(IJRSSH) 2025, Vol. No. 15, Special Issue No. V **e-ISSN: 2249-4642 p-ISSN: 2454-4671**

Empowering Agriculture In The Digital Technology And Innovative Policies

Dr. Bomma Hanumantha Rao.
Department of Political Science,
OU College of Arts and Social Sciences, Osmania University, Hyderabad, Telangana

DOI:10.37648/ijrssh.v15i05.011

[1] *Received: 01/11/2025; Accepted: 20/11/2025; Published: 25/11/2025*

Abstract

In light of worldwide issues such as rising food demand, climate change, and resource limitations, there is an urgent necessity for creative farming techniques. For India, optimizing agricultural practices to increase crop yield is regarded as a crucial phenomenon. India's economy is dominated by agriculture since the vast majority of its people depend on it for their livelihood. Digital instruments that provide accuracy, efficiency, and connectivity are transforming agriculture, which is sometimes thought to be reluctant to modernize. In digital agriculture, along with automated and GPS-equipped machinery, farm data is progressively gathered by robots, sensors, and drones, as well as through the analysis of satellite images, and stored on digital platforms and in cloud services. This offers contributions for "smart farming" while continuing to enhance automation, digitalization, and the integration of artificial intelligence within agriculture. Intelligent agriculture emphasizes utilizing collected data and integrating it from diverse data sources to illustrate the broader perspective for overseeing all farm activities. Smart farming represents a significant advancement over traditional farming by introducing certainty and predictability, Advancements in digital farming solutions are empowering millions of Indian farmers, unlocking increased productivity, boosting sustainability, and creating new digital farming jobs that fuel rural growth, shaping the future of agriculture. By improving the effectiveness and transparency of government programs, facilitating the use of precision farming technology that increase sustainability and production, and offering data driven insights for evidence-based decision-making, the digital age strengthens agricultural policies. The only ground level organization that can help with program implementation and offer knowledge support to farmers and other intermediaries is Agricultural Extension Services. Farmers require a broader spectrum of support, including organizational, marketing, technological, financial, and entrepreneurial assistance, given the changing nature of agriculture and the escalating problems. Farmers need assistance incorporating a variety of knowledge from multiple sources into their production environment in order to succeed. Farmers need access to trustworthy information in order to boost their output. Policies are being formulated to improve farmer literacy and establish open data systems to assist the entire agricultural value chain

Keywords: *Artificial intelligence; digital infrastructure; GPS-equipped machinery; robots; sensors; drones; satellite imagery; smart farming*

1. Introduction

The requirement for digital transformation in agricultural production, which will greatly enhance labour productivity and boost competitiveness in the agricultural sector. The effectiveness of managing agricultural production with information systems that utilize geoinformation technologies can minimize or entirely remove downtime caused by a lack of personnel or equipment, lower the expenses of agro-technical operations per unit of cultivated land, and

[1] **How to cite the article:** Rao B.H. (November, 2025); Empowering Agriculture In The Digital Technology And Innovative Policies; *International Journal of Research in Social Sciences and Humanities*; Vol 15, Special Issue 5; 58-62, DOI: http://doi.org/10.37648/ijrssh.v15i05.011

enhance yield performance. The digital transformation of agricultural production in India must lead to higher crop and livestock yields, enhance product quality, decrease labour intensity, lower costs and prices minimize energy and material usage, reduce reliance on imports of agricultural machinery as well as their hardware and software, and promote advancements in automation, robotics, and smart machine technologies. From a technical perspective, it leads us to precision farming. This offers a data-oriented approach for effectively cultivating and sustaining crops on arable land, allowing farmers to utilize the majority of available resources. Across the supply chain, everyday activities generate substantial amounts of data

A lot of this data was formerly neglected, but thanks to big data technologies, such data can be utilized to enhance the yield and efficiency of any agricultural crop. Based on the type of crop and its growth requirements, digitized harvesters can assist in managing large areas under different circumstances, especially in farming. With the global population projected to increase, farmers need to discover new methods to enhance food production and quality to satisfy this rising demand. Conventional agricultural techniques by themselves will not be enough. To address this challenge, we are looking to a “Digital Agricultural Revolution.” This involves employing advanced technology to enhance the efficiency and output of agriculture. These advancements are increasingly essential as worldwide challenges such as climate change and resource shortages jeopardize the lasting viability of our food system. Significant developments encompass the Internet of things, AI, big data, decision support systems, sophisticated sensors, and autonomous robots. Farmers who incorporate these technologies will enhance efficiency and sustainability across their operations by acquiring real-time insights and informed decision-making abilities.

The transfer of computer services, including networking, processing, storage, analytics, and intelligence, via the Internet (the cloud) as opposed to local servers or personal devices is known as cloud computing. The agricultural industry is becoming more efficient, productive, and sustainable thanks to cloud computing, which allows farmers to view and analyse data on their crops and livestock from any location with an Internet connection. Agriculture benefits greatly from cloud computing's capacity to manage and store enormous amounts of data. Sensors and equipment placed in fields, greenhouses, and barns can continuously monitor a variety of variables, including temperature, humidity, soil moisture, and air quality. Using powerful cloud-based computer resources, this data can be wirelessly transmitted to a central hub, uploaded to the cloud, and then saved and examined. Farmers no longer require expensive servers because data is processed and stored on the cloud, making it accessible from any location with an Internet connection.

Agriculture and artificial intelligence. AI is predicated on the idea that human intellect can be characterized in a way that makes it simple for a machine to mimic and use to carry out a variety of tasks, from the most basic to the most intricate. To achieve these objectives, artificial intelligence with the capacity for learning, reasoning, and perception would be helpful. These advancements seek to enhance resource distribution, boost crop production, and reduce ecological effects, thereby transforming conventional farming methods. At the heart of this change is the careful administration of agricultural inputs customized for particular field conditions, a defining feature of Precision Agriculture. This approach depends on comprehensive data gathering from sensors and satellite images, facilitating informed choices and improved practices. In comparison, Smart Farming emphasizes automating tasks and facilitating real-time monitoring of farm conditions.

2. Digitalization of agricultural data for practical insights

Digital agriculture provides farmers with timely, valuable information, enabling them to implement best practices and operate farms more effectively, thereby minimizing losses and enhancing profits. Technologies provide numerous options for adjusting to modern agriculture. Digital technology in Agricultural includes sensors, drones, and computer imaging combined with analytical tools to produce actionable insights. Positioning of physical devices on the farms tracks and logs information that is utilized to gain insights. Thanks to improvements in satellite images, machine learning, and cloud data storage, predictive analytics software has become quite popular due to its high scalability and user-friendliness.

3. Precision farming and resource efficiency

Policies can encourage the use of sensors, AI, and drones for activities such as assessing soil health, enhancing irrigation efficiency, and precise application of pesticides and fertilizers, minimizing waste and ecological effects.

4. Government Involvement in Digital Agriculture Support for Farmers

The Indian government acknowledges the transformative power of Information and Communication Technology in agriculture and has implemented several initiatives to encourage its use among farmers. These initiatives focus on equipping farmers with digital resources, boosting their access to information and markets, and raising overall agricultural efficiency. The future of farming needs to be digital, provided it is developed with the input of farmers and for their benefit. Digital and AI tools do not serve as a goal in themselves. Instead, they should serve as instruments to empower farmers, enhance their skills and autonomy, and allow them to take a proactive role in tackling global issues.

5. Farmer Training and Skill Development

A key component of India's agricultural development is now farmer skill and training. Acknowledging the demands of contemporary farming, the government has made capacity building a top priority in order to assist farmers in adjusting to changes in the market, climate, and technology. Farmers are receiving practical knowledge and vocational expertise for sustainable agriculture practices through programs like the Agricultural Technology Management Agency (ATMA), Krishi Vigyan Kendra's (KVKs), Pradhan Mantri Kaushal Vikas Yojana (PMKVY), Sub-Mission on Agricultural Mechanization (SMAM), and the Skill Training of Rural Youth (STRY).

6. Government Digital Schemes in Agriculture

The Government of India has introduced various digital initiatives to enhance agriculture and strengthen farmers. The Digital India program encourages the use of technology to offer farmers immediate information, web services, and digital connectivity. Financial support is directly sent to farmers' bank accounts via digital payment systems through PM-KISAN (Pradhan Mantri Kisan Samman Nidhi), ensuring transparency and minimizing intermediaries. Another significant project, Agri Stack, seeks to establish a single digital platform for farmers by connecting land records, crop information, and advisory services. These digital policies assist farmers in accessing resources more effectively, enabling informed choices, and enhancing productivity, which aids in achieving the broader objective of sustainable and inclusive agricultural growth in India.

7. Digital Farming Projects

Digital agriculture projects in India are transforming conventional farming methods by incorporating technology at every phase of growing. Farmers can utilize digital platforms to obtain up-to-date information on weather, soil conditions, and market rates, aiding them in making informed decisions based on data. Data analysis and satellite imagery are employed to track plant growth, identify pest outbreaks quickly, and enhance the efficiency of water and fertilizer application. These technologies facilitate accurate farming, minimize waste, and enhance efficiency. Collaborations among the government, private sector, and Agri-tech startups are enhancing Indian agriculture's efficiency, sustainability, and resilience to climate challenges through digital tools.

8. e-NAM (National Agriculture Market)

The National Agriculture Market (e-NAM) represents one of India's top digital ventures designed to establish a cohesive online platform for agricultural products. Initiated by the Government of India, e-NAM links farmers, traders, and buyers from various states via a transparent digital trading platform. It allows farmers to market their goods straight to consumers, minimizing the influence of middlemen and guaranteeing equitable and competitive pricing. The platform additionally offers real-time price determination, quality evaluation, and online payment options, which contribute to establishing trust and enhancing efficiency in agricultural commerce. Through enhancing market transparency and facilitating access to buyers across the country, e-NAM has enabled farmers to make educated selling choices and boosted

9. Facilitating the exchange of experiences among farmers

Numerous agricultural advisory services view farmers as consumers rather than creators of advisory information. Farmers may, nonetheless, respond more readily to guidance from fellow farmers than to recommendations from formal entities like extension services. Therefore, combining various knowledge cultures (formal, informal, local, experiential) could be essential for effective agricultural innovation processes.

10. Benefits of Digital Agriculture

Using these technology-based solutions helps farmers manage and keep track of their farms more reliably. With a full digital overview of their farms in real-time, farmers can make better decisions. This means they don't need to use too much pesticides or fertilizers, and they can also save water. Other advantages are:

- Boosts agricultural output and cuts down on production costs
- Helps prevent soil damage
- Reduces the use of chemicals in growing crops
- Encourages better and smarter use of water
- Improves the income and living conditions of farmers
- Minimizes harm to the environment and ecosystems
- Makes the work safer for farm workers

11. Future perspectives of digital agriculture

Agricultural technology is highly promising because the majority of technological innovations have the capacity to surpass existing limits. Artificial Intelligence and Machine Learning can be employed to enhance predictive analysis to enable farmers to make informed decisions on crop health, pest management, and yield prediction. Artificial intelligence-based applications are able to process large volumes of agriculture data and suggest and recommend in real-time for optimal use of resources. In addition, low-cost sensor networks and IoT sensors will increasingly make digital technologies available to even poor farmers. Scientists are designing low-cost, energy-efficient sensors that will be capable of monitoring soil moisture, weather, and plant health in real-time It takes government and private initiatives to bridge the digital divide. Rural broadband infrastructure investment, digital literacy, and smallholder farmer subsidies will accelerate the adoption of digital agriculture. Public-private collaboration can also accelerate innovation and build scalable solutions tailored to the needs of different farming communities. In summary, although the daunting challenges of digital farming are real, breakthroughs in AI, and IoT technology, coupled with judicious policy responses, can set the stage for a more sustainable and efficient food-farming future

12. Conclusion

The research emphasized the significance of concentrating on off-farm uses, particularly online platforms and mobile applications. Nonetheless, the digital agricultural environment must incorporate on-farm applications alongside the automation of essential farming activities, such as irrigation, weeding, spraying, crop monitoring, and cultivation. Encouraging outcomes were shown through smartphone applications and digital platforms, including minimized environmental effects, improved crop production, removed occupational hazards, and optimized resource utilization. Alongside enhancing market links and providing farmers with fair pricing for their products, the utilization of real-time data enabled them to make informed choices and boosted their overall financial health. A new level of development for the farm sector has been enabled by the combination of technology and financial support

In the future, the agricultural industry is on the verge of a digital revolution that has significant potential to meet worldwide food needs while reducing environmental harm. The agricultural industry can address the challenges of a rising population and climate change while transforming into a more effective, fair, and sustainable system by adopting these innovations. Certainly, technology will significantly influence agriculture in the future, and effectively integrating these innovations will be crucial for nourishing the world and conserving its natural resources for future generations.

References

A2i. (2023). *Smart agriculture for Smart Bangladesh*. https://a2i.gov.bd/smart-agriculture-for-smartbangladesh/

Aranguri, M., & Mera, H. (2025). Digital literacy and technology adoption in agriculture: A systematic review of factors and strategies. *AgriEngineering, 7*(9), 296. https://doi.org/10.3390/agriengineering7090296

Begen, N., & Atasoy, H. (2024). Technological literacy and employment: An inquiry into the adoption of learning technologies. *Telecommunications Policy, 48*, 102864. https://doi.org/10.1016/j.telpol.2023.102864

Boettiger, S., & Sanghvi, S. (2019). *How digital innovation is transforming agriculture: Lessons from India*. McKinsey & Company. https://www.mckinsey.com/industries/agriculture/our-insights/how-digital-innovation-is-transforming-agriculture-lessons-from-india

Fuentes-Peñailillo, F., & Gutter, K. (2024). Transformative technologies in digital agriculture: Leveraging Internet of Things, remote sensing, and artificial intelligence for smart crop management. *Journal of Sensor and Actuator Networks, 13*(4), 39. https://doi.org/10.3390/jsan13040039

Garg, D., & Alam, M. (2023). Smart agriculture: A literature review. *Journal of Management Analytics, 10*, 1–57. https://doi.org/10.1080/23270012.2023.2207184

Government of Maharashtra. (2021). *Harnessing drones and other disruptive technologies in agriculture*. Government of Maharashtra.

Goswami, R., Dutta, S., & Misra, S. (2023). Whither digital agriculture in India? *Crop & Pasture Science, 74*, 586–596. https://doi.org/10.1071/CP21624

Kadam, D. M., Chouhan, D., et al. (2023). Digital agriculture: The future of Indian agriculture. *International Journal of Environment and Climate Change, 13*(11), 3963–3976. https://doi.org/10.9734/ijecc/2023/v13i113577

Mahmood, M. R., & Matin, M. A. (2024). Machine learning for smart agriculture: A comprehensive survey. *IEEE Transactions on Artificial Intelligence, 5*(6), 2568–2588. https://doi.org/10.1109/TAI.2023.3345278

McFadden, J., et al. (2022). *The digitalisation of agriculture: A literature review and emerging policy issues* (OECD Food, Agriculture and Fisheries Papers No. 176). OECD Publishing. https://doi.org/10.1787/285cc27d-en

Rahmatul Wajdah, Risna, & Nurmalina, R. (2024). Transformation digital supply chain management in agriculture: A systematic literature review. *Prosiding Seminar Nasional Forum Manajemen Indonesia, 2*(1), 908–922. https://doi.org/10.47747/snfmi.v2i1.2076

Sharma, S., Rana, P., Samriti, & Sharma, S. (2025). Digital agriculture in India: A review of ICT interventions for sustainable farming. *International Journal of Agricultural Extension and Social Development, 8*(11), 17–25. https://doi.org/10.33545/26180723.2025.v8.i11a.2615

Sontowski, S., Gupta, M., & Chukkapalli, S. (2020). Cyber-attacks on smart farming infrastructure. In *2020 IEEE 6th International Conference on Collaboration and Internet Computing (CIC)* (pp. 135–143). IEEE. https://doi.org/10.1109/CIC50333.2020.00026

Sreekantha, D. K., & Kavya, A. M. (2017). Agricultural crop monitoring using IoT—A study. In *2017 11th International Conference on Intelligent Systems and Control (ISCO)* (pp. 134–139). IEEE. https://doi.org/10.1109/ISCO.2017.7856043

Steinke, J., van Etten, J., Müller, A., & Ortiz-Crespo, B. (2020). Tapping the full potential of the digital revolution for agricultural extension: An emerging innovation agenda. *International Journal of Agricultural Sustainability, 19*(5–6), 549–565. https://doi.org/10.1080/14735903.2020.1746531