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Agricultural and Horticultural Development Through Information and Communication Technology (ICT)

Pooja Aditya* and Simadri Rajasri

Abstract: -

Agriculture is a vital pillar of the Indian economy, contributing about 17% to the national GDP and employing over 60% of the population, yet it continues to face challenges such as fragmented landholdings, delayed access to information, and market inefficiencies. Information and Communication Technology (ICT) plays a crucial role in addressing these issues by providing farmers with timely, accurate, and personalized information through tools such as mobile applications, internet-based platforms, artificial intelligence, IoT, and drones. These technologies are especially valuable in regions like the Himachal Himalayas, where difficult terrain and climatic variability demand location-specific solutions, enabling a shift from subsistence farming to high-value horticultural production. Successful initiatives such as AGRISNET, AGMARKNET, e-NAM, e-Sagu, and mobile applications like Kisan Suvidha, Pusa Krishi, Kisan 2.0, and Farm-o-Pedia have significantly improved access to weather forecasts, crop management practices, and market prices, thereby supporting informed, data-driven decision-making. However, the full potential of ICT in agriculture is limited by challenges such as inadequate infrastructure, high implementation costs, and low levels of digital literacy, which must be addressed to ensure inclusive, sustainable, and resilient agricultural development in India.

Keywords: ICT, Precision Agriculture, IoT Sensors, Digital Market places, Agricultural Information System (AIS). Agricultural productivity, e-agriculture etc.

Introduction:

Information and Communication Technology (ICT) refers to electronic tools and systems used for collecting, processing, storing, and sharing information, including

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hardware, software, communication networks, and digital media (World Bank). In agriculture, ICT supports Agricultural Information Systems (AIS), which integrate and disseminate agricultural information to assist farmers in farm management and policy decision-making, thereby strengthening linkages between research institutions and farming communities (Singh et al., 2015). While ICT enhances efficiency, innovation, and connectivity, its effective implementation is challenged by the digital divide, cybersecurity risks, data privacy concerns, and environmental issues, highlighting the need for inclusive and sustainable ICT frameworks (Nehra et al., 2018; Sharma et al., 2017; Sharma et al., 2019).

Tools of ICT in Agriculture and horticulture

1. **Informative Tools:** ICT tools used to disseminate agricultural information in text, audio, video, and graphic formats through the internet and information systems.
2. **Situating Tools:** ICT applications that place users in real or simulated agricultural situations to enhance practical understanding and learning.
3. **Constructive Tools:** General-purpose software that enables users to create, organize, and visualize agricultural information and knowledge.
4. **Communicative Tools:** ICT tools that facilitate fast and effective communication among farmers, extension workers, and experts.
5. **Collaborative Tools:** ICT platforms that support group interaction, shared learning, and collective problem-solving (Singh et al., 2014).
6. **Decision Support Systems (DSS):** Computer-based tools that assist farmers in making informed decisions on crop and farm management using data analysis.
7. **Mobile Applications**: Mobile-based ICT tools provide instant information on weather forecasts, crop management practices, pest and disease diagnosis, and market prices for fruits and vegetables. *Examples:* Kisan Suvidha, Pusa Krishi, Horticulture Crop Advisor, Farm-o-Pedia.
8. **Geographic Information System (GIS) and Remote Sensing**: These tools are used to assess soil fertility, crop health, water stress, and spatial variability in orchards and vegetable fields. They support precision horticulture and resource optimization.

   Examples: Satellite-based crop monitoring, NDVI mapping.
9. **Expert Systems**: Expert systems simulate human expertise to diagnose pests, diseases, and nutrient deficiencies in horticultural crops and recommend

appropriate management practices. ***Examples:*** Plantix, e-Krishi

10. **Market Information Systems (MIS)**: MIS tools provide real-time information on prices, demand, supply, and market trends of horticultural produce, helping farmers make better marketing decisions. *Examples:* AGMARKNET, e-NAM.
11. **Communication Tools:** ICT-based communication tools facilitate interaction between horticulture farmers, extension workers, and researchers for knowledge sharing and problem-solving. *Examples:* SMS advisory services, WhatsApp groups, call centers (Kisan Call Centre – 1800-180-1551).
12. **Precision Horticulture Tools**:These tools integrate sensors, GPS, and automated systems for efficient use of water, fertilizers, and pesticides in orchards and protected cultivation. *Examples:* Soil moisture sensors, automated drip irrigation systems.

India's position in ICT use

As of early 2026, India's position in ICT use has significantly expanded compared to 2024, characterized by the following projections and milestones:

- **Software and IT Exports:** India's IT industry is projected to reach a value of **$350 billion by 2026**, contributing nearly 10% to the nation's GDP. India remains the world's **eighth-largest services exporter** and continues to hold a leading global position in IT and business service exports.
- **Internet User Base:** India is home to approximately **1.03 billion internet users** as of early 2026, making it the second-largest online population in the world. Some government projections suggest this number could reach as high as **1.2 billion** within the year.
- **Internet Penetration:** The internet penetration rate has surged to approximately **70% of the total population**.
- **Cellular Mobile Connections:** There are an estimated **1.06 billion active cellular mobile connections**, equivalent to **72.5% of the total population**. Furthermore, India is projected to reach **1 billion smartphone users** by 2026.
- **Social Media Adoption:** There are roughly **500 million active social media user identities**, equating to **34.1% of the total population**.
- **ICT Infrastructure and Projects:** India accounts for **49% of global real-time digital transactions**, reaffirming its status as a global leader in digital payment innovation. The expansion of 5G has reached **99.9% of**

districts, supporting a median mobile download speed of **131.77 Mbps**.

Benefits of ICT in Agriculture and Horticulture

- **Reduction in Costs:** The application of ICT and modern agricultural technologies helps farmers reduce production costs. Many farming activities that earlier required more labour and time can now be completed efficiently with minimal expense.
- **Improvement in Farm Productivity:** The use of advanced tools and machinery supported by ICT, such as tractors, automated harvesters, and weed management systems, increases agricultural productivity and overall farm output.
- **Ease in Transportation:** Modern technologies simplify the transportation of agricultural produce. Farmers can easily move crops from farms to markets using improved vehicles and digital logistics systems.
- **Less Physical Labour:** ICT-based technologies reduce the manual effort required in farming by replacing labour-intensive operations with automated and mechanized solutions.
- **Better Access to Information:** ICT enables farmers and extension personnel to access important information such as weather updates, market rates, pest management advice, and improved farming practices in a timely manner.
- **Efficient Data Management:** Digital technologies allow the collection and maintenance of agricultural databases, including soil information, weather records, and crop yield data, which support better planning and decision-making.
- **Mobile-Based Advisory Services:** ICT tools such as SMS alerts and mobile applications provide farmers with real-time agricultural information, particularly beneficial in remote areas with limited internet access.
- **Improved Communication and Knowledge Sharing:** ICT platforms enhance communication among farmers, researchers, and extension workers, encouraging collaboration and faster adoption of improved agricultural technologies.
- **Remote Training and Extension Services:** ICT supports distance education through online training programs, webinars, and virtual meetings, helping farmers receive guidance even in areas with limited extension services.

Conclusion:

Information and Communication Technology (ICT) has become a key driver in transforming Indian agriculture and horticulture by improving access to information, enhancing productivity, and promoting efficient resource use. The adoption of advanced tools such as mobile applications, AI, IoT, precision agriculture technologies, and digital marketplaces has strengthened decision-making and value chains, even in challenging regions like the Himachal Himalayas. However, challenges related to infrastructure, cost, and digital literacy remain. With supportive policies, improved connectivity, and capacity building, ICT can play a crucial role in achieving sustainable agricultural development and improving farmers' livelihoods in India.

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