

Can Smart Farming Technologies Transform Farmers Income in India

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INTRODUCTION

India is an agrarian economy where nearly half of the population depends directly or indirectly on agriculture for livelihood. However, Indian farmers continue to face several challenges such as low productivity, climate change, fragmented land holdings, labor shortages, rising input costs, and uncertain market prices. In this context, smart farming technologies are emerging as a revolutionary solution capable of transforming Indian agriculture into a more profitable, sustainable, and efficient system.

Smart farming refers to the use of modern technologies such as Artificial Intelligence (AI), Internet of Things (IoT), drones, sensors, robotics, satellite imaging, mobile applications, precision farming, and data analytics in agriculture. These technologies help farmers make informed decisions, optimize resources, reduce losses, and improve crop productivity. The Government of India is also promoting digital agriculture through various schemes and initiatives.



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Available online at

www.sunshineagriculture.vitalbiotech.org

Article History

Received: 28. 4.2026

Revised: 3. 5.2026

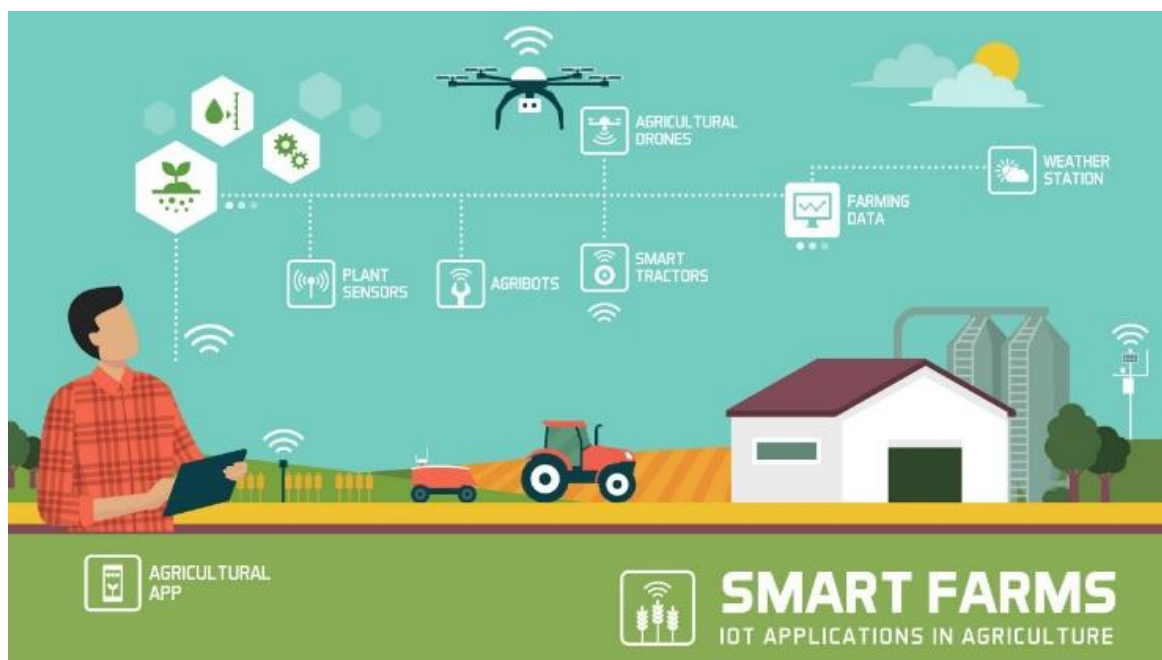
Accepted: 8. 5.2026

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What is Smart Farming

Smart farming, also called digital agriculture or precision agriculture, involves the integration of advanced technologies into traditional farming practices. It enables farmers to monitor crops, soil, water, weather, and pests in real time and make data-driven decisions.



According to discussions and industry insights shared in online agritech communities, smart farming focuses on improving efficiency and productivity through technologies like AI, IoT, drones, sensors, and cloud computing.

Major Components of Smart Farming

- Internet of Things (IoT)
- Artificial Intelligence (AI)
- Drones and remote sensing
- GPS and GIS technologies
- Precision irrigation systems
- Mobile-based advisory services
- Automated machinery and robotics
- Big data and cloud computing
- Smart weather forecasting systems

Need for Smart Farming in India

Indian agriculture is under pressure due to increasing population, shrinking agricultural land, and changing climatic conditions. Traditional farming methods often result in excessive use of fertilizers, pesticides, and water, increasing production costs and environmental damage.

Smart farming technologies are essential for modern agriculture as they help increase crop productivity, reduce input costs, and improve water-use efficiency. They also minimize crop losses through better monitoring and provide accurate weather information for timely decision-making. In addition, these technologies improve market access and ultimately enhance farmers' profitability and sustainability.

Types of Smart Farming Technologies

1. Precision Farming

Precision farming involves applying inputs such as fertilizers, pesticides, and irrigation only where and when needed. Sensors and satellite data help identify nutrient deficiencies, pest infestations, and soil moisture variations. Smart farming offers several important benefits, including reduced fertilizer use, lower production costs, increased crop yield, and improved soil health. By optimizing resource use and enhancing farm management practices, these technologies help make agriculture more efficient, productive and sustainable.



2. Internet of Things (IoT) in Agriculture

IoT devices in smart farming include sensors installed in fields to monitor soil moisture, temperature, humidity, nutrient status, and crop growth. These devices collect real-time data and send it directly to farmers through smartphones, helping them make timely and accurate farming decisions. Smart farming technologies offer several advantages, including efficient irrigation management, reduced water wastage, better crop monitoring, and timely decision-making. These benefits help farmers improve productivity, conserve resources and manage crops more effectively.

3. Drone Technology

Agricultural drones are increasingly being used for crop monitoring, pesticide spraying,

fertilizer application, yield estimation, and disease detection. The Government of India is actively promoting drone technology in agriculture through subsidies and training programs to encourage its adoption among farmers. Drones help reduce labor requirements, perform spraying operations more quickly, and ensure precision application of chemicals, which minimizes wastage and improves efficiency. They also reduce health hazards for farmers by limiting direct exposure to pesticides and other chemicals. Overall, drone-based precision agriculture has significantly improved farm efficiency and resource conservation.



4. Artificial Intelligence (AI)

Artificial Intelligence (AI) helps farmers analyze large amounts of agricultural data to predict weather conditions, pest attacks,

disease outbreaks, yield potential, and irrigation needs. AI-powered advisory systems can also recommend suitable farming practices for specific crops and regions, enabling

farmers to make accurate and timely decisions for improved productivity and resource management.

Examples in India

- AI-based crop monitoring
- Kisan e-Mitra chatbot
- Smart advisory mobile applications

5. Smart Irrigation Systems

Smart irrigation systems use sensors and automated controls to provide water according to crop requirements. These systems help conserve water, reduce electricity consumption, improve crop growth, and lower irrigation costs. By ensuring efficient water management, smart irrigation technologies can save up to 50% of water compared to traditional irrigation methods.



How Smart Farming Can Increase Farmers Income

1. Higher Crop Productivity

Smart technologies enable farmers to identify crop problems early and take corrective measures. Precision farming improves nutrient management and increases productivity. Research and pilot projects indicate yield increases of 15-40% in precision farming systems.

2. Reduction in Input Costs

Smart farming enables precise use of fertilizers, pesticides, and water, reducing wastage and input costs. It lowers fertilizer, pesticide, water and labor expenses while improving resource-use efficiency. Technologies like drone spraying and AI-based recommendations help avoid unnecessary applications and support sustainable, cost-effective farming.

3. Better Market Access

Digital platforms enable farmers to track market prices, sell their produce directly, and connect with buyers more efficiently. These technologies reduce the exploitation caused by middlemen and improve market access for farmers. E-commerce platforms and mobile applications also enhance price transparency, helping farmers receive better prices and increase their profitability.

4. Climate Resilience

Climate change poses a major threat to Indian agriculture by increasing the frequency of droughts, floods, heat stress, and unpredictable weather conditions. Smart farming technologies help farmers adapt to these challenges through weather forecasting, early warning systems, drought monitoring, and precision irrigation. These digital agriculture tools improve decision-making, enhance risk

management, conserve resources, and reduce crop losses, thereby increasing the resilience and sustainability of farming systems.

5. Reduction in Post-Harvest Losses

Smart storage systems, cold-chain monitoring, and supply-chain tracking technologies reduce spoilage and improve product quality. This increases farmers' marketable surplus and income.

Government Initiatives Supporting Smart Farming in India

Digital Agriculture Mission

The Government of India launched the Digital Agriculture Mission to modernize the agricultural sector through advanced digital technologies. The mission promotes the use of Artificial Intelligence (AI), big data analytics, geospatial technologies, digital crop surveys, and farmer databases to improve agricultural planning, monitoring, and decision-making. These technologies aim to enhance productivity, ensure efficient resource management, provide better advisory services,

and support sustainable agricultural development.

Promotion of Kisan Drones

The government provides subsidies and support for drone adoption under agricultural mechanization schemes.

AgriStack Initiative

AgriStack aims to create a comprehensive digital ecosystem for agriculture by integrating farmer databases, crop records, land information, and weather and soil data. This digital platform helps provide targeted services, personalized advisories, financial support, and government benefits directly to farmers. By improving data-driven decision-making, AgriStack supports efficient farm management, enhances productivity, and promotes sustainable agricultural development.

RKVY-RAFTAAR and Agri-Startups

Government programs are supporting agritech startups and innovation ecosystems to bring modern technologies to rural India.

Challenges in Adoption of Smart Farming

Challenge	Description
High Initial Cost	Smart farming equipment such as drones, sensors, and automation systems are expensive for small farmers.
Lack of Digital Literacy	Many farmers are not familiar with digital tools and modern technologies.
Poor Internet Connectivity	Rural areas often suffer from weak internet infrastructure, limiting technology adoption.
Small Land Holdings	Most Indian farmers have small and fragmented landholdings, making large-scale mechanization difficult.
Lack of Awareness	Many farmers are unaware of the benefits and availability of smart farming technologies.

Future of Smart Farming in India

The future of smart farming in India looks promising due to:

- Increasing smartphone penetration
- Government support
- Rising agritech investments
- Expansion of digital infrastructure
- Growing awareness among farmers

CONCLUSION

Smart farming technologies have immense potential to transform farmers' income in India by increasing productivity, reducing input costs, conserving resources, and improving

market access. Technologies such as AI, IoT, drones, precision irrigation, and digital platforms can make Indian agriculture more sustainable, profitable and climate-resilient. However, widespread adoption requires strong government support, affordable technologies, farmer training, rural internet connectivity, and awareness programs. If implemented effectively, smart farming can play a major role in doubling farmers' income and ensuring food security in India.