

Smart Farming: The Rise of AI in Agro-Advisory Services

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ABSTRACT

Artificial Intelligence (AI) is rapidly transforming agricultural advisory services by providing farmers with timely, data-driven, and location-specific information. Compared to conventional extension approaches, AI-enabled tools such as chatbots, voice assistants, and predictive analytics offer faster and more accessible support for decisions related to irrigation, fertilizer application, and pest management. These innovations have the potential to enhance farm productivity, improve resource efficiency, and promote sustainable agriculture. However, challenges including limited digital infrastructure, language barriers, concerns about data reliability, and low farmer trust continue to affect their wider adoption. Hence, integrating AI-based advisory systems with traditional extension services is essential to ensure inclusive, reliable, and effective support for farming communities.

INTRODUCTION

Conventional agricultural extension systems, which mainly rely on face-to-face interactions between farmers and extension workers, are increasingly facing challenges due to climate change, limited resources, and rising food demand. These

systems often struggle to reach remote farmers and usually provide generalized rather than farm-specific advice. With the global population projected to reach 8.5 billion by 2025 and 9.8 billion by 2050, agricultural systems are facing increasing pressure to

produce more food with fewer resources, thereby highlighting the need for more efficient and scalable knowledge dissemination methods (Sharma *et al.*, 2025).

According to Sharma *et al.* (2025), the adoption of AI in agricultural advisory differs across regions based on digital infrastructure and policy support. While developed countries show greater AI integration, developing regions are increasingly using mobile-based AI tools for smallholder farmers. AI is helping improve accessibility, precision, and decision-making in agriculture, although challenges such as digital inequality, reliability, and institutional integration still remain.

How AI is Changing Agricultural Advisory



Artificial Intelligence (AI) is improving agricultural advisory services by providing farmers with timely and location-specific recommendations using data from weather, sensors, and farm records. These AI-based services help farmers make better crop management decisions and improve farm productivity.

1. Real-Time, Personalized Advice

AI supports farmers by providing timely and location-specific advisory services based on weather, soil, crop, and sensor data. Through mobile-based platforms, farmers can access accurate recommendations on irrigation, fertilizer use, and pest management. It also helps reduce resource wastage and offers early warnings about climatic and pest-related risks.

2. Chatbots and Voice-Based Advisory

AI-powered chatbots and voice assistants help farmers access agricultural information quickly through mobile phones. They provide instant advice on crop diseases, irrigation, fertilizers, pest control, and market prices in local languages. By considering factors like location, crop type, and season, these tools offer practical and farmer-friendly recommendations while supporting traditional extension services.

3. Predictive and Preventive Advisory

AI is supporting farmers in proactive farming by providing early warnings and predictive advice using weather, sensor, and historical data. These tools help farmers improve planning, manage resources efficiently, and make better decisions related to crop production and marketing. Predictive digital technologies also strengthen climate resilience and reduce agricultural risks. According to the Food and Agriculture Organization, such technologies are important for improving climate-resilient farming systems and food security (FAO, 2023).

4. 24/7 Digital Advisory Support

AI-enabled advisory services allow farmers to access agricultural information anytime through mobile phones, apps, SMS, and voice-based platforms. These systems provide instant guidance on crop management, helping farmers make timely and informed decisions. They are especially useful in remote areas where traditional extension services are limited. According to the Food and Agriculture Organization, continuous digital advisory support is important for strengthening agricultural resilience under climate and resource challenges (FAO, 2023).

Challenges and Limitations of AI in Agricultural Advisory

Although AI has great potential to improve agricultural advisory services, its adoption still faces several social, technical, and practical challenges. Unequal access to technology and other barriers limit the widespread and inclusive use of AI among farmers.

1. Digital Divide

A major challenge in AI-based agricultural advisory services is the digital divide among farmers. Many small and marginal farmers, especially in developing and remote areas, still lack smartphones, internet access, and proper digital infrastructure. As a result, the reach and effectiveness of AI-powered agricultural solutions remain limited (Birner *et al.*, 2021; Klerkx & Rose, 2020).

2. Language and Literacy Barriers

Language and literacy barriers limit the effective use of AI-based agricultural advisory services among many farmers. Digital information is often difficult to understand when it is not available in local languages or simple formats. Low reading and digital skills can further reduce farmers' ability to use mobile apps and online platforms. Therefore, local-language and voice-based advisory systems are important for improving accessibility and adoption.

3. Data Quality and Availability Issues

AI-based agricultural advisory systems rely on accurate and high-quality data to generate reliable recommendations. Incomplete or outdated information can lead to incorrect predictions and affect farm decisions. Challenges related to data management, integration, and ownership also limit the effectiveness of AI in agriculture. Researchers emphasize that strong data infrastructure and proper governance are essential for successful

AI-enabled advisory services (Klerkx & Rose, 2020; Birner *et al.*, 2021).

4. Trust and Adoption

Lack of trust and awareness can limit farmers' adoption of AI-based advisory services. Many farmers may hesitate to follow AI-generated recommendations because they are unfamiliar with how the technology works. Concerns about reliability and fear of new technologies also slow its acceptance. Research indicates that farmers are more likely to adopt AI tools when they receive support from trusted extension workers or local institutions (Rose *et al.*, 2021).

CONCLUSION

In summary, while AI offers powerful opportunities for improving agricultural advisory, its success depends on addressing key challenges related to access, usability, data reliability, and trust. Overcoming these limitations will require coordinated efforts in infrastructure development, inclusive design, data management, and farmer engagement to ensure that AI benefits all segments of the agricultural community.

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