crop forecasting, input management, command area management, watershed management, land and water resources development , drinking water potential mapping precision management, natural disaster management, fishery management , hill area development and post-harvest management are major areas, where Information Technology has vital role. There are some technologies helpful for farmers to enhance productivity. Numerous methods like the practises of remote sensing using satellite technologies, geographical information systems, and agronomy and soil sciences are used to increase the agricultural productivity:

Global Positioning System:

A position information system enables the user to determine absolute or relative location of a feature on or above the earth's surface. Global Positioning Systems (GPS) involve numerous components and are most frequently used in agriculture for navigation (Whelan and Taylor. 2013). In agriculture, the Global Positioning System offer many benefits in geo-fencing, map-making and surveying. Global Positioning Systems receivers dropped in price over the years, making it more popular for inhabitant use. With the use of GPS, citizens can produce simple yet highly accurate digitized map without the help of an expert cartographer (Barry Allred, et, al., 2008).



Geographic information system has been broadly used in agriculture. In this technique, land is mapped digitally, and pertinent geodetic data such as topography and contours are combined with other statistical data for easier analysis of the soil. Global Positioning Systems is used in decision making such as what to plant and where to plant using historical data and sampling.

Global positioning options

Types of GPS	Accuracy	Average cost in AU\$	Agricultural uses
Standalone receiver: Usually a handheld unit that receives satellite signals	4-10 mtrs	100-1000	<ul style="list-style-type: none"> Recording location of on-farm activities such as soil and tissue tests Strategic trials
Differential receivers: Receiver plus additional fixed, ground-based reference stations to correct errors in original signal. May require a subscription.	0.1-1 mtr	Up to 10000	All the above plus: <ul style="list-style-type: none"> Guidance Yield mapping Variable rate control
Real-time Kinematic differential receivers: Type of differential receiver where correction signal comes	2-10 cm	10000-40000	All the above plus: <ul style="list-style-type: none"> Auto-steer Elevation mapping

from a local base station in real time.			Land levelling and forming
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Benefits of satellite navigation: Satellite navigation has many advantages as it improves efficiency of farming operations that help farmers save time and money. Some of these benefits are mentioned below.

1. Reduced skip and overlap of inputs
2. Reduced driver fatigue
3. Reduced compaction
4. Improved soil water management
5. Increased yield
6. Inter-row cultivation, spraying, and planting

Agricultural uses of Global Positioning Systems: There are several agricultural uses of Global Positioning Systems besides navigation. A common thread amongst all of these activities is the use of spatial data. When you have access to specific information about where different things are happening on the farm, this can help farmers better understand land and give them more confidence in making management decisions.

Additionally, agricultural Global Positioning Systems equipment and accompanying software can be used for automated record keeping and inter-vehicle communications, among other things. Understanding equipment and all of its capabilities can help farmers streamline their farming operation to become more efficient and productive (Whelan. and Taylor. 2013).

Mobile technologies:

Mobile technologies are very useful and act as a tool of intervention in agriculture. Smartphone penetration enhance the multi-dimensional positive impact on sustainable poverty reduction and identify accessibility as the main challenge in harnessing the full potential (Silarszky et al., 2008) in agricultural space. Reach of smart phone even in rural areas extended the information and communication technology services beyond simple voice or text messages. Several smartphone apps are available for agriculture, horticulture, animal husbandry and farm machinery. With the aid of mobile technology in the field, cultivators have been able to get their crops to grow to an ideal size, making it easier to harvest. Now crops were optimized for the soil type in which they were growing, resulting in maximum yield and more revenue for the farmer.

Smartphone Mobile Applications

The mobile phone technology is significant device to enhance farmers' access to better paying agricultural markets. Smartphone mobile applications designed and developed by Jayalaxmi Agrotech Pvt Ltd from India. These are the most broadly used agriculture apps in India. Their mobile apps are in regional language are designed to break the literacy barrier and deliver the information in most simple manner. Several thousands of farmers across Asia have generated

revenue with these apps. Today, smartphones are equipped with various types of physical sensors which make them a promising tool to assist diverse farming tasks. One factor that enhances the smartphones' ability to assist users to perform various tasks is the numerous built-in sensors (e.g., positioning sensors, motion sensors, cameras and microphones). Agriculture sector has adopted smartphones to facilitate their work (Cheung, 2009). Farmers use following relevant mobile apps to increase productivity.

1. Manure Monitor: This application aids a farmer in managing and logging data regarding manure. Base of the application depends on the data fed by the user. A simple interface offers categorized inputs for farmer. Easy and big sized input buttons are used and the flow among menu moves very smoothly. A farmer can record rainfall, storage, animal mortality, manure transfer, waterline and equipment information. Besides this, the App also provides some tutorials regarding manure. One major feature in the app is to create emergency plans and storing emergency contact information. Another important feature to be learnt from this App besides user interface is its self-sufficiency. The app keeps data local and does not depend much on internet connectivity for its operations. This guarantees its utility in areas with poor or no internet access.

2. Wireless Monitor: This app is aimed mainly for farm management. A standard data entry interface is provided to record information regarding different farmer tasks. For instance area coverage, chemical usage, property records are recorded for cost management. Crop monitoring tasks by regular data logging are provided. Information regarding pesticide spray, planting, and ground preparation can be stored in the app and then reviewed independently.

3. Location based apps: These apps use map and location details for their operations. They offer several facilities which rely on location parameters of the user or of the services he is looking for. These apps are basically used as Market finder apps for farmers to sell their produce.

- i. Delaware Fresh: This is a location based app which provides interface in the form of a map. It is local to Delaware and provides details of a large number of farmer markets in the area. It offers location detection thus enabling the user to search for a market nearby. After location point selection from the map, the app provides contact and time details of market with additional options of locating on map, calling the market, sending mail or visiting their website. Such operations accessible directly from the map make the use and navigation simple and efficient.
- ii. Michigan Farm Market Finder: This app furnish farm market information. It gives multiple interface methods, map based and alphabetically sorted list. Every location has its address, contact details, hours of operation, operating acres listed along. Also it shows all facilities available in that farm market ranging from fruit and vegetable to presence of recreational area in the market. The app also provides GPS routing to reach to the location.

4. Agriculture specific calculation apps: These are specially designed apps from IT professionals in agriculture. They contain pre-fed data and values according to which calculations are performed regarding agriculture information. These apps highpoint use of numerical input and not much text information, which helps manage language problems to a certain extent.

5. News and information specific: This is general app category for any domain. Apps that provide news and information are highly beneficial and popular among users. In agriculture also many

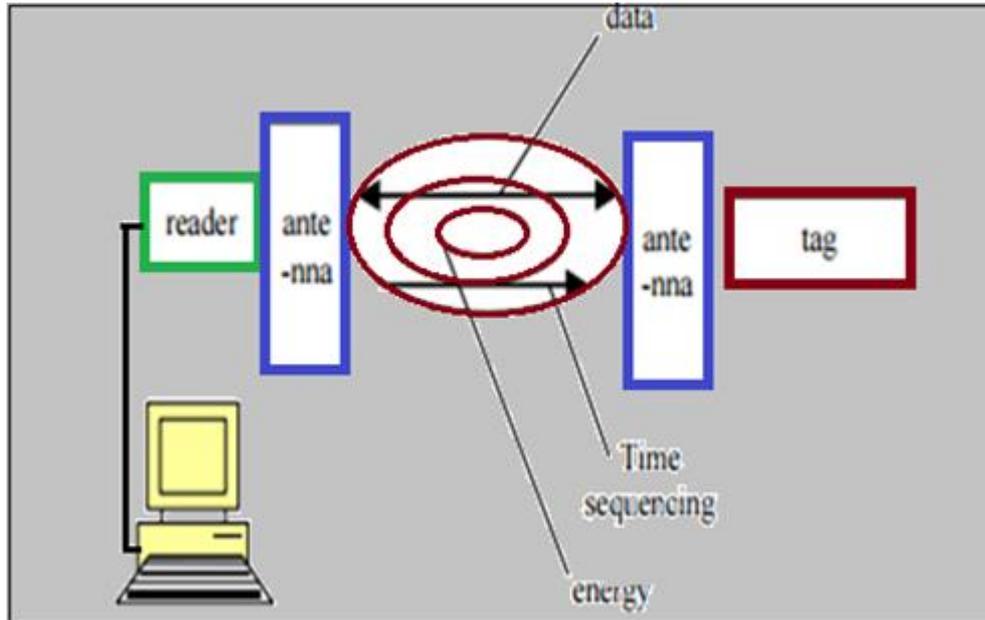
apps like Farm progress, Ag Weather tools etc. serve the purpose of delivering information relevant to agriculture stakeholders. From farmers' viewpoint, there are many apps that provide seed price, equipment price and similar information.

Automatic dehumidifier control system for agriculture using smart phone



RFID technology:

Technological advancement in RFID offer huge opportunities for research, development and innovation in agriculture. A standard RFID system comprises of Tag, Reader, and Application (Daoliang Li, Yingyi Chen, 2015). When an independent RFID tag approaches the RFID antenna, the induction between RFID tag and antenna happens. The RFID antenna reads the information and content recorded in the tag. Then the information is translated into the computational data by the RFID reader. Due to the portable RFID tag and untouched data transmission, many local or small area wireless applications for track and trace based on RFID systems were proposed. RFID has been widely used since over a decade in animal identification and tracking, being a common practice in many farms. It has been used in the food chain for traceability control. The implementation of sensors in tags, make possible to monitor the cold chain of perishable food products and the development of new applications in fields like environmental monitoring, irrigation, specialty crops and farm machinery.

Basic model of RFID system

Passive RFID transponders are used in a tree nursery to identify a special type of elm (Clasen & CO, 2010). The transponder is implanted under the bark and remains there even after delivery to the customer. With this method the tree nursery can give a guarantee of authenticity, and of the tree's source. Another application of this technology is that the RFID technology supports management of different attachment tools for hydraulic diggers. The fully automatic coupling systems are equipped with a RFID reader from manufacturer and the attachment tools themselves fitted with passive RFID transponders. This allows transmission of relevant data e.g. oil level, pressure and type of oil, when the digger and the respective tools are coupled.

Advantages of information technology/ e-agriculture:

There are many advantages of Information technology for the improvement and strengthening of agriculture sector in India which includes timely information on weather predictions and disasters as detailed under.

1. Better and spontaneous agricultural practices.
2. Better marketing exposure and pricing.
3. Lessening of agricultural risks and enhanced incomes.
4. Better awareness and information.
5. Enhanced networking and communication.
6. Facility of online trading and e-commerce.
7. Better representation at various forums, authorities and platform.
8. E-agriculture can play vital role in the increased food production and productivity in India.

Information technology and Indian Agriculture in the Future:

In the technical environment, it is possible to develop appropriate systems to cater the information needs of Indian agriculturalist. User friendly systems, particularly with content in local languages,

can generate interest in the farmers and others working at the grassroots. It is possible to create dedicated networks or harness the power of Internet to make these services available to all parts of the country.

It is a big and challenging task to create application packages and databases to cater to complete spectrum of Indian agriculture. The Long Term Agriculture Policy provides an exhaustive list of all the areas that are to be covered. This can be taken as a guiding list to evolve design and develop suitable systems catering to each of the specified areas. In India, there is an advantage of having a large number of specialised institutions in place catering to various aspects of Indian agriculture. These institutions can play a vital role in designing the necessary applications and databases and services. This will facilitate modularisation of the task, better control and help in achieving quick results. As several institutions have already developed systems related to their area of specialisation.

To get instant results, it may be useful to get the applications outsourced to software companies in India. This will enable quick deployment of applications and provide boost to the software industry in India. In order to avoid repetition of efforts, it may be suitable to consider promoting a coordinating agency which will have an advisory role to play in evolving standard interface for users, broad design and monitoring of the progress.

In the post WTO regime, it is proposed that it is beneficial to focus more on some agricultural products to maintain an unquestionable competitive advantage for exports. This will call for urgent measures to introduce state of the art technologies such as remote sensing, geographical information systems (GIS), and bio-engineering. India has made rapid paces in satellite technologies. It is possible to successfully monitor agricultural performance using remote sensing and GIS applications. This will aid in planning, advising and monitoring the status of the crops as well as also will help in responding speedily to crop stress conditions and natural calamities. Challenges of crop stress, soil problems, and natural disasters can be tackled effectively through these advanced technologies.

In order to develop these systems, it is essential to know that major audience that is targeted are not comfortable with computers. This places quality on user-friendliness and it may be useful to consider touch screen technologies to improve user comfort levels. It is often observed that touch screen kiosks, with their intuitive approach, provide a means for quick learning and higher participation. It is also necessary to provide as much content as possible in local languages. Once the required application packages & databases are in place, a major challenge is with respect to dissemination of the information. The Krishi Vigyan Kendras, NGOs and cooperative societies may be used to set up information kiosks. Private enterprises may also perform these activities. Facilities for email, raising queries to experts, uploading digital clips to draw the attention of experts to location specific problems can be predicted.

To summarize, Information and communication technologies have capability to enhance agricultural sector in developing countries by functioning as pioneering solutions to agricultural challenges. Information technology are drastically changing the life of human in all arenas including agriculture sector. Information technology use computers along with the telecommunication equipment for the retrieval, storage, transmission and manipulation of data, which are aimed to improve the competence in agriculture sector. Information and communication technologies act as an agent for changing farming and farmer's life by improving access of

information and sharing knowledge. Farmers can require extensive knowledge and information about improved farming practices, pricing strategy, market betterment, and new policy regarding agriculture technology and transfer it to among farmers. Information technology can directly support farmers 'access to timely and relevant information, as well as empower the formation and distribution of knowledge of the farming community itself. When agriculturalists will be able to obtain information about price, stock, supply and available market for their product, he would sell their products at the right price at the right time without much worry.

Government and various Agro based companies can provide various services through mobile technology by which farmers can access the information about price, stock and market practices (G.Kumar and R. Sankarakumar, 2012). It will help them to reduce the risk of under-selling and of either over or under-supplying or low price their crops in a given market. It can be established that the Information and communication technologies tools can change the ideas, activities and knowledge of the agriculturalists. Farmers feel empowered and can embrace appropriate measures at the time of need.