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2. Applications of ICT in Agriculture

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Abstract:

The use of information and communication technology (ICT) in agriculture is becoming more essential. E-agricultural is a new field that focuses on improving agricultural and rural development through improved information and communication systems. E-agricultural, in particular, entails the conceptualization, design, development, assessment, and deployment of novel ways to employ information and communication technologies (ICT) in the rural domain, with a primary focus on agriculture. The phrase "e-agriculture" is relatively new. E-agriculture is one of the action lines highlighted in the World Summit on the Information Society's statement and plan of action. The United Nations Food and Agriculture Organisation (FAO) has been tasked with organising activities connected to the action line C.7 ICT Applications on E-Agriculture. Crop Cultivation, Water Management, Fertiliser Application, Fertigation, 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, Food Marketing are the major phases of the agriculture industry. To handle these phases properly, all players in the agriculture industry require information and expertise about them. Any system used to obtain information and knowledge for decision making in any industry should provide accurate, complete, and concise information on time or on time. This paper will explore ICT Applications in Agriculture.

Keywords:

Information, Communication, Technology, E-Agriculture, Design, Development, Primary Agriculture, Water Management, Fertilizer Application, Fertigation, Pest Management, Harvesting, Transporting Food, Food Products, Packaging, Food Preservation.

2.1 Introduction:

ICT in agriculture is a new field that focuses on improving agricultural and rural development. It entails the employment of innovative ICT applications in the rural domain. ICT advancements can be used to provide farmers with accurate, timely, and relevant information and services, facilitating an environment for more profitable agriculture. However, all ICT projects are not uniform, with inequalities in the degree and quality of telecommunications, information, and the effort of individuals, public and commercial organisations, and the diversified nature of farmer demand in different places. [1]

As a result, there have been numerous successes, failures, lessons learned, and years of experience gained. While these initiatives are intended to address farmers' needs through ICT, their actual usage and ability to have a significant impact on farm productivity and socioeconomic development of the intended beneficiaries actually use the facilities provided for them to meet their needs. [2]

Common obstacles in rural ICT adoption include ICT illiteracy, the availability of relevant and localised information in their own languages, easy and affordable accessibility, and other issues such as rural peoples' understanding and willingness to use new technology, among others. As shown in various ICT-driven efforts, one essential feature in the use of ICTs for farmers and their groups is the engagement of the human interface at the last mile, demonstrating that there is human dependency in the transfer of Information Knowledge to farmers.

As a result, there is a need to evaluate how far ICT projects can fulfil farmers' demands so that better solutions can be developed to address those unmet needs. The proposed research will look at important ICT initiatives in agriculture from the past and current. [3]

Information and communication technology in agriculture (ICT in agriculture), often known as e-agriculture, aims to boost agricultural and rural development by enhancing information and communication operations. E-agricultural, in particular, entails the conceptualization, design, development, assessment, and deployment of novel ways to employ information and communication technologies (ICTs) in the rural domain, with a primary focus on agriculture. ICT devices, networks, mobiles, services, and applications [4] span from cutting-edge Internet-era technologies and sensors to pre-existing aids such as landline telephones, televisions, radios, and satellites. E-agriculture includes the provision of standards, norms, techniques, and instruments, as well as the development of individual and institutional capacities and policy support. [5]

Many ICT in agriculture or e-agriculture solutions have been created and tried around the world to assist agriculturists in improving their livelihoods by increasing agricultural output and revenue or lowering risks. [6] Some useful resources for learning about e-agriculture in practise include the World Bank's e-sourcebook ICT in agriculture - connecting smallholder farmers to knowledge, networks, and institutions (2011), ICT uses for inclusive value chains (2013), and Success stories on information and communication technologies for agriculture and rural development, which has documented many cases of ICT use in agriculture. [7]

Regardless of the animal, automatic cleaning systems are the most extensively used technology in animal husbandry. These devices aid in the removal of waste and runoff from animal enclosures such as pens and stalls and transporting it to a mound that can subsequently be moved by machines. The benefits of this technology are self-evident. Dairy farming has evolved tremendously in the last few decades. Farmers no longer spend hours milking each cow by hand. Dairy farmers have enhanced the daily quality of life for their herds as a result of technical improvements. Cows are milked using a suction technique in dairy production. Vacuums in a parlour are contained within separate milk machines. [8]

With this method, multiple cows can be milked at the same time. On dairy farms, automatic milking systems, commonly known as "robots," are becoming increasingly popular. To maintain their herds healthy and produce milk, most dairy farms rely on cutting-edge technology. Farmers may now control their productivity and animal health using computers and mobile apps. GPS for navigation and location finding, mobile phones for trade, information exchange, and emergencies, Satellite Remote Sensing (RS) for fishing forecasts and cultural site selection, and radio for communication, particularly in the fishing industry, are all examples of how ICT is widely used. [9]

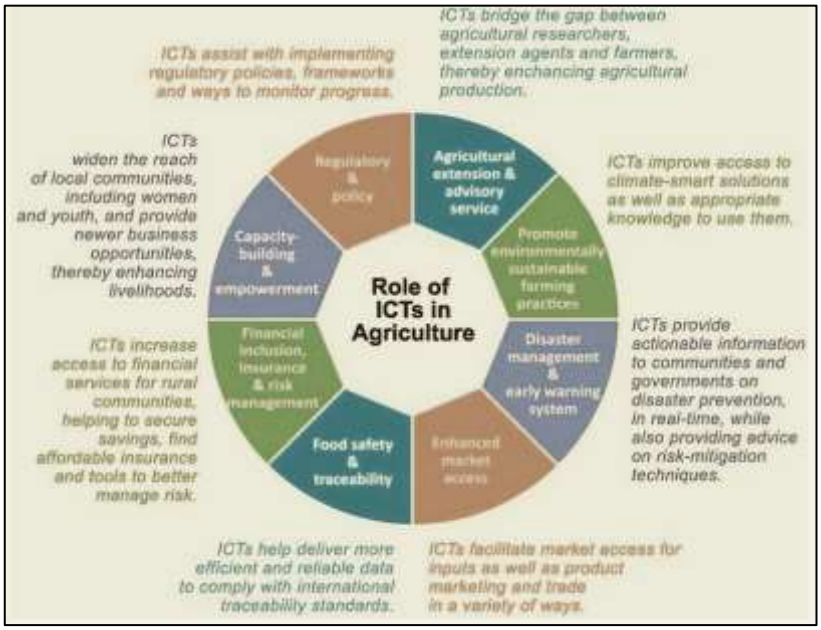

Figure 2.1: Role of ICT in Agriculture [10]

Farmers and the food industry as a whole can benefit greatly from ICT. ICT is especially important for crop and environmental monitoring, supporting sustainable development, and enhancing supply chain logistics. Chemical fertilisers, insecticides, herbicides, advanced farming machinery, and artificial selection have all increased food output. Satellites are used to monitor agricultural progress, identify crop diseases, and assess the need for extra fertiliser. So, these are the ICT uses in agriculture in today's dynamic world. [11]

2.2 Role of ICT in Agriculture: Harnessing Modern Technology for Farming:

Information and communication technologies (ICT) have swiftly altered numerous industries around the world, including agriculture. ICT in agriculture is becoming a significant field, employing modern technologies to streamline farming practises, cut expenses, and optimise productivity. The breadth of ICT applications is enormous and ever-evolving, ranging from sensor-based systems to mobile apps.

2.2.1 Mobilizing Agriculture With ICT:

When considering ICT in agriculture, mobile technology is another key role. Mobile applications enable real-time access to vital information such as weather predictions, market pricing, and expert advice. These applications also promote knowledge-sharing and collaborative problem-solving within the farming community.

Figure 2.2: Mobilizing Agriculture With ICT

2.2.2 The Power of IOT in Agriculture:

The Internet of Things (IoT) elevates agricultural ICT to a whole new level. The Internet of Things entails the usage of sensor-based systems and smart gadgets that connect and interact with one another. These systems collect and analyse information on weather, soil quality, crop health, and livestock behaviour. IoT has a wide range of applications, including automating irrigation systems, optimising fertiliser use, and forecasting possible pest or disease outbreaks. IoT devices can monitor animal health and behaviour in livestock production, offering early warning indications of disease or discomfort.

2.2.3 ICT And Big Data in Agriculture:

Big Data has found its way into the agriculture industry, thanks to the constant influx of data from many sources. The combination of ICT and Big Data delivers intelligent analyses and projections that can improve agricultural decision-making processes. Agriculture ICT applications can handle, interpret, and derive insights from massive data sets, enabling for better production prediction, cost efficiency, and risk management. [12]

2.2.4 Role of ICT in E –Agriculture:

Communication and Information Technology refers to any communication device or application, such as television, radio, mobile and computer, network hardware, fixed phones, satellite systems, and software, that is required for the delivery of information

from Point P to Point Q in the form of data, image, audio, video, and so on. ICT refers to all technology techniques of handling information and facilitating communication. The dissemination of information to farmers has grown more integrated with ICTs. [13]

Many corporate, cooperative, government, and public organisations have also worked to assist technology transfer in the agriculture industry. A novel notion of agricultural informatics that has resulted from the rapid development of information and communication technology, as well as the internet. Rural telecentres give agricultural, educational, and healing tissue information, as well as computer skills and basic literacy to rural citizens. The role of information and communication technologies in promoting communication and access to information for rural development and agriculture is critical. [14]

ATV shows and radio broadcasts also provided agricultural information. Because of its popularity and widespread use, information and communication technologies are having a significant impact on the rural economy. It may appear odd that modern technology, which is associated with developed-country markets and capital-intensive techniques of production, has any relevance for a country like India, where many millions of people lack basic necessities. Nonetheless, many attempts are being made in India and other developing nations to demonstrate the actual benefits of ICT for rural populations and to do so in a cost-effective manner. Following are some examples of ICT applications. [15]

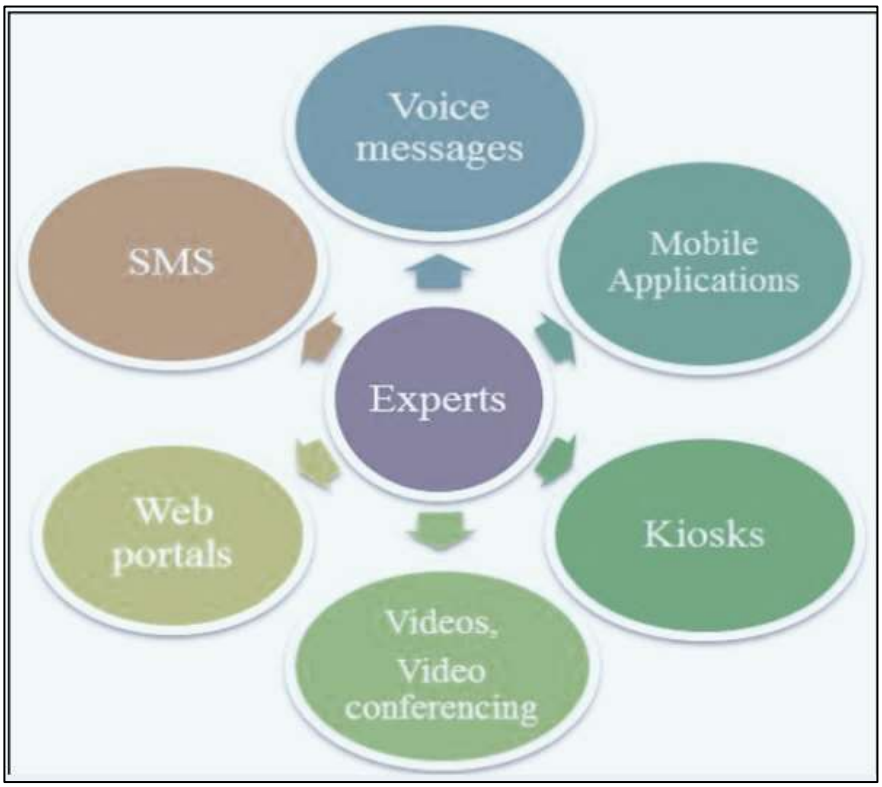

Figure 2.3: Some Application of ICT [16]

2.3 Advantages of ICT in E-Agriculture:

Advantages of ICT in E-agriculture are following.

a. Increased farmer productivity and profitability with ICT and E-Agricultural facilities.
b. Effective resource utilisation and management
c. The farmer receives timely rain and other crucial information.
d. By utilising tools such as GIS, it can help policy and decision-making information and evaluation on optimal farm production, agri-environmental resource management, and so on.
e. It can also generate new agricultural and rural businesses such as rural tourism, real estate for satellite offices, e-commerce, and virtual corporations of small-scale farmers.
f. It can give a more pleasant and secure rural life with amenities comparable to those available in urban areas, such as telemedicine, distance education, remote public services, remote entertainment, and so on.
g. Creation of Decision Support, Knowledge Management, and Advisory Systems to improve Extension services and to be used in the Farmers Redressed System.
h. It may improve farm management and agricultural technologies through efficient farm management, risk management, knowledge transfer, and effective information dissemination, among other things, resulting in competitive and sustainable farming with safe goods. In this assistance, farmers must make key decisions such as what to plant, when to sow, and how to manage blighter while taking into account off-farm considerations such as market access, environmental implications, and industry norms. A decision support system based on information technology can undoubtedly aid their decisions.
i. It can provide processes and instruments to ensure food reliability and traceability, which has emerged as a worry with agricultural products since major contamination such as chicken flu was discovered. [17]

2.4 Future Outlook in ICT for Agricultural:

The importance of ICT and its application in agriculture for the long-term development of agriculture and the national economy cannot be overstated. The concerns listed below are critical for ICT management in sustainable agriculture.

a. Agriculture information system
b. Marketing data management system
c. Information management system for research
d. Information system for water and irrigation management
e. System for anticipating production
f. Scenarios of climate change
g. Inventory management methods
h. Database of agricultural technology
i. Price Information System for Agricultural Products
j. Access to an up-to-date bio-physical database
k. Crop zoning diagram [18]

Table 2.1: Use of Information and Communication Technology in Agriculture [19]

Type of ICT	Type of Farmers	
	No. of Small Scale Farmers	No. of Medium Scale Farmers
Newspaper	30	32
Periodical/Agriculture magazines	3	5
TV (Agriculture Programme)	15	10
Radio (Agriculture Programme)	5	2
Availability of Mobile phones	40	45
With internet	5	5
Without internet	15	20
Availability of Computer	5	10
With internet	2	5
Without internet	3	2
Information through mobile phone call	2	5
SAU website	0	0

A. ICT for Agriculture:

Information and communication technologies (ICTs) have grown increasingly significant in all parts of our everyday lives and work around the world. The World Bank argues in its newest report "Digital Dividends" that "digital technologies—the internet, mobile phones, and all the other tools for collecting, storing, analysing, and sharing information digitally—have spread rapidly." [20] In underdeveloped countries, more families own a mobile phone than have access to power or clean water, and about 70% of the bottom fifth of the population owns a cell phone. "In a decade, the number of internet users has more than tripled, from 1 billion in 2005 to an estimated 3.2 billion by the end of 2015." [21]

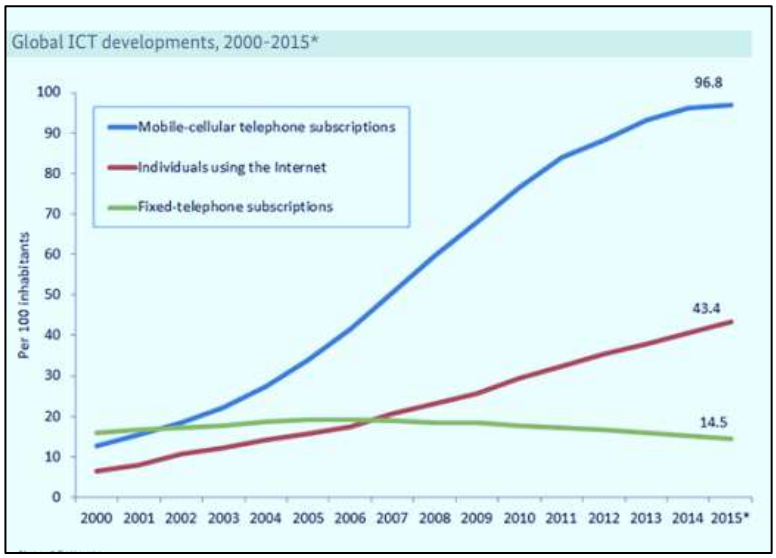

Figure 2.4: Global ICzT Developments

Impact of Some ICT-Based Initiatives:

Because the initial investment in ICT for agricultural development is costly, one of the crucial problems to consider is the potential influence ICT can have on farmers and farming. It is impossible to isolate the sole influence of ICT, but any impact evaluation would basically suggest the potentialities of ICT in employing information transmission and the following benefit of augmenting farmers' revenue by saving time and money. [22]

Yield Gain and Reduction in Cost of Cultivation:

Figure 20.1 shows that both the I kisan and Helpline programmes increased farmers' access to knowledge, allowing them to adopt improved varieties and need-based pest and nutrient management practises, as well as reducing the frequency with which agrochemicals were applied. As a result, crop yield increased by 4-5 percent. [23]

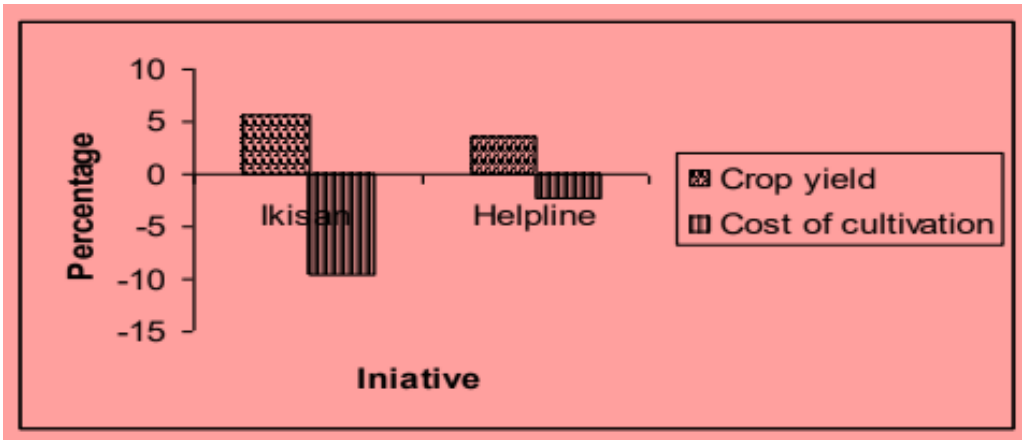

Figure 2.5: Impact of ICT on crop yield and cost of cultivation

Furthermore, the cost of cultivation was reduced by 14% and 3% in the case of the I kisan and Helpline programmes, respectively. I kisan's ICT-enabled farm management advising, i.e., visits by agricultural experts to fields and technical recommendations to farmers based on soil testing, increased farmers' knowledge utilisation level. [24]

2.5 Conclusion:

Hundreds of grassroots ICT projects have been implemented in India over the last decade and a half. Agriculture is invariably included as an essential component of the project service menu. However, we have yet to see significant increases in agricultural production as a result of ICT implementation. Because most initiatives are executed in smaller geographical areas and involve only a few hundred farmers, generalisations may be inappropriate. Much-touted ICT programmes have yet to provide results in agricultural information distribution. Despite the fact that ICTs have the potential to make a difference and accelerate information access for some farmers, most ICT projects have been implemented as pilot projects, and institutionalisation of ICTs needs to be prioritised.

ICTs for agricultural extension programmes must be objectively assessed and evaluated. Mobile phones, for example, are low-cost ICT instruments that hold a lot of promise for agricultural extension. Simultaneously, experience suggests that ICT will play a larger role in private sector agribusiness, market information, and market intelligence. Furthermore, certain types of farm information (e.g., informing government schemes) and online monitoring of governmental programme progress have proven to be successful. As a result, it is critical to identify acceptable information to disseminate via ICTs.

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