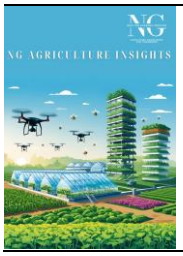

NG Agriculture Insights

A Popular Magazine (ISSN: 3107-5703)
Volume 2, Issue 5, September-October, 2026, 42-50

Revolutionizing Farming: Emergence of AI in Agriculture

Rajashree Khatua[1], N. Pradhan[1], M. Roy[2]

[1]Department of Agricultural Meteorology, Odisha University of Agriculture and Technology, Bhubaneswar, India
[2]AICRP on Linseed, Keonjhar, Odisha University of Agriculture and Technology, Bhubaneswar, India

*Corresponding author email ID: rajashreekhatua.agmet@ouat.ac.in

A B S T R A C T

Agriculture will face increased pressure to provide the food needs of a big population due to the existing situation of fast population expansion and climate change. A major factor in changing agricultural methods, increasing productivity and food security for the expanding population will be the application of artificial intelligence (AI) in agriculture. AI-powered solutions optimize crop management and resource utilization by offering real-time data and predictive analytics. AI improves irrigation, fertilization, and pesticide application while minimizing resource waste and environmental effect by gathering data from sensors, drones, and satellite photography. In order to address issues like climate change and labour shortages, AI-driven real-time crop and soil health monitoring, yield forecasts, early pest and disease detection, and automated machinery are revolutionizing traditional farm operations. With new technology raising agricultural output and efficiency to unprecedented levels, artificial intelligence in agriculture has a bright future.

Keywords: Artificial Intelligence, Climate change, Food Security, Population growth, Real-time data

Submitted: 01-09-2026 Accepted: 03-09-2026 Online: 04-09-2026

1. INTRODUCTION

As agriculture and its related industries supply the majority of India's income, it is seen as the foundation of the civilization that sustains a sizable population. About 42.3% of Indians depend on agriculture for their living, and it accounts for 18.2% of the nation's GDP (PIB,2024). The sector will continue to play a vital role as India's population is expected to increase, possibly reaching 1.7 billion by the 2060s (Kumar, S., 2025). Increased consumerism brought on by the expanding population will eventually result in higher emissions and climate change. These circumstances will put agriculture under a lot of strain to meet the world's food needs. To fulfil the demands of an expanding population, farmers cannot rely solely on their conventional methods. Natural cycles and physical labour were key components of traditional farming. Therefore, in order to confront and overcome these obstacles, farmers need new and creative technology.

The advent of artificial intelligence (AI) in agriculture offers a unique chance to tackle these issues. AI enables real-time data analysis, predictive modelling, and automated decision-making processes by integrating data science, machine learning, robots, and the Internet of Things (IoT) into agricultural systems. Recently, AI technologies have been transforming conventional farming methods to increase productivity, sustainability, and profitability.

AI is crucial for safeguarding the agriculture sector from a variety of risks, including global food insecurity, labour disputes, population growth, and climate change. AI's cutting-edge solutions preserve soil fertility while assisting in the reduction of excessive water, pesticide, and herbicide use.

https://doi.org/10.5281/zenodo.22308705

© 2026 The Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0).

Additionally, it facilitates the efficient use of labour to boost productivity and improve quality. Among other aspects of farming, AI has improved crop yield, real-time monitoring, harvesting, processing, and marketing. AI is being used by India to address climate change and resource scarcity in agriculture. Initiatives like Kisan e-Mitra and IoT-enabled technologies, which enhance farmer lifestyles, productivity, and sustainability, show the nation's commitment to an AI-driven agricultural revolution.

By 2025, artificial intelligence (AI) will have significantly changed many facets of farming to increase productivity and sustainability and create a more resilient global agricultural sector. Prospects call for cooperation between farmers, academics, politicians, and technologists to fully utilize AI in order to guarantee food security. AI is therefore more than just a tool; it may be the foundation of the upcoming agricultural revolution.

2. ARTIFICIAL INTELLIGENCE (AI)

During the 1955 Dartmouth Conference, John McCarthy coined the phrase "Artificial Intelligence." In computer science, artificial intelligence (AI) is the study of building robots that can carry out activities that normally call for human intellect. The technology known as artificial intelligence is predicated on the notion that human intellect may be simplified such that a machine can simply imitate it and carry out activities that range from easy to difficult (T. Davenport et al., 2020). To enable robots to do tasks effectively and independently, artificial intelligence (AI) seeks to replicate human skills like learning, thinking, and sensing.

Theoretically, there are three distinct kinds of AI. i) Artificial Narrow Intelligence (ANI): AI that is particularly good at a particular task, including automated categorization, illness detection, or self-driving automobiles. ii) Artificial General Intelligence (AGI): A computer that can execute a variety of intellectual activities and matches human intelligence is referred to as AGI. iii) The term Artificial Super Intelligence (ASI) describes a hypothetical AI that greatly outperforms human intelligence in practically every domain (Bostrom 2014).

Object recognition, language comprehension, and autonomous decision-making are just a few of the amazing capabilities of AI-powered apps and gadgets that can replace human intellect or involvement. They frequently exhibit human-like intelligence in their ability to learn from new knowledge, make tailored recommendations, and complete tasks on their own.

Automating tedious processes, gaining deeper and quicker insights from data, and improving decision-making are just a few of the many benefits artificial intelligence offers across a range of applications and sectors. Additionally, AI avoids physical dangers, works around the clock without interruption, and lowers human error all of which boost production and efficiency. Therefore, artificial intelligence (AI) is a partnership between humans and technology that enhances rather than replaces capabilities; it is about people working with machines rather than against them.

3. AI TECHNOLOGIES IN AGRICULTURE

AI encompasses a broad spectrum of technologies that improve production, sustainability, and efficiency in agriculture, each with a distinct contribution.

i) Machine learning: It refers to algorithms that allow a machine to learn from data to make judgments or predictions without explicit guidance. This allows a computer system to keep learning and getting better on its own via experience. utilized for illness detection, yield prediction, and weather forecasting.

ii) Predictive analytics: To anticipate market trends, crop yields, disease outbreaks, insect infestations, and planting schedule optimisation, predictive analytics models employ big data and machine learning algorithms to analyse weather patterns, soil conditions, and historical crop data. It enhances crop management decision-making and lessens resource waste.

iii) Computer vision and drones: It uses drones to take high-resolution crop photos to monitor plant health, illnesses, and nutrient shortages in real time. It reduces the usage of chemicals by enabling tailored pesticide application and early disease diagnosis. It makes use of devices like CNNs for image-based diagnostics and AI-powered drones for precise spraying.

iv) Robotics and Autonomous Systems: AI-driven robots are used to automate labour-intensive operations like planting, harvesting, and weeding. Autonomous harvesters, tractors, and seed planters boost productivity and solve the labour problem.

v) IoT (Internet of Things) and Sensors: Using weather stations, drones, and ground-based sensors, it gathers data on crop health, temperature, and soil moisture in real time.

vi) Generative AI and Simulation: It optimizes farm layouts and resource allocation by simulating crop growth under various climatic circumstances. It

promotes the development of high-yielding, disease-resistant crops and strengthens climate resilience (M. Aggrawal, 2024). Beyond crop and weather applications, machine-learning techniques are increasingly being employed to analyse socioeconomic and livelihood dimensions of farming systems, allowing complex nonlinear determinants of farmer outcomes to be identified (Ghosh et al., 2025).

vii) Natural Language Processing: Enables voice-activated farmer interfaces and agricultural advice translation. To produce useful insights, it analyses market trends and data from agricultural research. It enhances forecasting of customer demand and supply chain transparency. It makes it easier for farmers to use digital technologies.

4. STEP-BY-STEP APPROACH TO USING AI IN AGRICULTURE

The step-by-step approach is presented in Table 1.

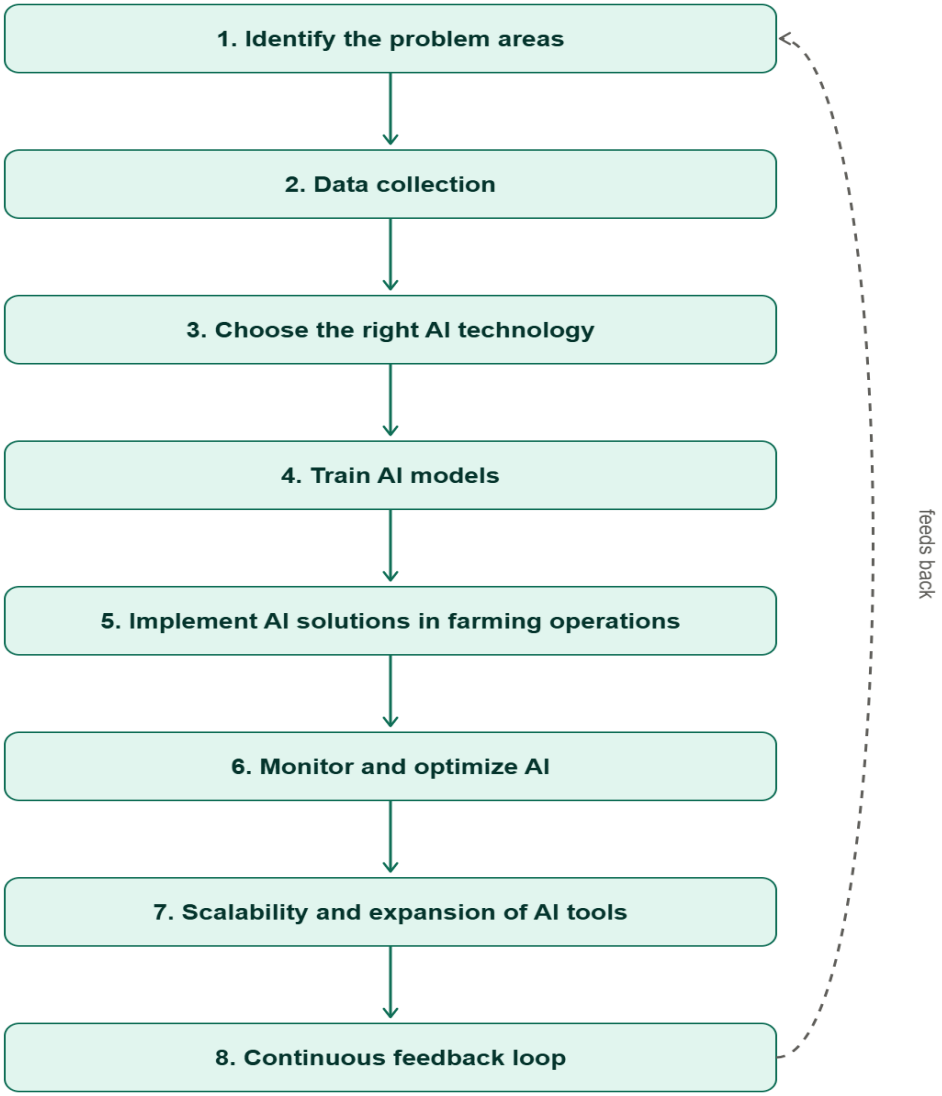

Figure 1. Step-by-step approach to using AI in agriculture (Srivastava, 2025)

5. BENEFITS OF AI IN AGRICULTURE

For farmers, artificial intelligence (AI) in agriculture is like a superhero, providing a host of incredible benefits. Farmers can produce more on the same amount of land because to AI. AI helps farms reduce waste and save the environment by managing resources like fertilizer and water more effectively. This encourages environmentally friendly agricultural methods that complement the objectives of green marketing. AI in agriculture offers climate-resilient technologies, such predictive analytics for weather forecasting, soil moisture monitoring, and crop disease identification, that assist farmers in adapting to climate change. AI-powered precision farming increases crop yields and encourages environmentally friendly

agricultural methods that support climate resiliency and food security. AI in agriculture is therefore a clever assistant that helps farmers increase the productivity and profitability of their operations.

5.1. Reductions In Loss

Through better decision-making, resource optimization, and early danger identification, AI assists farmers in minimizing losses. AI may reduce crop failure and assist a farmer in taking the appropriate steps to lessen the loss by detecting diseases and pests early, forecasting weather and the possible effects of atmospheric factors like wind, rain, or drought to guide planting decisions, and managing agricultural methods effectively.

5.2. Addresses Labour Shortage by Automation

AI automation offers a solution to the issue of agriculture's need for additional workers. Traditional agricultural techniques are enhanced by AI without needing farmers to do all the difficult chores individually. AI-powered devices such as autonomous tractors, robotic harvesters, weeding and sowing robots, and intelligent irrigation systems may do all of the work on their own, freeing up farmers' time for planning and decision-making (Srivastav, 2025).

5.3. Cost Saving

The problem of agriculture's requirement for more labour can be solved with AI technology. AI improves traditional farming methods without requiring farmers to perform all the challenging tasks by themselves. Farmers may have more time for planning and decision-making if AI-powered tools like intelligent irrigation systems, robotic harvesters, autonomous tractors, and robots for weeding and sowing do all the labour themselves (Srivastav, 2025).

5.4. Productivity Improvements

The potential of AI in agriculture to boost food production through productivity gains is another intriguing benefit. AI solutions help farmers make better decisions by predicting outcomes using machine learning and clever algorithms. Yields and resistance are also increased by AI-driven genetic improvement, accurate resource allocation, and useful applications (Aijaz et al., 2025).

5.5. Bridge Technology Gap

Illiterate or semi-literate people can communicate with technology without reading or typing thanks to recent developments in AI that allow local languages and voice instructions. In the farmer's native tongue, AI may offer tailored, location-specific guidance such as crop recommendations, weather predictions, and pest alarms.

5.6. Sustainable Agriculture

By maximizing the use of resources (water, fertilizer, and pesticides), cutting waste and greenhouse gas emissions, anticipating and averting crop diseases and pests, and advancing precision agriculture, artificial intelligence (AI) supports sustainable farming. Farmers can increase agricultural yields, preserve natural resources, lessen their influence on the environment, and eventually promote a more sustainable food system by utilizing AI.

6. APPLICATIONS OF AI IN AGRICULTURE

6.1 Soil Management

Farmers' approaches to soil fertility and health have changed as a result of the use of AI in soil management. Real-time monitoring of soil health, including nutrient levels, moisture content, and pH balance, is made possible by AI-powered technologies. Farmers may obtain important insights into soil health and implement more focused and accurate treatments by utilizing machine learning algorithms and data analytics.

Predictive analytics, which can anticipate soil erosion and nutrient depletion, is one of the main uses of AI in soil management. This makes it possible for farmers to proactively reduce these risks, so encouraging sustainable farming practices and minimizing soil deterioration. In order to reduce their negative effects on the environment, AI-powered soil management systems may also offer tailored suggestions for when to apply fertilizer and when to schedule irrigation. Farmers may find regions of soil variability with the use of AI-driven soil mapping and categorization, allowing for more accurate management techniques. AI can offer a thorough understanding of soil health by combining data from multiple sources, such as sensors, drones, and satellite imagery. This helps with decision-making and resource allocation, which reduces fertilizer waste, improves soil conservation, and increases crop yields.

6.2. Crop Health Monitoring

AI is revolutionizing agricultural monitoring by making it possible for farmers to gather, process, and act upon data more effectively. Real-time aerial footage is captured by AI-powered drones, satellites, and cameras to assess crop health and identify insect infestations, allowing farmers to minimize crop losses

and use fewer herbicides. Real-time data from drones may be used to analyse crop growth trends. Through real-time monitoring, resource use is optimized, yield is increased, environmental impact is decreased, and sustainability is enhanced.

6.3. Precision Agriculture

Optimizing field-level management in relation to crop farming is the primary goal of precision agriculture. By analyzing data from sensors, satellites, and other sources, artificial intelligence (AI) plays a crucial part in this. Based on soil and meteorological data, AI-based decision support systems give farmers more insights and assist them in choosing the best periods for planting, fertilizing, and harvesting. Variable Rate Technology (VRT) optimizes resources by applying insecticides, fertilizer, and water at variable rates across the field according to diverse demands. Early indicators of crop stress are identified via drone-based monitoring before they become apparent. By predicting production outputs, predictive models aid in better market management and planning. Additionally, AI helps farms adjust to climate change-related harsh weather. Basic AI technologies like the Sowing App and a phone that can send SMS messages might be beneficial to farmers. Meanwhile, farmers who have access to Wi-Fi may use AI programs to continuously receive an AI-customized farm plan. AI thereby aids in improving agricultural methods, increasing productivity, and raising crop yields.

6.4. Weather Prediction

It is difficult for farmers to decide when to plant seeds because of climatic uncertainties. Machine learning algorithms forecast future weather by analysing historical weather patterns. This allows farmers to modify planting schedules, crop choices, and farming practices to increase yields and lower climate-related losses.

6.5. Detection of diseases and pests

Diseases and pests are major problems in agriculture. By integrating computer vision and sensor data, AI-powered systems may identify the presence of pests or illnesses, such as locusts, grasshoppers, and diseases like mildew, rot, etc. Large fields may be monitored and regions under pest and disease assault can be identified with the use of AI algorithms in conjunction with satellite and drone footage. This helps farmers perform the required pest control steps and preventative measures when combined with alarm systems that are sent to their mobile phones. AI-powered pest monitoring programmes, such as the National Pest Surveillance System (NPSS), are supporting timely pest diagnosis and management among Indian farmers (Kumar et al., 2025).

6.6. Yield Mapping

Large datasets are analysed in real time using ML algorithms. By integrating methods such as 3D mapping, sensors, and drones, data is gathered that allows precise forecasting of future crop yields. This enables farmers to utilize resources as efficiently as possible to increase the net return on their investments.

6.7. Optimizing automated irrigation System

When paired with IoT (Internet of Things) sensors, AI algorithms can track weather patterns and soil moisture levels to pinpoint crops' precise water requirements in real time. In addition to conserving water, a valuable resource, this guarantees that crops get the proper quantity of hydration, increasing production and decreasing waste. Farmers may now better manage their water supplies and prevent abuse by utilizing an autonomous agricultural irrigation system. By examining variations in flow and pressure, artificial intelligence (AI) also assists in the real-time detection of irrigation leaks, reducing water waste and crop damage and improving water conservation and efficiency.

6.8. Automatic weeding

Similar to how AI can identify pests and illnesses, it can also identify invasive plant species and weeds. Computer vision driven by machine learning can reliably detect weeds from crops by evaluating the size, shape, and colour of their leaves. Robots that can do autonomous weeding may be programmed using this, which would address the labour shortage issue and enable more reliable and effective work.

6.9. Automation in Harvesting

Harvesting is a labor-intensive procedure that needs a lot of manpower to complete. Autonomous tractors and harvesters powered by AI increase productivity while lowering the need for manual labour. Robotic harvesters use computer vision to determine the freshness of fruits and vegetables. AI can also forecast the best periods for harvest, which would simplify farming even more.

6.10. Sorting of Produce after Harvesting

AI is crucial after product has been collected, not just when crops are being grown or harvested. The collected produce can be more precisely sorted by AI.

It has the ability to rate products according to their size, shape, and colour. Unlike labor-intensive manual sorting methods, this allows farmers to separate the crops rapidly.

6.11. Livestock Management

Wearable cameras and sensors with AI capabilities track the behaviour of cattle. AI technology makes 24-hour surveillance possible. They aid in the early detection of sickness and anomalies in eating, drinking, ruminating, moving, standing, and lying down behaviours. AI systems examine this data to identify reproductive cycles, stress, and disease, allowing for prompt response. In order to minimize waste and guarantee that animals receive the right nutrients, automated systems can help with feed optimization. Herd management software and AI-powered milking robots boost productivity and cut labour expenses (Spleiss, 2025).

6.12. Supply Chain Optimisation and Market Forecasting

By employing demand forecasting and predictive analytics to improve distribution, cut waste, and ensure that commodities are delivered to markets on time, artificial intelligence is significantly contributing to the optimization of agricultural supply chains. Additionally, supply chain resilience is increased, post-harvest losses are reduced, and inventory management is improved using AI-powered smart logistics.

AI also has a big impact on price prediction, which helps farmers decide when to sell their goods. The food supply chain is more transparent and traceable when blockchain and AI are integrated.

6.13. Initiatives of Government driving AI Adoption

AI integration in agriculture has been actively pursued by the Indian government. Under the "Make AI in India and Make AI work for India" campaign, India recently established three AI Centres of Excellence (CoEs) in prestigious academic institutions with an emphasis on sustainable cities, healthcare, and agriculture. With a budget of ₹990 crore spread throughout 2023–2024 and 2027–2028, its goal is to provide farmers with AI-powered solutions to tackle a range of agricultural issues. Among the projects are:

i) Kisan e-Mitra is an AI chatbot created to help farmers by responding to inquiries and offering assistance on the PM Kisan Scheme. This AI system offers multilingual support and is being developed to help with other government initiatives. This tool overcomes language barriers and gives farmers easily accessible, complete information by providing voice-based, customized support. This project is a component of a larger endeavor to improve decision-making, empower farmers with AI tools, and encourage sustainable practices.

ii) AI-based crop health monitoring that uses weather, soil moisture, and satellite data to provide a thorough crop health evaluation for wheat and rice.

iii) The National Pest Surveillance System, which employs AI and machine learning to identify pest infestation in crops and enable prompt intervention for healthier crops, aims to reduce the loss of output brought on by climate change. (PIB Report, 2025)

iv) The Ministry of Electronics and Information Technology's Future Skills PRIME initiative aims to upskill and reskill professionals in cutting-edge technologies, including artificial intelligence.

v) To improve accessibility and remove language obstacles for farmers, the Digital India Bhashini project has created more than 350 AI-powered language models for ten Indian languages (Jeevan Andam, N.,2024).

Agricultural expert systems have transformed the way scientific knowledge is delivered to farmers by making expert advice readily available through digital platforms. Their ability to provide quick, reliable, and crop-specific recommendations has enhanced the efficiency of agricultural extension and reduced farmers' dependence on limited human expertise. With the integration of artificial intelligence, mobile technologies, remote sensing, and real-time weather information, these systems are becoming increasingly intelligent and user-friendly (Saha et al., 2026). Continued investment in digital infrastructure, multilingual interfaces, and farmer capacity building will further improve their adoption. Strengthening these technologies will be instrumental in promoting sustainable agriculture, increasing farm profitability, and ensuring food security in the years ahead.

7. AI-BASED PROJECTS FOR TRANSFORMING AGRICULTURE

7.1. AI Sowing App

Microsoft's AI seeding. The Microsoft Cortana Intelligence Suite-powered app, created in partnership with ICRISAT, optimizes farming methods for Indian farmers by utilizing cutting-edge technologies. In order to provide sowing advice, our AI application

combines real-time meteorological inputs with over 30 years of climate data. In order to select the best times to plant, it uses rainfall and soil moisture data to calculate the Moisture Adequacy Index (MAI) (Courtois, 2019). Farmers merely need a feature phone that can receive text messages; they don't need to invest any cash.

7.2. Fasal App for irrigation recommendation

Fasal is a smart irrigation system powered by AI and IoT that monitors soil moisture and weather patterns to make precise irrigation recommendations that maximize water utilization. Fasal's sensor array is easy to place in fields and gathers information on crop, soil, and microclimate conditions. It helps farmers maximize crop protection, irrigation, and nutrition by using machine learning to make forecasts at the farm level. It saves 20–25% on fertigation or irrigation expenses, preventing further agricultural spending. (Mhatre,2024)

7.3. AgriApp-Smart Farming App

AgriApp is a smart agricultural platform, with features including soil testing, weather predictions, real-time updates, market access, crop guides, and advice services, It offers farmers a one-stop shop with round-the-clock customer support and bilingual assistance. (Victor,2024)

7.4. Plantix app to prevent pests and diseases

PEAT (Progressive Environmental and Agricultural Technology) GmbH created a smartphone app using artificial intelligence (AI) that analyses photos of afflicted plants to assist farmers in identifying crop pests, illnesses, and nutritional deficits. More than 7 million farmers in India have used it, and it reduces crop losses by 20–25% in the areas where it is utilized. It covers 30 important crops. (Victor,2024)

7.5. Kisan e-Mitra

The Ministry of Agriculture created this AI-powered chatbot to help farmers by providing multilingual responses about several government initiatives. Originally created for PMKISAN, it eventually changed to address other government programs. (Jeevanandam, 2024)

7.6. BrijBot

This AI-powered robot was created by Tartan Sense, an agritech business located in Bengaluru. It utilizes cameras and algorithms to precisely spray herbicides on weeds, lowering agricultural yield loss and labour expenses for Indian farmers. It greatly reduces the amount of pesticides used by precisely spraying them on weeds with an accuracy of up to 3 cm. It can go through small farms and be used in harsh weather situations. It costs Rs 1500 per acre, and an operator offers doorstep service. (Balaji,2020)

7.7. DeHaat's AI-driven farming advisory solutions

An AI-powered platform that serves over 2 million farmers in 11 states—Bihar, Uttar Pradesh, Maharashtra, Odisha, West Bengal, Rajasthan, Chhattisgarh, Haryana, and Jharkhand—by providing tailored advising, financial, and market connections. Through its smartphone app, it offers AI-based personalized pest and disease control advice for over 30 crops in regional languages. (Medhi,2023)

7.8. Skymet's AI-driven Weather predictions

It helps farmers with hyper-local weather forecasts by offering weather forecasting services. It just released a weather website that provides customers with free weather updates in a number of regional languages. (Nair ,2012)

8. CHALLENGES

Despite its enormous promise, there are a number of obstacles to the use of AI in agriculture. Model accuracy is hampered by irregular data availability and quality since AI requires high-quality datasets, which might take years to compile. For many small-scale farmers, the hefty initial expenditures of drones, sensors, and AI infrastructure may make this technology expensive. AI system deployment and maintenance need training for farmers. Therefore, a lack of digital infrastructure and restricted access to technology in rural locations may make it more difficult to use AI effectively. Significant challenges also exist with regard to data privacy, cyber security, and integration with current agricultural methods.

9. FUTURE OF AI

With cutting-edge technologies like biotechnology, big data analytics, and remote sensing poised to spur innovation, the future of artificial intelligence in agriculture is extremely bright. Agricultural production and efficiency may reach new heights when AI, blockchain, and cloud computing are used to improve transparency, security, and scalability. AI has the ability to increase agricultural output in both developed and underdeveloped regions. AI has the potential to completely transform India's agricultural methods with the help of public and private sector

initiatives, guaranteeing future generations' access to food and financial stability. With a compound annual growth rate (CAGR) of 23.1%, the worldwide AI in agriculture market is projected to grow from USD 1.7 billion in 2023 to USD 4.7 billion by 2028 (Piddubna,2024). With the help of this technical breakthrough, Indian farmers will have access to cutting-edge technologies that offer real-time information, minimize manual labour, increase crop output, and foster sustainability.

10. CONCLUSION

The advent of artificial intelligence in agriculture ushers in a new era of efficiency and creativity by revolutionizing farming practices and food production. Predictive analytics, automated equipment, precision farming, and intelligent irrigation systems are just a few examples of AI technologies that are assisting farmers in making better decisions, boosting yields, and maximizing resource utilization. These technologies offer sustainable solutions that are essential for feeding a rising global population in the context of climate change, in addition to addressing more conventional issues like labour shortages, weather unpredictability, and pest management.

With the use of AI-powered insights, farmers can track crop conditions, weather trends, and soil health in real time, enabling focused actions that lessen waste and their impact on the environment. Planting and harvesting are streamlined by automation using robotics and machine intelligence, freeing up people for strategic work. Additionally, by predicting customer demands and market trends, AI strengthens food systems and increases supply chain visibility.

Even while AI has a lot to offer the agricultural industry, there are drawbacks to its adoption, such as high investment costs, dangers to data security, and possible disparities between large and small farmers. Governments, tech companies, and the agricultural community must work together to address these problems and guarantee equitable access to and ethical use of AI technologies. AI has the potential to revolutionize agriculture by making it a more intelligent, effective, and sustainable sector.

AI is changing farming by making it more data-driven and educated, which has an impact on social, educational, and economic facets. It is not only about automating tasks. AI is revolutionizing agriculture. With technologies like predictive analytics, farmers can more precisely estimate crop yields and market demand, which improves pricing tactics and boosts profitability. By making efficient use of resources like water, fertilizer, and pesticides, AI also lowers operating costs, which may greatly lower costs and boost net profits.

By granting access to technology formerly reserved for bigger enterprises, artificial intelligence is socially levelling the playing field, particularly for small and medium-sized farms. These smaller businesses are better able to compete, which helps local communities and rural economies. AI is also causing a revolution in education. The agricultural labour needs a new set of abilities, from comprehending intricate machinery to analysing data gathered by artificial intelligence systems. New training opportunities and educational initiatives are resulting from this, giving farmers the know-how they need to prosper in this new era.

REFERENCES

Aggarwal, M. (2024, March 5). *AI in agriculture: Key trends*. Tavant. https://tavant.com/blog/ai-in-agriculture-key-trends/

Aijaz, N., Lan, H., Raza, T., Yaqub, M., Iqbal, R., & Pathan, M. S. (2025). Artificial intelligence in agriculture: Advancing crop productivity and sustainability. *Journal of Agriculture and Food Research, 20*, 101762. https://doi.org/10.1016/j.jafr.2025.101762

Balaji, R. (2020, October 30). *This agritech startup is helping farmers reduce the cost and effort of removing weeds*. YourStory. https://yourstory.com/2020/10/tech30-agritech-startup-farmers-weeds-robot-tartansense

Bostrom, N. (2014). *Superintelligence: Paths, dangers, strategies*. Oxford University Press.

Courtois, J.-P. (2019, August 7). *Harnessing the power of AI to transform agriculture*. Microsoft. https://blogs.microsoft.com/blog/2019/08/07/harnessing-the-power-of-ai-to-transform-agriculture/

Davenport, T., Guha, A., Grewal, D., & Bressgott, T. (2020). How artificial intelligence will change the future of marketing. *Journal of the Academy of Marketing Science, 48*, 24–42. https://doi.org/10.1007/s11747-019-00696-0

Ghosh, S., Kumar, A., Prusty, A. K., Naik, A., & Padhy, C. (2025). Modelling livelihood security of tribal farmers in South Odisha using machine learning. *Indian Journal of Extension Education, 61*(4), 141–147. https://doi.org/10.48165/IJEE.2025.61423

Javaid, M., Haleem, A., Khan, I. H., & Suman, R. (2023). Understanding the potential applications of artificial intelligence in agriculture sector.

Advanced Agrochem, 2(1), 15–30. https://doi.org/10.1016/j.aac.2022.10.001

Jeevanandam, N. (2024). *India's AI-driven agricultural growth: The future of Indian agriculture*. INDIAai.

Kesari, G. (2024, March 31). The future of farming: AI innovations that are transforming agriculture. *Forbes*. https://www.forbes.com/sites/ganeskesari/2024/03/31/the-future-of-farming-ai-innovations-that-are-transforming-agriculture/

Kumar, A., Prusty, A. K., Naik, A., Kumar, P. N., Ojha, P. K., & Mounika, T. (2025). Adoption and compliance of AI-enabled pest advisories: Evidence from the National Pest Surveillance System (NPSS) in Odisha, India. *Indian Journal of Extension Education, 61*(4), 78–83. https://doi.org/10.48165/IJEE.2025.61413

Medhi, T. (2023, November 8). *Agritech startup DeHaat's revenue up 54.2% in FY23*. YourStory. https://yourstory.com/2023/11/agritech-startup-dehaat-revenue-grew-1965-crore-fy23

Mhatre, S. (2024, August 25). *10 practical AI-based projects which are transforming Indian agriculture*. Medium. https://saurabhnativeblog.medium.com/10-practical-ai-based-projects-which-are-transforming-indian-agriculture-3b9aac8e711a

Nair, R. P. (2012, March 23). Skymet Weather Services: Jatin Singh provides services to climate-dependent sectors like agriculture, energy. *The Economic Times*. https://economictimes.indiatimes.com/small-biz/entrepreneurship/skymet-weather-services-jatin-singh-provides-services-to-climate-dependent-sectors-like-agriculture-energy/articleshow/12376298.cms

Nguyen, T. (n.d.). *The role of AI in revolutionizing agriculture*. Neurond AI. https://www.neurond.com/blog/ai-in-agriculture

Piddubna, A. (2024, August 12). *AI in agriculture – The future of farming*. Intellias. https://intellias.com/artificial-intelligence-in-agriculture/

Press Information Bureau. (2024, July 22). *Agriculture sector has registered an average annual growth rate of 4.18 per cent over the last five years: Economic Survey*. Government of India.

Saha, S., Patra, A., Reddy, M. D., & Prusty, A. K. (2026). Bibliometric analysis of the role of artificial intelligence in enhancing agricultural extension services. *Indian Journal of Extension Education, 62*(3), 27–34. https://doi.org/10.48165/IJEE.2026.62305

Spleiss, C. (2025, February 10). *AI in agriculture: Smarter crops, healthier livestock, better yields*. Cloud Security Alliance. https://cloudsecurityalliance.org/blog/2025/02/10/ai-in-agriculture-smarter-crops-healthier-livestock-better-yields

Stryker, C., & Kavlakoglu, E. (2024, August 9). *What is artificial intelligence (AI)?* IBM. https://www.ibm.com/think/topics/artificial-intelligence

Talaviya, T., Shah, D., Patel, N., Yagnik, H., & Shah, M. (2020). Implementation of artificial intelligence in agriculture for optimisation of irrigation and application of pesticides and herbicides. *Artificial Intelligence in Agriculture, 4*, 58–73. https://doi.org/10.1016/j.aiia.2020.04.002

Victor, J. (2024, January 10). *AI in agriculture: Best apps for modern farming*. Insiderbits. https://insiderbits.com/best-apps/ai-in-agriculture-best-apps/

Walch, K. (2020, October 30). *How AI can be used in agriculture: Applications and benefits*. TechTarget. https://www.techtarget.com/ai/feature/How-AI-can-be-used-in-agriculture-Applications-and-benefits

Yun, C. (2024). *7 applications of AI in agriculture*. BasicAI. https://www.basic.ai/blog-post/7-applications-of-ai-in-agriculture

Zha, J. (2020). Artificial intelligence in agriculture. *Journal of Physics: Conference Series, 1693*(1), 012058. https://doi.org/10.1088/1742-6596/1693/1/012058