



TECHNOLOGICAL INTERVENTION OF ARTIFICIAL INTELLIGENCE (AI) IN INDIAN AGRICULTURE



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have been using traditional techniques and methods to increase productivity yields. Since then, the increase in population means more demand for increasing food production. The manual intensity of farming practices significantly affects arithmetic productivity rates. AI technology has recently emerged in India and the agriculture and farming sector is one area that can utilize the advantages of the AI technology. AI agriculture is the future of smart farming; a technology that can power the economy using predictive technology that will ease the way for farmers in getting information about the weather and fertile land conditions for optimum productivity levels. AI and precision farming can revolutionize the agricultural sector in other to reach and meet the goals of productivity demands to secure the country's future.

With the emergence of Artificial Intelligence (AI), precision farming, digital advice, remote sensing, drones and crop insurance remedies, Indian agriculture is poised to undergo a revolution. These technologies are designed with innovative approaches to increase productivity, improve climate resilience, minimize resource waste and empower farmers with data-driven decision-making. In partnership with government initiatives and innovations through scientific institutions, Indian agriculture is steadily evolving for sustainable development.

India's economy is still significantly impacted by Agriculture, which is a source of living, food security, and rural development. Nonetheless, again the climate change, water shortages, deterioration of soil

Agriculture plays a major role in the economic development of India. For the past decades, the farmers



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fertility, pest infestation, tiny land plots, and fluctuating markets have negative effects on the farmers. India has been steadily moving toward the digitalization-based technologies and complete analytics to address these issues. Innovations in the fields of Artificial Intelligence, precision agriculture, geospatial engineering industry and digital governance platforms are opening new avenues to transform agriculture. This permits the farmers the efficient usages of inputs, increasing yields and improving resilience to unpredictable and uncertain climate and market factors.

Precision agriculture: The foundation of smart farming

Precision agriculture is a scientific technique where high technology is used to optimize outcrop production. Unlike traditional farming techniques, precision farming uses up-to-date data to make precise field-based decisions. Farmers determine their crops' health status, soil quality, nutrient availability, and irrigation needs with the help of technologies like satellite images, drones, Internet of Things (IoT) sensors, GPS mapping and Geographic Information Systems (GIS). This allows them to administer the right amount of water, fertilizer and pesticides in an efficient manner with reduced cost and lower impact on the environment. In India, successful precision farming programs have

been shown to improve crop yields, improve water-use efficiency, and enhance profitability for all farms.

Artificial Intelligence in agriculture

The growing importance of Artificial Intelligence in agricultural innovations, AI systems possess the capacity to systematically evaluate the enormous amount of agricultural data and transform it into valuable insights while providing information to farmers, researchers, and policymakers. The applications of AI are in crop disease detection, pest detection, yield prediction, weather forecasting, irrigation planning, and market information. The machine learning models will learn the hidden patterns in the agricultural data and will provide localised recommendations. Artificial Intelligence-powered advisory systems are assisting farmers in choosing appropriate sowing time, fertilizer application time, harvesting time, and mitigation of risks etc. The productivity-enhancing effects of AI technologies are expected to rise rapidly as these technologies gain traction.

Climate resilience and sustainable agriculture

Agriculture is greatly affected by climate variability, possibly the current-day biggest threat to its sustainability. Droughts, floods, heat waves, and unpredictable rains have great impacts on crop production and farmers' livelihood. Farmers are

receiving coaching and assistance through cutting-edge forecasting systems, satellite-based monitoring, and AI-based climate analysis to deal with harsher weather. Early-warning systems help critically in early warning of adversary weather situations and pest infestation and thus, preventive measures can be taken at the earliest. Technology encourages sustainable agriculture practices for conserving natural resources. Its advanced irrigation systems, precision nutrition competence, and data-driven farming ensure growth while minimizing environment-pressure.

PMFBY and tech-driven risk management

PMFBY is arguably the world's largest crop insurance scheme. The main objective of this scheme is to provide financial assistance to the farmers in case of unexpected crop loss due to natural disasters. The advancements in technology have also greatly transformed the landscape of crop insurance. Currently, there is a growing trend in the use of remote sensing, geo tagging, drones, satellite imaging, and mobile applications to monitor crops and assess damages. These techniques are aimed to introduce transparency in the system, expedite the claim process, and install confidence among the farming community in crop insurance. The use of digital technology with crop insurance will ensure the socio-economic



stability and sustainable rural development of Indian agriculture. The use of digital technology with crop insurance will ensure the socio-economic stability and sustainable rural development of Indian agriculture.

Role of scientific institutions and innovation ecosystems

The research and scientific ecosystem in India contribute significantly to the evolution of agrarian transformation. The research organizations, universities, start-ups, innovation centres, government agencies are focusing on creating the necessary solution for dealing with the local challenges in agriculture. Innovations such as AI-driven advisory platforms, smart irrigation systems, automatic pest detection devices, precision nutrient management systems, and drone-based crop health monitoring tools. Innovations are paving the way for the convergence of research outcomes with farm practices. Partnerships across sectoral boundaries among government agencies and tech creation communities would spur the growth and incorporation of using frontier technology in farming.

Digital agriculture and farmer empowerment

There is empowerment of farmers with the help of digital

technologies and modern agricultural methods. Forecast of weather, information about the markets, advisory on crops, government schemes, insurance and financial products can be accessed through mobile applications and online platforms. Digital technologies enhance the availability and accessibility of agricultural information and knowledge, thus, allowing farmers to make informed decisions based on factual data. Besides, rapidly increasing mobile phone access and internet connections in villages encourage technology usage and digital technology-based agricultural extension services. Agriculture's digital transformation improves efficiency and also fosters financial inclusion and market access.

Challenges and future outlook

Even after progress had been made, there are still few challenges. Lack of digital infrastructure, unaffordability, lack of awareness, and lack of skill are barriers to technology adoption, especially to small and marginal farmers. Going forward, ensuring the digital infrastructure, improving the farmers' capacity building, ensuring enthusiasts partnership between the private sector and public sector, and coming up with affordable localized solutions should be prioritized. Investments in

research, innovation, and capacity building will be instrumental in ensuring that inclusive growth in agriculture is realized. We will have to infuse the experience of agri-value and supply chain, science-based technologies with centuries of knowledge, to build the new-age agriculture systems for sustainability, resilience and farmers at the centre.

Conclusion

The application of Artificial Intelligence, Precision farming, Digital agriculture, and technology-enabled crop insurance are transforming Indian agriculture. These developing technologies are enabling farmers to increase productivity, judicious use of resources, risk management, and increasing income. With joint efforts between the farmers, scientists, policymakers, industry and development stakeholders, the agriculture sector in India is indeed on its way towards a technological transformation. With more investment in terms of research and development in accordance with innovative technologies, India will achieve a sustainable agricultural system that can cope up with the challenges of food security and sustainability in the present and the future.

