SUNSHINE AGRICULTURE
e-Newsletter

ISSN (E): 2583 – 0821

Sun. Agri.:e- Newsletter, (2025) 5(12), 86-88

Article ID: 500

ICT-Based Extension Services for Small and Marginal Farmers

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Available online at
www.sunshineagriculture.vitalbiotech.org

Article History
Received: 6.12.2025
Revised: 11.12.2025
Accepted: 16.12.2025

INTRODUCTION

Agricultural extension plays a vital role in transferring scientific knowledge, improved technologies, and innovative practices from research institutions to farmers. Traditionally, extension systems in India have relied on face-to-face interactions, demonstrations, field visits, and group meetings. While effective to some extent, these conventional approaches often suffer from limitations such as inadequate extension personnel, delayed communication, limited geographical coverage, and high operational costs. These challenges disproportionately affect small and marginal farmers, who require frequent, timely, and customized advisory support.

The rapid expansion of Information and Communication Technology (ICT) has transformed the agricultural knowledge and information ecosystem. Technologies such as mobile phones, the internet, digital platforms, satellite-based services, and social media have created new opportunities for delivering extension services efficiently and inclusively. ICT-based extension systems enable faster dissemination of information, interactive communication, and wider outreach, making them particularly suitable for addressing the diverse needs of small and marginal farmers.

2. Concept of ICT-Based Extension

ICT-based agricultural extension refers to the systematic use of digital technologies to generate, store, process, retrieve, and disseminate agricultural information to farmers and other stakeholders. Unlike traditional one-way communication, ICT-based extension supports two-way and multi-directional information flow, allowing farmers to interact directly with experts, researchers, and fellow farmers.

For small and marginal farmers, ICT-based extension services provide easy and affordable access to critical information related to crop planning, weather forecasts, pest and disease management, soil and nutrient management, irrigation scheduling, post-harvest handling, market prices, and government schemes. These services enhance transparency, responsiveness, and accountability within the extension system.

3. Major ICT Tools Used in Agricultural Extension

3.1 Mobile Phones and SMS/IVR Services

Mobile phones are the most accessible and widely adopted ICT tools among farmers. Short Message Service (SMS) and Interactive Voice Response (IVR) systems deliver timely advisories on weather conditions, crop management practices, pest and disease outbreaks, and market prices. Voice-based services are particularly beneficial for farmers with low literacy levels, ensuring inclusivity and wider adoption.

3.2 Mobile Applications (Agri-Apps)

Agricultural mobile applications provide comprehensive, crop-specific, and location-based information. These apps offer soil testing recommendations, fertilizer dose calculations, irrigation scheduling, pest diagnostics, crop insurance details, and government scheme updates. Many agri-apps include image-based disease identification and expert chat features, enhancing on-farm decision-making.

3.3 Internet and Web Portals

Agricultural web portals serve as digital repositories of scientific knowledge, extension literature, research recommendations, success stories, and best practices. Farmers and extension workers can access e-learning modules, training videos, and expert consultations. These platforms also support capacity building through online certification courses and virtual workshops.

3.4 Social Media Platforms

Social media platforms such as WhatsApp, YouTube, Facebook, and Telegram have become popular tools for agricultural knowledge sharing. Farmer groups, extension agencies, and experts use these platforms to share videos, photographs, advisories, and success stories. Peer-to-peer learning through social media enhances trust, adoption, and innovation diffusion among smallholders.

3.5 Call Centers and Helplines

Toll-free farmer helplines and call centers provide personalized, real-time advisory services. Farmers can directly interact with subject matter specialists to seek solutions for specific field problems. These services act as an effective bridge between farmers and research institutions, especially during emergencies such as pest outbreaks or extreme weather events.

3.6 GIS, GPS, and Remote Sensing Technologies

Geospatial technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing support precision agriculture by providing data on soil variability, crop health, moisture status, and weather patterns. Simplified and user-friendly applications of these technologies are increasingly being tailored for small and marginal farmers to optimize resource use and reduce production risks.

4. Role of ICT in Empowering Small and Marginal Farmers

4.1 Timely and Accurate Information Access

ICT-based platforms ensure real-time delivery of weather forecasts, pest and disease alerts, and crop advisories, enabling farmers to take preventive and corrective actions at the right time.

4.2 Cost-Effective Extension Delivery

Digital extension reduces the cost associated with physical visits, printed materials, and logistical arrangements, making extension services more efficient and scalable.

4.3 Improved Market Linkages

ICT tools provide access to market prices, demand trends, digital trading platforms, and value chain information. This transparency helps farmers make informed marketing decisions and improve income realization.

4.4 Risk Mitigation and Climate Resilience

Early warning systems, climate advisories, and crop insurance information help farmers manage production risks associated with climate variability and extreme weather events.

4.5 Capacity Building and Skill Development

Online training programs, instructional videos, and interactive content enhance farmers' technical knowledge, managerial skills, and entrepreneurial capabilities.

4.6 Inclusivity and Social Equity

ICT-based extension services reach remote, underserved, and marginalized farming communities, promoting equitable access to information and reducing regional disparities.

5. Challenges in ICT-Based Extension

Despite its immense potential, the adoption of ICT-based extension services among small and marginal farmers faces several challenges:

- ✓ Low digital literacy and limited technical skills
- ✓ Inadequate internet connectivity and power supply in rural areas
- ✓ Language barriers and lack of region-specific content
- ✓ Limited access to smartphones and digital devices
- ✓ Trust deficit and preference for traditional advisory sources
- ✓ Fragmentation and lack of integration among ICT platforms

6. Strategies for Effective Implementation

To enhance the effectiveness of ICT-based extension services, the following strategies are essential:

- ✓ Development of simple, user-friendly, and local-language content
- ✓ Strengthening rural digital infrastructure and broadband connectivity
- ✓ Capacity building and digital literacy training for farmers and extension personnel
- ✓ Integration of ICT tools with conventional extension systems such as KVKs, ATMA, and NGOs
- ✓ Promotion of public–private partnerships and agri-start-up innovations
- ✓ Establishment of feedback and monitoring mechanisms for continuous improvement

7. Future Prospects

The future of ICT-based agricultural extension lies in the integration of advanced technologies such as Artificial Intelligence (AI), Big Data analytics, Internet of Things (IoT), blockchain, and decision support systems. Personalized advisories based on farm-specific data, predictive analytics for yield and pest outbreaks, and real-time monitoring of crops and resources will further enhance productivity and sustainability. Supportive policies, institutional convergence, and farmer-centric design approaches will be crucial for scaling up ICT-based extension services.

CONCLUSION

ICT-based extension services represent a paradigm shift in agricultural knowledge dissemination, particularly for small and marginal farmers. By providing timely, relevant, and actionable information, these services enhance productivity, profitability, and resilience in farming systems. Although challenges persist, strategic interventions, capacity building, and inclusive policies can ensure that ICT becomes a powerful enabler of sustainable, climate-resilient, and farmer-led agricultural development.

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