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## ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN INDIAN AGRICULTURE AND ITS CHALLENGES

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### Abstract

Information and communication technology (ICT) is an umbrella term that covers all form of communication technology, including radio, television, cellular phones, satellite systems, computer and networks, as well as the various services and applications that are linked to them, such as video conferencing and distance learning. ICT in agriculture is an emerging field that focuses on improving agriculture and rural development. With the increasing importance of ICT in different segments of agriculture and its application in boosting the performance of farmer's activities, the proposed research aims to explore the role of ICT and its challenges in agriculture. The present study is purely a review paper, so the existing literatures are used as research methods. The findings of the study revealed that ICT plays an important role in agriculture. It helps in the improving and strengthening the agriculture sector in India by providing certain benefits such as information on weather forecasting and natural calamities, better agricultural practices, better marketing exposure and pricing, decrease agricultural risks and enhanced incomes, better awareness, better networking and communication, facility of online trading, better representation of various forums etc. The study also found that language barrier, lack of training and practical exposure to ICTs, low ICT literacy, lack of ICT handling skills, poor finances and power shortages etc were some of the serious challenges in using different ICTs tools in agriculture.

**Keywords:** Information And Communication Technology, Role Of ICT, Agriculture, Challenges

### 1. Introduction

Agriculture is the backbone of the Indian economy and hence there had been a number of initiatives to aid the growth of agriculture in India. Agriculture is one segment where information and communication technology (ICT) has experienced significant expansion. ICT in agriculture is an emerging field that focuses on improving agriculture and rural development (Passah et al., 2022). ICT is an umbrella term that covers all forms of communication technology, including radio, television, cellular phones, satellite systems, computer and networks, as well as the various services and applications that are linked to them, such as video conferencing and distant learning. It also includes a wide range of modern technologies, such as satellite-based communication systems, mobile phones, multimedia, and internet, in addition to more traditional ones like radio, television, and the telephone. They include the "new" ICTs such as computer software, satellite and wireless technologies, and the Internet in addition to the "old" ICTs such as radio, television, and the telephone (Anand et al., 2020). ICT in agriculture may take a variety of forms, including websites, radio, kiosks, television, mobile applications etc. Most frequently used ICT for social communication, contacting middle men for the marketing of produce and contacting experts on real time basis was mobile phone followed by television. The government and numerous other organizations have undertaken a number of initiatives in recent years to accelerate the ICT trend in agriculture, including eNam, Kisan Call Center, mKisan, Kisan TV, AGMARKNET, Digital Green, ITC's E-choupal, etc. ICT, with a primary focus on agriculture, helps to enhance rural areas through a number of its services (Jat, Punjabi and Bhindi, 2021; Passah et al., 2022b).

ICTs has a significant impact on agricultural production and productivity (Ali, Jabeen and Nikhitha, 2016; Chavula, 2014; Lio and Liu, 2006; Parmar, Kathiriya and Kamani, 2015; Sennuga, Conway and Sennuga, 2020). ICTs have the potential to provide farmers with accurate, timely, and pertinent information about agricultural technologies, best



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practices, markets, price trends, consumer preferences, weather, and soil moisture conditions, facilitating an environment for more lucrative agriculture and better agricultural output. Information based on ICTs is essential for the adoption of various crop-related technologies to improve small-holder farmers' income and yield (Pandey, 2017; Sethy and Mukhopadhyay, 2020). ICT-based technologies are a blessing for agriculture since they provide farmers the data, knowledge, and power to use modern agricultural technology to increase the production of higher-value crops, reduce production costs, raise selling prices, and use fewer pesticides on their farm's vegetable crops (Das, Munshi and Kabir, 2016). The information and communication infrastructure is necessary for the application of modern industrial inputs in agricultural production. Higher levels of ICT adoption, which indicate more favourable conditions for transactions, could result in the emergence of more specialized labour and intermediate goods and raise agricultural productivity levels (Lio and Liu, 2006b). According to Saidu et al. (2017), among the potential advantages of ICT in the agricultural sector are the enhancement of market activities, the exchange of pertinent information, financial gain, global networking of the agricultural sector, conducting research, and planning economic growth for self-reliance. Furthermore, ICT contributes to the rise in demand for innovative methods, commercial models, best practices, and design principles in agricultural and rural development initiatives. The usage of ICT allows farmers to access lot support. Through a variety of media and ICT methods, the right knowledge and understanding about crops, seeds, fertilizers, marketing, and other related information is obtained (Sinha, 2013).

Hence with the increasing importance of ICT in different segments of agriculture and its application in boosting the performance of farmer's activities, the proposed research aims to explore the role of ICT and its challenges in agriculture.

## 2. Material and Methods

The present study is purely a review paper, so the existing literatures are used as research methods. Several articles were located through Google searches and compiled by making in-depth studies of articles published in various journals in order to gather pertinent literature on the various roles of ICT and its challenges in agriculture. Therefore, the study is an opinion piece that prominently cited recent literatures from journals, internet and other sources.

## 3. Findings and Discussions

### 3.1 Role of Information and Communication Technology (ICT) in Agriculture

Information and communication technology (ICT) refers to all information and communication systems including print media, electronic media such as radio, television, and digital media such as internet or World Wide Web (Baruah and Mohan, 2021). Information and communication technology have always played a key role in agriculture. Farmers have been looking for ways to improve crop production ever since they started growing crops. Many government agencies have looked into how ICT can support agriculture production systems, and it has proved that this technology can transmit technology and can be used to share modern agricultural methods with farmers (Lokeswari, 2016). According to Das, Munshi, and Kabir's (2016b) study, ICT play a significant role in boosting agricultural production of rice, wheat, potato, maize and pulses. ICT also contributes to the empowerment of the underprivileged and rural populations by providing access to natural resources, enhanced agricultural technologies, efficient production techniques, markets, banking and financial services, local and national agricultural policies etc. ICT has greatly aided the agricultural industry, improving rural people's quality of life (Sinha, 2013b).

Information and Communication Technologies (ICT) act as a crucial agent in agriculture sector to address a number of agricultural issues and enhance the livelihoods of the rural poor who depends on farm produce. ICT plays a significant role in improving the impact and performance of agricultural production and in directly reducing poverty by enhancing poor people's activities and increasing their productivity through new credit and financial services, new opportunities to design, manufacture, and market products through the Internet or intranet systems etc (Bhalekar, Ingle and Pathak, 2015). ICT helps in the improvement and strengthening of the Indian agriculture sector by providing



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significant benefits like information on weather forecasts and calamities, better agricultural practices, better marketing exposure and pricing, decreased agricultural risks and increased incomes, better awareness, better networking and communication, the ability to conduct online trading, better representation of various forums, etc. (Kumar et al., 2021; Singh, 2012). Furthermore, ICT should be included in national policies for poverty reduction because it has the ability to support agricultural productivity, food security, and sustainable livelihood. ICTs have a well-established role in advancing agriculture and enhancing the lives of farmers in rural areas. It can be beneficial for a small-scale farmer to obtain pertinent information about agricultural inputs, crop production techniques, agricultural processing, market assistance, agricultural financing, and farm enterprise management (Ajani, 2014). Additionally, it provides a centralized method for farmers to share information, cutting-edge technology, actual information, cutting-edge farming practices, and harvesting procedures with the agricultural sector (Kumar, Kumar and Pal, 2021).

ICT in agriculture is a growing paradigm that focuses on improving agricultural and rural development in India. With the use of modern information and communication technology (ICT), rural households, farmers, fishermen, and women now have new opportunities to overcome the knowledge gap that cause them to suffer. Technology has the benefit of being gender neutral. ICTs give people access to training and market information that can benefit both men's and women's enterprises. ICT applications, especially mobile phones, are assisting farmers in changing the exiting attitudes. These days, farmers in particular have the possibility to obtain information on marketing and weather due to mobile phones. Farmers connect with market vendors, Kisan Call Centers, friends, extension agents, and the internet via mobile phones. They can also use smart phones to access the internet. Most importantly, help them in changing the traditional farming pattern (Anand et al., 2020b; Deka et al., 2019; Pandey, 2017b; Swaminathan and Swaminathan, 2018).

Information and communication technology (ICT) can play a variety of roles in the growth of agriculture, including decision support systems, empowering and strengthening farmer communities, and expanding market access (Singh, Ahlawat and Sanwal, 2017). Esfahami and Asadiyeh's (2009) study revealed that ICT can have an impact on agriculture by informing farmers about the best times, prices, and locations to sell their products, assisting them in marketing their goods, facilitating access to new markets, credit, and production resources, increasing awareness of current market policies, facilitating cheaper and faster trade of agricultural goods, and creating a web-based database of websites that offer information and tutorials in farming. The development of agriculture depends on the new ICTs, which are essential catalysts. It helps in the timely delivery of solutions to farmers by scientists, the dissemination of information to farmers through the agriculture extension service, and government awareness-raising among farmers. ICTs can be effectively used to adopt contemporary agricultural techniques and increase production in a sustainable way. ICTs therefore play a vital role in the lives of farmers since they give them access to the most recent information on agriculture, online buying and selling, daily weather forecasts, details on cropping patterns, soil conservation, government programmes etc (Chowhan and Ghosh, 2020; Parmar, Kathiriya and Kamani, 2015b).

### 3.2 Challenges of Information and Communication Technology (ICT) in Agriculture

The role of Information and Communication Technologies (ICTs) in most agricultural operations is gradually increasing, yet there are several issues with ICT-based services that need to be addressed and necessitate extensive research.

The major challenges to farmers in adopting ICT, according to Rengaraj and Shibu (2020), is a lack of training on how to use ICT tools to improve agricultural practices. This is followed by poor power supply, complicated use, poor internet or phone connectivity, inadequate availability of ICT services to rural farmers, a lack of financial resources, etc. According to Syiem and Raj (2015), the main obstacles to the farmers' effective use of ICTs included lack of confidence in operating ICTs, ignorance of the benefits of ICTs, a lack of skill in handling ICTs, low ICT literacy, a lack of repair facilities, attitudes towards ICTs that were unfavourable, a lack of financial resources, a lack of training and practical experience, a high cost of repairing ICTs, and a dearth of regional languages. Although using ICTs to enhance agriculture has benefits, there are also barriers to accessing ICT use in agriculture, including poor accessibility of ICT services to



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rural farmers, ignorance of ICT use in agriculture, market information on cost, supply, and demand that has a negative impact on the compensation paid to farmers, lack of knowledge of the needs and difficulties faced by small-scale farmers, inability of verbal communication of data and information provided by ICT medium, need for government machinery to boost ICT application in rural areas, and a lack of enough electricity (Sinha, 2013c; Singh, Sankhwar and Pandey (2014).

The review also identified a number of challenges and issues that prevent successful ICT adoption in agricultural expansion, including inadequate ICT facilities, a lack of employees, poor infrastructure, harmonisation of knowledge and language, and farmers' perceptions (Saidu et al., 2017b). Moreover, Sennuga, Conway, and Sennuga (2020b) study reveals that language barriers, low levels of formal education, a lack of ICT devices, a high cost of ICT devices, and extremely low smallholder income are the biggest challenges preventing smallholders from using ICT devices. Additional challenges to smallholders utilising ICT tools include a lack of ICT centres (signals) in the area, poor ICT benefits, a lack of understanding of the value of ICT in the area, and a lack of ICT training facilities in the area.

At the macro level, barriers to the adoption of ICT include uneven regional development, which increases state inequality as well as rich-poor and urban-rural disparities, and a lack of absorptive capacity, which prevents information from spreading to other economic sectors. At the micro level, ICT's improvement is still a cause for concern (Adhiguru and Devi, 2012). There are few studies that demonstrate that the common issues with ICT adoption in agriculture are the high cost of maintaining ICTs and infrastructure, the availability of pertinent and localised content in their own languages, a lack of training and practical exposure to ICTs, poor ICT development and implementation decisions, the absence of ICT marketing to farmers, a lack of ICT handling skills, poor finances, and power shortages, and a limited awareness of the benefits of managerial information systems (Franklyn and Tukur, 2012; Mahant et al., 2012; Rajoria et al., 2022).

As a result of reviewing and analyzing the role of ICT and its challenges in agriculture, the following recommendations or suggestions for government agencies, decision-makers, and ICT developers can be made for future development and research:

- Developing advanced sophisticated ICT tools in agriculture, such as Global Positioning Systems (GPS), Geographic Information Systems (GIS) and remote sensing, to improve the environment and the sustainability of agriculture.
- Improve farmers' digital literacy.
- For farmers to be more confident, competent, and skilled in using ICTs for development, more awareness-cum-training programmes on ICTs should be fostered by agricultural state departments, research organizations, and its associated departments.
- The use of renewable energy sources, such as solar panels, is advised to combat the state's erratic and fluctuating power supply, especially in rural areas.
- It would be suggested to provide youngsters with vocational training in ICT infrastructure.

#### 4. Conclusions

Based on the aforementioned findings, it is found that ICT play a key role in improving agricultural production, productivity, and empowering the poor and rural people by providing better access to natural resources, improved agricultural technologies, information on weather forecasts and natural calamities, better agricultural practices, better marketing exposure and pricing, reduction of agricultural risks, better awareness, better networking and communication, and effective production. Furthermore, the study also found that key challenges to ICT adoption in agriculture is a lack of physical and human resource infrastructure.

Hence, in order to boost confidence, competence, and skill in using ICTs for development, it is recommended that more awareness and training programmes on ICT's role be organized. There are undoubtedly a number of obstacles to the efficient integration of ICT into agriculture, but these may be overcome with careful planning, policy developments, and



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the provision of the necessary awareness and educational programmes. Unquestionably, the farming community needs to be made aware of the value, role, and services that can be provided using ICT tools.

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