



Digital Extension Services for Rural Farmers

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INTRODUCTION

Agriculture is essential to rural economies in many developing nations, especially in countries like India where many people rely on farming for their livelihoods and food security. Agricultural productivity and sustainability depend on the timely availability of information about improved crop varieties, efficient resource use, pest and disease management, soil health, and market opportunities.

Agricultural extension systems act as a link between research institutions and farmers, delivering knowledge and technologies created by scientists to farming communities. Traditionally, extension services have been delivered through methods such as field demonstrations, farmer training programs, agricultural fairs, extension bulletins, radio broadcasts, and personal visits by extension workers.

While these traditional methods have contributed to agricultural development, they have several drawbacks. The number of extension workers compared to farmers is often very low, making personalized advisory services difficult. Additionally, geographical barriers, inadequate infrastructure, and limited mobility of extension staff can restrict the reach of programs, especially in remote rural areas.

The fast growth of digital technologies, smartphones, and internet access has opened up new opportunities for improving agricultural extension systems. Digital Extension Services use modern ICT tools to deliver agricultural advice directly to farmers through online platforms. These services provide real-time information and help farmers make informed decisions regarding production, risk management, and marketing. Digital extension systems are becoming essential to modern agricultural strategies aimed at improving productivity, bridging information gaps, and supporting rural livelihoods.



2. Concept of Digital Extension Services

Digital extension services involve using digital technologies and electronic communication tools to offer agricultural information, training, and advice to farmers. These services rely on ICTs like mobile phones, internet platforms, cloud computing, artificial intelligence, and satellite monitoring.

The main goal of digital extension is to make agricultural information easier to access, faster to obtain, and more efficient to spread. Unlike traditional methods that depend on face-to-face interactions, digital extension allows farmers to access information anytime and anywhere. Digital extension systems are set up to provide location-specific, need-based, and timely information to farmers. They offer advice on various agricultural topics, including crop management, soil fertility, irrigation scheduling, pest and disease control, climate information, market price updates, and access to government schemes.

Key components of digital extension systems include:

- ✓ Digital knowledge platforms
- ✓ Mobile-based advisory services
- ✓ Interactive voice response systems
- ✓ AI-based advisory tools
- ✓ Remote sensing and satellite monitoring
- ✓ Online farmer training modules

By integrating these technologies, digital extension services improve knowledge sharing and strengthen connections among farmers, researchers, extension workers, and policymakers.

3. Tools and Technologies Used in Digital Extension

Digital extension services use a variety of modern technologies to effectively deliver agricultural advice.

3.1 Mobile-Based Advisory Services

Mobile phones are powerful tools for spreading digital agricultural information. The growing availability of smartphones and affordable mobile networks has greatly expanded the reach of digital extension services in rural areas. Mobile-based advisory services deliver information through:

- ✓ SMS alerts
- ✓ Mobile applications
- ✓ Voice messages
- ✓ Interactive voice response systems (IVRS)
- ✓ Social media platforms like WhatsApp and Telegram

Farmers receive regular updates on weather forecasts, crop management practices, fertilizer recommendations, pest outbreaks, and market prices. Mobile-based extension services allow for quick sharing of critical information during emergencies like pest invasions or extreme weather.

3.2 Agricultural Mobile Applications

Multiple agricultural mobile apps have been created by government organizations, research institutions, and private companies to assist farmers. These apps provide extensive information covering various farming aspects. Common features of agricultural mobile apps include:

- ✓ Crop production guidelines
- ✓ Soil health management tips
- ✓ Pest and disease identification tools
- ✓ Weather forecasting services
- ✓ Market price information
- ✓ Access to government subsidies
- ✓ Online consultations with agricultural experts

Mobile applications allow farmers to access a wealth of information in a user-friendly and interactive way.

3.3 Digital Video and Multimedia Advisory

Video-based extension services are increasingly used to showcase improved agricultural practices. Short instructional videos help farmers grasp complex technologies more easily than traditional text-based information. Digital videos might include demonstrations of:

- ✓ Advanced crop cultivation techniques
- ✓ Integrated pest management practices
- ✓ Organic farming methods
- ✓ Post-harvest handling and storage practices
- ✓ Use of modern farming equipment

These videos can be shared via smartphones, community information centers, and farmer producer groups. Research indicates that video-based extension methods significantly enhance farmers' understanding and adoption of better agricultural technologies.

3.4 Artificial Intelligence and Chatbots

Artificial Intelligence (AI) is quickly changing digital agricultural advisory services. AI systems analyze extensive data on weather patterns, soil conditions, crop growth, and pest outbreaks to provide tailored advice to farmers. AI chatbots enable farmers to engage with digital advisory platforms and receive instant answers to their questions. They can inquire about crop diseases,

fertilizer use, irrigation schedules, or pest management and get immediate assistance.

3.5 Satellite and GIS Technologies

Satellite imagery and Geographic Information Systems (GIS) are vital in modern digital agriculture. These technologies allow for extensive monitoring of agricultural areas and offer valuable insights into crop health. Satellite monitoring can assist with:

- ✓ Tracking crop growth
- ✓ Assessing soil moisture
- ✓ Identifying pest and disease outbreaks
- ✓ Monitoring drought conditions
- ✓ Estimating crop yields

GIS mapping systems provide location-specific recommendations to farmers, improving resource management and crop planning.

4. Benefits of Digital Extension Services

Digital extension services provide many benefits for farmers, extension workers, and agricultural institutions.

4.1 Timely Information Delivery

Digital platforms allow for quick sharing of information about weather forecasts, pest outbreaks, irrigation schedules, and crop management techniques. Farmers who access information in a timely manner can take preventive steps and lower production risks.

4.2 Improved Agricultural Productivity

Gaining access to scientific knowledge and better technologies helps farmers adopt improved farming practices. Digital advisory services promote efficient resource use, enhance crop management, and increase crop productivity.

4.3 Wider Reach of Extension Services

Digital platforms enable agricultural extension services to reach thousands of farmers at once. Even those in remote or hard-to-reach areas can access advice through mobile phones and internet services.

4.4 Cost-Effective Extension Delivery

Traditional extension services often require considerable funding for field visits, training, and demonstrations. Digital extension systems cut operational costs by facilitating remote advisory services and large-scale information sharing.

4.5 Strengthening Climate Resilience

Climate variability presents serious challenges for agricultural production. Digital extension services supply farmers with climate information, weather forecasts, and risk management strategies that help them adapt to shifting climate conditions.

4.6 Enhanced Market Access

Digital platforms also give farmers real-time market information, including commodity prices, demand trends, and marketing opportunities. This helps them make better decisions about selling their crops and boosts farm profitability.

5. Challenges in Digital Extension Services

Despite their many benefits, digital extension services encounter several challenges that hinder their widespread use.

5.1 Limited Digital Literacy

Many rural farmers lack experience with smartphones, apps, and digital platforms. Limited digital skills can stop farmers from properly using digital advisory services.

5.2 Poor Internet Connectivity

Reliable internet access remains a challenge in many rural areas. Slow internet speeds and limited network coverage can hinder the effectiveness of digital extension platforms.

5.3 Language and Content Barriers

Many digital platforms offer information only in major languages, making it difficult for farmers who speak local dialects to understand the material. Adapting digital advisory services for local languages is essential.

5.4 Affordability Constraints

The cost of smartphones, internet data plans, and digital devices can be a barrier for small and marginal farmers. Limited financial resources limit the uptake of digital technologies.

5.5 Lack of Technical Support

In many rural areas, farmers lack access to technical support that could help them navigate digital platforms or mobile apps.

6. Government and Institutional Initiatives

Governments and agricultural institutions have launched several initiatives to promote digital extension services and strengthen agricultural information systems. Major initiatives include:

- ✓ Kisan Call Centres (KCC) providing telephonic advisory services to farmers
- ✓ Digital Agriculture Mission aimed at promoting digital technologies in agriculture
- ✓ Farmer advisory portals providing online agricultural information
- ✓ Mobile-based agricultural applications developed by research institutions
- ✓ Artificial intelligence-based advisory platforms for personalized recommendations
- ✓ These initiatives aim to improve the accessibility and efficiency of agricultural extension services.

7. Future Prospects of Digital Extension

The future of digital extension services is highly promising due to the rapid development of emerging technologies. Several innovations are expected to further transform agricultural advisory systems. Key future developments include:

- ✓ Artificial Intelligence (AI) for predictive agricultural analytics
- ✓ Internet of Things (IoT) for real-time monitoring of farm conditions
- ✓ Drones and remote sensing for crop surveillance and precision agriculture
- ✓ Blockchain technology for transparent agricultural supply chains
- ✓ Big data analytics for improved agricultural decision-making
- ✓ Integration of these technologies will enable more precise, data-driven, and personalized advisory services for farmers.

Digital extension systems will also promote smart farming, precision agriculture, and climate-smart agricultural practices, contributing to sustainable agricultural development.

CONCLUSION

Digital extension services represent a transformative approach to agricultural knowledge dissemination in the modern era. By leveraging digital technologies such as mobile phones, internet platforms, artificial intelligence, and satellite monitoring systems, farmers can access timely, accurate, and location-specific agricultural information.

These services improve decision-making, enhance agricultural productivity, strengthen climate resilience, and increase farmers' access to markets and financial services. Digital extension also helps bridge the gap between agricultural research institutions and farming communities by facilitating faster knowledge transfer.

However, challenges related to digital literacy, infrastructure, affordability, and language barriers must be addressed to ensure inclusive and equitable access to digital advisory services. Governments, research institutions, and private organizations must work collaboratively to expand digital infrastructure, promote farmer training, and develop localized digital content. With continued technological innovation and supportive policy frameworks, digital extension services will play a critical role in modernizing agricultural extension systems and promoting sustainable agricultural development for rural farmers.

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