



The Digital Revolution on the Farm: How Technology is Transforming Agriculture

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Digital technologies like artificial intelligence (AI), machine learning (ML), remote sensing, big data, blockchain, and IoT are revolutionizing agricultural value chains and modernizing operations. While countries like the Netherlands, the US, Australia, and Israel have successfully embraced these digital solutions to transform agriculture, their adoption in India is still in its early stages. The future implementation of digital agriculture in India is expected to be driven by Public-Private Partnerships (PPP). Globally, digital technology is reshaping agriculture. Farmers worldwide are utilizing high-tech sensor technology and smartphone apps to cultivate healthy crops while optimizing resource usage. Agriculture is undergoing a rapid evolution, with technology becoming an integral part of farming, changing the landscape of food production. This article delves into how advanced technologies are reshaping agriculture, enabling farmers to produce more efficiently and sustainably. Recently, the Ministry of Agriculture and Farmers' Welfare (MoA&FW) released a consultation paper on the India Digital Ecosystem of Agriculture (IDEA), heralding a digital revolution in the agricultural sector. It emphasizes that every facet of modern life has a growing appetite for data.

Concept of IDEA

- ❖ The farmer and the improvement of farmers' livelihood is the aim of the IDEA concept and it is proposed to happen through tight integration of agri-tech innovation and the agriculture industry ecosystem to farming and food systems.
- ❖ The IDEA principles explicitly talk about openness of data, which means open to businesses and farmers, indicating the integration.
- ❖ Value-added innovative services by agri-tech industries and start-ups are an integral part of the IDEA architecture.

Objective of IDEA

To enable the farmer to realize higher income and better profitability through access to right information at the right time, and from innovative services.

- ❖ To enable better planning and execution of policies, programs, and schemes of the Central and State governments, and also of the private sector and Farmers Producer Organizations (FPOs).
- ❖ To enhance efficiencies in the usage of resources including land, water, seeds, fertilizers, pesticides, and farm mechanization by providing easier access to information.
- ❖ To build capacities across the gamut of digital agriculture and precision agriculture
- ❖ To give a fillip to R&D and Innovations in agriculture through access to high-quality data.

- ❖ To adopt the best principles of cooperative federalism while working with the states and union territories for the realization of the vision of IDEA.
- ❖ To formulate and leverage PPP frameworks for realizing the ‘power of the digital’.

Digital Technologies to be used in Agriculture

From GPS to Smart Tractors: Remember the days of navigating fields with paper maps and guesswork? Thanks to GPS technology, those days are long gone. Global Positioning Systems (GPS) have become an integral part of modern farming. GPS-guided tractors, equipped with precise satellite data, can plow, plant, and harvest with astonishing accuracy. This not only saves time but also reduces fuel consumption and minimizes the overlap in operations, saving money and resources.

Drones: Eyes in the Sky: Drones have taken to the skies, offering farmers a bird's-eye view of their fields. Equipped with cameras and sensors, drones can capture high-resolution images and data, helping farmers monitor crop health, detect pests and diseases early, and assess irrigation needs. This not only boosts yields but also reduces the need for chemical treatments, making farming more eco-friendly.

Data-Driven Farming: Big data is no longer just for tech giants. Farmers are now collecting vast amounts of data on everything from soil moisture to crop yields. This data is then analysed to make informed decisions about planting, irrigation, and fertilizer use. It's all about precision agriculture, tailoring farming practices to the specific needs of each field. The result? Higher yields, lower costs, and a more sustainable approach to farming.

Genetic Engineering and Crop Breeding: In the lab, scientists are working on the next generation of crops. Genetic engineering and advanced breeding techniques are producing plants that are more resistant to pests, diseases, and extreme weather. Drought-resistant crops, for example, can thrive in water-scarce regions, offering hope for farmers facing changing climate patterns.

The Future: Robots and AI: The future of farming is looking increasingly robotic. Robots can perform tasks like weeding, planting, and harvesting with speed and precision. They don't need rest, and they can work around the clock, helping farmers make the most of short planting and harvesting windows. Artificial intelligence (AI) is also being used to analyse data, predict crop diseases, and optimize farming operations.

Benefits of Digital Agriculture

The integration of these technological solutions facilitates the effective oversight and management of farms. By providing farmers with real-time, comprehensive digital assessments of their farms, they can make informed decisions, minimizing the need for excessive use of pesticides, fertilizers, and reducing overall water consumption. Furthermore, the advantages encompass:

- ❖ Boosting agricultural productivity while decreasing production expenses
- ❖ Preventing soil degradation
- ❖ Reducing the reliance on chemical inputs in crop production
- ❖ Encouraging the judicious and efficient utilization of water resources
- ❖ Elevating the socio-economic status of farmers
- ❖ Mitigating environmental and ecological impacts
- ❖ Enhancing worker safety

Implementation of Digital Agriculture in India

The gradual acceptance of digital farming in India can be attributed to the prevalence of small-holder farms, which pose challenges for data collection. Moreover, limited access to mechanization tools and frequent natural disasters such as droughts, floods, and excessive monsoon rains have hindered the implementation of digital solutions in the sector. Therefore,

a tailored approach is necessary for introducing digital agriculture to a typical Indian small farm, which can later be scaled up for broader adoption. To ensure the success of digital agriculture in India, the following steps could be taken:

- ❖ **Affordable technology:** Given that the average annual income of an Indian farmer is less than \$1,000, it's crucial to offer technology at a lower cost to accommodate their financial constraints.
- ❖ **Portable hardware:** Since Indian farms are typically small in size, plug-and-play hardware presents a promising opportunity in the Indian market. Additionally, as land leasing arrangements are common, farmers may move to different plots each season. In such cases, investing in portable equipment is more practical.
- ❖ **Rental and sharing platforms for agricultural equipment and machinery:** Due to limited financial resources and small farm plots, there is potential for digital platforms that facilitate equipment rental and sharing rather than outright purchases. Several agritech startups like Farmkart (rent4farm), EM3 AgriServices, and Trringo are already offering equipment rental services.
- ❖ **Academic support:** Local agricultural organizations and academic institutions regularly engage with farmers through various community programs and government initiatives. Offering training facilities through these institutes and organizations will enhance the adoption of digital technologies among farmers

Conclusion

The Indian Agriculture and Allied sector is poised to embrace modern technologies like IoT, AI/ML, and agri-drones for unmanned aerial surveys. Both Indian and foreign agritech companies can play a crucial role in providing these advanced technologies to farmers. Although the market currently has limited players, the potential to serve around 267 million farmers in India presents a significant opportunity for private and foreign entities to establish a strong presence. However, the success of digital agriculture in India hinges on factors like affordability of technology, user-friendly accessibility and operation, system maintenance convenience, and supportive government policies. Taking a comprehensive ecosystem approach to tackle challenges in the Indian agriculture sector is a matter of national importance, aligning with goals such as doubling farmer incomes and promoting sustainable development. Therefore, achieving widespread adoption of digital agriculture in India will necessitate a multi-stakeholder approach, with the government playing a pivotal role as a facilitator in the ecosystem.