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Information and Communication Technology (ICT) in Indian Agriculture: Revolutionizing Farming Practices and Promoting Sustainability

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Agriculture, serving as the primary livelihood for the majority of rural inhabitants in India, plays a pivotal role in the nation's economy, contributing about 18.3% of the country's GDP (Ministry of Agriculture & Farmers Welfare, 2022-23). Despite its fundamental importance, the agricultural sector grapples with numerous challenges, including low productivity, inefficient resource utilization, and limited market access. However, in recent years we have witnessed a remarkable transformation in agricultural practices with the integration of Information and Communication Technology (ICT). This integration has ushered in a new era of efficiency and effectiveness, empowering farmers with access to a plethora of resources and information previously unavailable. The advent of precision farming techniques, facilitated by ICT, has revolutionized traditional agricultural methodologies, enabling farmers to optimize resource utilization, minimize waste, and enhance productivity. Moreover, digital market platforms have emerged as a boon for farmers, eliminating intermediaries and connecting them directly with consumers, thereby ensuring fairer prices and increased profitability. Additionally, ICT has facilitated the implementation of smart farming practices, encompassing the use of sensors, drones, and automated machinery for enhanced monitoring and management of crops and livestock. Hence, it has become important to identify the various ICT tools and applications that have been used in agriculture. This article aims to examine the role of ICT in Revolutionizing Farming Practices in India.

Role of ICT in agricultural sector

ICT has played a significant role in revolutionizing farming practices by bridging information gaps, improving decision-making, and enhancing productivity and profitability (FAO, 2017). The use of ICT in agriculture has reduced information and transaction costs, streamlined service delivery, generated new job opportunities, and new revenue streams. ICT tools such as mobile phones, laptops, the internet, artificial intelligence (A.I) and Geographic Information Systems (GIS) have become indispensable assets for farmers, providing real-time access to crucial data on weather patterns, market trends, agricultural inputs, and best package of practices. The use of ICT in agriculture brings huge gains in efficiency and cost-saving as it plays an important role in providing up-to-date and requisite information to farmers in a user-friendly form. It is cost-effective and presents unprecedented opportunities to empower small-scale and marginal farmers by strengthening their capabilities. ICT not only assists policymaking but also enhances farm management, therefore boosting the livelihoods of the rural masses. In agriculture, ICTs can be beneficial for farmers through the latest information on markets and depicting changing consumption patterns. Farmers can better plan production based on supply and demand considerations as access to mobile phones are easy now a days, enhancing market efficiency and enabling market access. The use of ICT in agriculture has accelerated agricultural and rural development by adopting innovative ways to improve the existing information and has particularly revolutionized small land holder in several agrarian economies and has helped address several socio-economic concerns.

Applications of ICT

ICT has numerous applications in agriculture, including precision agriculture, digital market access, and remote monitoring. Precision agriculture involves using sensors to track soil health, plant growth, and weather patterns to make informed decisions about using inputs like seeds and water. In this context, the role of Indian Meteorological Department (IMD) becomes crucial, as they provide essential weather forecasts and climate information that enable farmers to make informed decisions and adapt their farming practices accordingly, ultimately contributing to

increased productivity and resilience in agriculture. Also, digital market access provides farmers with the latest information on markets and changing consumption patterns, allowing them to better plan production based on supply-and-demand factors, increasing market efficiency and facilitating market access. Remote monitoring involves using drones, sensors, and cameras to monitor crops and livestock remotely, allowing farmers to identify areas for improvement and respond quickly to threats such as disease or pests. ICT also promotes learning and facilitates technology adoption among farmers, revolutionizes early warning systems through better quality data and analysis, and enhances coordination and collaboration among international organizations, the private sector, and civil society (FAO, 2017). ICT has revolutionized farming practices by bridging information gaps, improving decision-making, and enhancing productivity and profitability in agriculture.

ICT implementation

The successful implementation of ICT in Indian agricultural sector is evident through various case studies and real-life examples. For instance, the Agricultural Technology Information Centre (ATIC), Digital Green, Easykrishi, e-SAP from University of Agricultural Sciences, Raichur, IFFCO Kisan Sanchar Limited (IKSL), Kisan Community radio station from University of Agricultural Sciences, Dharwad, and mKisan have significantly impacted the lives of farmers by providing weather-based agro-advisories, digital market access, and remote monitoring (MANAGE, 2019). Additionally, the Meghdoot app, developed by the India Meteorological Department (IMD), Indian Institute of Tropical Meteorology (IITM), and Indian Council of Agricultural Research (ICAR), has revolutionized crop management by providing real-time weather updates, pest alerts, and market prices, leading to significant improvements in crop health and productivity for farmers. On an average, 12,218 agro-advisories per state have been issued through Meghdoot (as of July 26, 2021) since the inception of the app (Dhulipala *et al*., 2021). Similarly, the Damini app, launched by the Ministry of Earth Sciences, has proven instrumental in weather forecasting and risk management, aiding farmers to successfully prepare for a cyclone, thereby minimizing crop damage and preserving livelihoods.

Factors affecting dissemination of ICT

Despite the numerous benefits offered by information and communication technology (ICT) in agriculture in India, the adoption and dissemination of ICT tools within the sector have faced significant challenges, resulting in slow progress. Several factors contribute to sluggish dissemination of ICT in agriculture. A significant obstacle hindering the adoption and spread of ICT tools in Indian agriculture is the low levels of digital literacy among farmers and also due to financial constraints. The majority of farmers lack familiarity with computers, smartphones, and other ICT devices, making it difficult for them to utilize digital information and services effectively. This issue is especially prevalent in rural regions, where access to ICT infrastructure is limited, and opportunities for training and capacity building are scarce. Limited access to ICT infrastructure, especially in rural areas also poses a significant challenge to the dissemination of ICT in agriculture. Many farmers lack internet access, and those who have it often encounter slow and unreliable connections, hindering their ability to access online information and services like weather forecasts, market prices and agricultural inputs and may find it difficult to fully leverage these technologies to enhance their farming activities and livelihoods.

Suggestions for successful implementation and improvement of ICT in Indian agricultural sector

To promote the adoption and dissemination of ICT tools in agriculture there is a crucial need for increased investment in infrastructure, encompassing broadband connectivity, mobile networks, and electricity. Secondly, priority should be given to training and capacity building programs aimed at enhancing the technical knowledge and skills of farmers and extension workers, covering ICT tool usage, crop management practices, and marketing strategies. It is essential to conduct awareness-raising campaigns targeting farmers, extension workers, and other stakeholders to highlight the benefits of ICT tools in agriculture. Additionally, fostering public-

private partnerships is vital, with the government collaborating with the private sector to enhance the availability and affordability of ICT tools. Lastly, establishing policy and regulatory frameworks is imperative to promote the adoption and dissemination of ICT tools, including regulations for precision agriculture tools and policies to support the development of e-commerce platforms for agricultural products.

Conclusion

In conclusion ICT tools have the potential to greatly enhance agricultural productivity and uplift the livelihoods of farmers in India. However, challenges such as limited availability and affordability of technology, inadequate technical knowledge and skills, and low awareness of ICT tool benefits hinder their widespread adoption. To fully leverage the potential of ICT tools in the agricultural sector, increased investment in infrastructure, training, awareness campaigns, public-private partnerships, and supportive policy frameworks are essential.

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