

Digital Transformation in Indian Agriculture and Fisheries: ICT Pathways to Sustainability

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ABSTRACT

Information and Communication Technology (ICT) is playing a significant role in transforming agriculture and fisheries in India. ICT tools help farmers and fishers access timely information on weather forecasting, market prices, pest and disease management, precision farming, irrigation scheduling, and government welfare schemes. The Government of India is promoting the digital empowerment of farmers and fishers through various ICT initiatives such as the Digital Agriculture Mission, Agri-Stack, e-NAM, National Pest Surveillance System (NPSS), India Digital Ecosystem of Agriculture (IDEA), Meghdoot App, Kisan Suvidha App, National Digital Fisheries Platform (NDFP) and the Matsya Setu App. ICT platforms developed by organizations such as the Indian Council of Agricultural Research, Indian National Centre for Ocean Information Services, and National Fisheries Development Board are improving scientific decision-making, technology dissemination, market access, and rural livelihoods. These ICT-based initiatives support climate-resilient agriculture, smart aquaculture, digital extension services, and efficient natural resource management in India.

INTRODUCTION

Agriculture and fisheries are vital sectors of the Indian economy and play an important role in food security, employment generation, nutritional security, and rural development. Agriculture and allied sectors contribute about 18% to India's Gross Value Added (GVA) and support the livelihoods of nearly 42–46% of the country's population, while the fisheries sector contributes around 7.5% to the agricultural GVA and provides livelihood support to millions of people in coastal and inland regions of India (Economic Survey, 2025–26).

However, Indian farmers and fishers face several challenges such as climate change, irregular rainfall, floods, droughts, pest and disease outbreaks, declining soil fertility, rising input costs, fluctuating market prices, and post-harvest losses. Limited access to timely scientific information and inadequate extension services further affects farm productivity and income.

In recent years, Information and Communication Technology (ICT) has emerged as an effective tool for improving agricultural and fisheries management.

Several studies have reported the positive impact of ICT interventions in agriculture and fisheries. Aker (2011) reported that mobile-based information services improved farmers' market access and reduced price variability. Mittal and Mehar (2016) observed that ICT-based agro-advisory services enhanced farmers' decision-making and productivity. Rao *et al.* (2019) reported that Potential Fishing Zone (PFZ) advisories improved fishing efficiency and reduced fuel consumption.

Status of ICT in India

India is one of the fastest-growing Information and Communication Technology (ICT) economies in the world. The ICT sector contributes nearly 7–8 per cent to India's Gross Domestic Product (GDP) (Ministry of Electronics and Information Technology, Government of India, 2025). According to the National Association of Software and Service Companies (NASSCOM), India's technology industry reached about USD 282 billion in FY 2025. India has more than 120 crore telecom subscribers and around 97 crore internet users, making it one of the world's largest digital markets. The rapid expansion of 4G and 5G networks, along with affordable mobile data services, has increased smartphone usage to over 77 crore users, which is expected to reach nearly 100 crores by 2026 (Deloitte, 2024). Government initiatives such as Digital India, e-Governance, telemedicine, and digital payment systems are further strengthening ICT development in the country.

Need for ICT in Agriculture and Fisheries

Agriculture and fisheries are highly dependent on weather conditions and natural resources, making them vulnerable to climate change, natural disasters, and market fluctuations. Farmers and fishers require timely and reliable information on crop production, irrigation management, pest and disease control, fish harvesting, weather forecasting, and market prices.

ICT tools help bridge the communication gap between scientists, extension workers, farmers, and fishers through real-time information sharing and digital advisory services. ICT initiatives also support rural communities by providing access to crop insurance, subsidies, digital banking, e-commerce platforms, and

government welfare schemes, thereby improving livelihoods and rural development.

Tools Used in Information and Communication Technology (ICT)

Information and Communication Technology (ICT) tools are broadly classified into Traditional ICTs and Modern ICTs (Van Dijk, 2006).

Traditional ICTs: Traditional ICT tools include radio, television, telephone, books, posters, films, and interpersonal communication methods (Obayelu and Oyunlade, 2006). These technologies played an important role in education, agricultural extension, awareness generation, and rural communication and are still useful in remote and rural areas where digital connectivity is limited (Rogers, 2003).

Modern ICTs: Modern ICTs include computers, mobile phones, the internet, e-mail, satellites, Global Positioning Systems (GPS), video conferencing, databases, and web services (Chapman and Slaymaker, 2002). These digital technologies enable rapid communication, real-time information sharing, and improved access to knowledge in agriculture, fisheries, healthcare, education, business, and e-governance (Aker, 2011).

Major ICT Initiatives and Platforms in Agriculture

The ICT initiatives and digital platforms developed in India to support farmers through precision agriculture, digital advisory services, market linkages, pest surveillance, and access to government schemes are shown in Table 1.

Table 1. Major ICT Initiatives and Digital Platforms in Indian Agriculture

| ICT Initiative | Functions and Benefits |
|------------------------------------|---|
| Digital Agriculture Mission | The Digital Agriculture Mission aims to establish a comprehensive farmer-centric digital and space technology |

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| (DAM) | ecosystem to improve transparency and efficiency in the implementation of government programs. It also supports evidence-based policy making and provides digital solutions for the welfare and development of farmers. |
| Agri-Stack | Agri-Stack creates digital identities for farmers by integrating land records, crop data, and farmer databases. It supports personalized advisories, direct benefit transfer (DBT), digital crop surveys, and easier access to government schemes and agricultural services. |
| e-NAM | e-NAM is a nationwide electronic agricultural marketing platform connecting mandis across India. It enables transparent price discovery, online trading, wider market access, reduced middlemen involvement, and better price realization for farmers. |
| National Pest Surveillance System (NPSS) | The system utilizes latest digital technologies such as Artificial Intelligence and Machine Learning (AI and ML) to provide quick and instant solutions for pest attacks, crop diseases, crop damage, etc., by issuing real-time crop protection advisories to farmers. It includes a user-friendly mobile app and portal for pest identification and disease management. |
| Kisan e-Mitra Chatbot | Kisan e-Mitra is an AI-powered virtual assistant that provides 24/7 support for agricultural schemes. It helps farmers by instantly resolving queries related to the PM-KISAN scheme, crop insurance under PMFBY, and Kisan Credit Card (KCC) loans. |
| Kisan Sarathi | ICT-enabled multilingual advisory platform developed by ICAR to connect farmers with agricultural scientists and extension experts. It provides multimedia advisories, modern agricultural technologies, and scientific farming recommendations. |
| Plantix | Plantix is a mobile crop advisory app for farmers, extension workers, and gardeners that uses image recognition |

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| | technology to diagnose crop diseases, insect pests, and nutrient deficiencies. It also provides instant crop management and treatment recommendations to farmers. |
| Agriculture Infrastructure Fund (AIF) Portal | A digital platform that facilitates financial support for the development of warehouses, cold storage, pack houses, logistics, and other post-harvest infrastructure to reduce post-harvest losses and strengthen the agricultural supply chain. |
| Kisan Rath App | Kisan Rath App is a mobile application that connects farmers and traders with transport service providers for the efficient movement of agricultural produce, helping to reduce transportation issues and post-harvest losses. |

Major ICT Initiatives and Platforms in Fisheries and Aquaculture

The ICT-enabled initiatives and digital platforms developed in India to support fish farmers and fishermen through scientific aquaculture management, weather and ocean advisories, fish health monitoring, digital fisheries governance, and sustainable livelihood improvement are shown in Table 2.

Table 2. Major ICT Tools and Digital Platforms in Fisheries and Aquaculture

| ICT Initiative | Functions and Benefits |
|---|--|
| Pradhan Mantri Matsya Sampada Yojana (PMMSY) | A Government of India scheme for sustainable fisheries development that supports fish farmers through modernization, ICT-based services, infrastructure, training, and digital access to subsidies and technologies to improve production and livelihoods. |
| National Digital Fisheries Platform (NDFP) | A unified digital fisheries platform developed under Pradhan Mantri Matsya Sampada Yojana (PMMSY) that provides online registration of fish farmers and fishermen, digital databases, access to subsidies and government |

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| | schemes, traceability services, and digital governance support for the fisheries sector. |
| SMART Pond | ICT-enabled precision aquaculture system integrating IoT sensors, automated feeders, aerators, and pond monitoring technologies for scientific fish farming, improved water quality management, and higher fish productivity. |
| Matsya Setu App | Multilingual mobile application developed by ICAR-CIFA that provides fisheries training modules, fish health management advisories, feed management practices, water quality guidance, and scientific aquaculture information. |
| Sagar Vani Mobile App | Mobile application providing ocean state forecasts, high wave alerts, tsunami warnings, weather forecasts, and Potential Fishing Zone advisories in regional languages for safe and efficient marine fishing operations. |
| Fisher Friend Mobile Advisory (FFMA) | Mobile-based fisheries advisory service delivering weather forecasts, sea condition alerts, fish market prices, and disaster warnings in local languages to improve fishermen safety and livelihood security. |
| Aqua One Centre | ICT-enabled aquaculture support centres established by National Fisheries Development Board (NFDB) providing pond water testing, fish disease diagnosis, feed management advisory, and scientific aquaculture support services to fish farmers. |
| ATIC for Fisheries Support | Agricultural Technology Information Centres (ATICs) provide fisheries-related technical guidance, diagnostic services, aquaculture advisory support, extension literature, and quality input information through a single-window system. |

Common ICT Initiatives and Platforms to Both Agriculture and Fisheries

The ICT platforms and digital services commonly used in both agriculture and fisheries sectors for weather forecasting, market information, digital advisory services, e-governance support, and technology dissemination are shown in Table 3.

Table 3. ICT Initiatives and Digital Platforms for Agriculture and Fisheries Sectors

| ICT Initiative | Functions and Benefits |
|--------------------------------|--|
| Kisan Call Centre (KCC) | Toll-free expert advisory service providing technical guidance related to crop production, livestock, fisheries, disease management, and government schemes in regional languages through the helpline number 1800-180-1551. |
| Meghdoot App | Weather forecasting and agro-advisory platform providing district-level weather information useful for crop management, irrigation scheduling, pond management, and climate-risk reduction. |
| Digital Green | ICT-enabled digital extension platform using participatory videos, AI-enabled learning systems, and community-based training approaches for dissemination of agricultural and fisheries technologies. |
| e-Choupal | ICT-enabled rural information and market linkage platform providing weather forecasts, market prices, scientific farming practices, and direct market access to rural producers. |
| Agmarknet | National agricultural marketing information system providing real-time commodity prices, arrivals, and market trends to support better marketing decisions by farmers and fisheries stakeholders. |

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| m-Kisan Portal | SMS-based advisory platform delivering weather alerts, pest and disease warnings, market information, and scientific advisories in regional languages directly to farmers and fish farmers. |
| Kisan Suvidha App | Mobile application providing weather updates, market prices, input dealer information, advisory services, and government scheme details useful for agriculture and aquaculture sectors. |

Future trends of ICT in agriculture

The future of ICT in Indian agriculture and fisheries is highly promising. Emerging technologies such as Artificial Intelligence (AI), blockchain, robotics, drones, Internet of Things (IoT), and big data analytics are expected to revolutionize farming and fisheries systems.

Future ICT initiatives will emphasize the development of smart farming and smart aquaculture systems, climate-resilient agricultural practices, automated irrigation systems, AI-based advisory services, precision fisheries management, and efficient digital supply chain management. These technological advancements are expected to enhance sustainability, productivity, profitability, and resilience in the agriculture and fisheries sectors.

CONCLUSION

ICT initiatives are playing a transformative role in strengthening agriculture and fisheries in India by improving access to timely information, communication, market linkages, and efficient resource management. The key initiatives presented in the table highlight how digital platforms, AI-based advisory systems, precision technologies, and mobile applications are supporting farmers and fishers in improving productivity, reducing risks, and enhancing income.

These government-led programmes and digital innovations are promoting climate-resilient, sustainable, and technology-driven development in the rural sector. However, continuous efforts in digital infrastructure development, capacity building, and farmer awareness are essential for wider ICT adoption.

The integration of advanced ICT tools with traditional farming and fisheries practices will be crucial for achieving sustainable and inclusive rural development in India.

REFERENCES

- Aker, J. C. (2011). Dial “A” for agriculture: A review of information and communication technologies for agricultural extension in developing countries. *Agricultural Economics*, 42(6), 631–647.
- Chapman, R., & Slaymaker, T. (2002). *ICTs and rural development: Review of the literature, current interventions and opportunities for action*. Overseas Development Institute, London.
- Deloitte (2024). *Digital Agriculture and Agritech in India: Transforming the Future of Farming*. Deloitte Insights Report.
- Government of India (2025–26). *Economic Survey 2025–26*. Ministry of Finance, Economic Division, New Delhi.
- Ministry of Electronics and Information Technology (MeitY), Government of India (2025). *Digital India / ICT and e-Governance Progress Report 2025*. New Delhi.
- Mittal, S., & Mehar, M. (2016). Socio-economic factors affecting adoption of modern information and communication technology by farmers in India: Analysis using multivariate probit model. *The Journal of Agricultural Education and Extension*, 22(2), 199–212.
- Obayelu, A. E., & Oyunlade, O. A. (2006). Analysis of ICT uses for gender empowerment and sustainable poverty alleviation in Nigeria. *International Journal of Education and Development using ICT*, 2(3), 45–69.
- Rao, K. H., Venkatesan, R., & Rao, T. C. (2019). Potential Fishing Zone advisories and their impact on marine fisheries in India. *Marine Fisheries Information Service*, 241, 10–15.
- Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). Free Press, New York.
- Van Dijk, J. (2006). *The Network Society: Social Aspects of New Media*. Sage Publications, London.