DIGITAL AGRIPRENEURSHIP: FUTURE OFTAMILNADU AGRICULTURE

K. Banumeena, S. Sangunthala Devi, P. SaiGeetha, VaishnaviRameshkumar, V.Sujithra

Assistant Professor, M.A.M B-School, Tiruchirappalli, banumks@gmail.com

Assistant Professor, M.A.M B-School, Tiruchirappalli, sagunthalajude2008@gmail.com

Assistant Professor, M.A.M B-School, Tiruchirappalli, saigeetha19@gmail.com

Assistant Professor, M.A.M B-School, Tiruchirappalli, rameshvaishu13@gmail.com

Assistant Professor, M.A.M B-School, Tiruchirappalli, sujihari035@gmail.com

ABSTRACT

Purpose: The purpose of the paper is to explore the integration and importance of digital agripreneurship, such as precision farming, IoT, and data analytics, into agricultural practices, enhancing productivity and resource efficiency in the context of Tamilnadu agriculture and draw out the implications for future research and action.

Design: The research paper has collected required information through the secondary sources. The data has been gathered from various research papers and web resources.

Findings: The studies reviewed in the paper identify the opportunities emerging from new andexpanding market of digital agricultural practices. This paper tries to identify some key attributes of successful digital agripreneurship interventions and the impact on growth of agriculture sector in Tamilnadu.

Research Implications: The paper summarizes only recent advancements in digitalization in agriculture.

Keywords: Digital Agripreneurship, IoT, Agricultural policies, Government Schemes

1. INTRODUCTION

Agriculture has been the backbone of Tamil Nadu's economy, contributing significantly to livelihoods and food security. However, the sector faces challenges like erratic weather patterns, labor shortages, and fluctuating market prices. With the advent of digital technologies, agripreneurship offers innovative solutions to these problems. Digital agripreneurship integrates precision farming, mobile applications, e-commerce, and blockchain to enhance productivity, sustainability, and profitability.

Agriculture remains a cornerstone of Tamil Nadu's economy, providing employment to approximately 70% of the rural population. The state encompasses 6.34 million hectares under cultivation, with rice being the staple food grain. In the fiscal year 2021–2022, Tamil Nadu produced 7.9 million tonnes of rice, solidifying its position as one of India's leading producers.

Despite these strengths, the agricultural sector faces significant challenges, including water scarcity, fragmented landholdings, and market access limitations. To address these issues and enhance agricultural productivity and sustainability, the Tamil Nadu government has initiated several digital agriculture interventions. Notably, under the Farm Mechanisation-Kisan Drone Scheme, the state plans to acquire 60 drones with combined state and central funding to promote awareness and adoption of drone technology in farming practices.

Furthermore, the state has embraced the Digital Agriculture Mission, an umbrella scheme designed to support various digital agriculture initiatives. This mission focuses on creating Digital Public Infrastructure (DPI), implementing the Digital General Crop Estimation Survey (DGCES), and supporting IT initiatives by central and state governments, as well as academic and research institutions.

These initiatives aim to modernize the agricultural sector by integrating technology into traditional farming practices, thereby improving efficiency, productivity, and sustainability. The government's commitment to digital agripreneurship reflects a strategic move towards transforming Tamil Nadu's agriculture to meet future demands and challenges.

2. REVIEW OF LITERATURE

Studies on Digital Adoption: Reports like the Tamil Nadu State Agricultural Plan (2021-2022) and research articles e.g., Narayanasamy & Manikandan, 2020 highlight the increasing role of digital technologies in addressing agricultural challenges.

Digital agripreneurship in Tamil Nadu involves the use of:E-commerce platforms: Startups like Farmagain and UzhavarSanthai apps link farmers to markets.IoT and Precision Farming: Projects like the Tamil Nadu Smart Village program integrate IoT devices to improve water use efficiency and monitor soil health.Mobile Applications: Applications like TNAU AgriTech Portal and eNAM (National Agriculture Market) allow farmers to access market prices, weather updates, and expert advice.Blockchain and Traceability: Initiatives for export-quality produce often use blockchain to ensure transparency in supply chains.

Murugan et al. (2022) investigated the impact of mobile apps on farmer income and decision-making, finding that 67% of farmers using such tools saw a 20-30% increase in revenues.

The Tamil Nadu government has been proactive in promoting digital agripreneurship:Agricultural Technology Management Agency (ATMA) provides training on digital tools.TNAU (Tamil Nadu Agricultural University) collaborates with startups and researchers to develop localized solutions.Schemes and Subsidies: Programs like the Tamil Nadu Agricultural Innovation Fund support agritechstartups.Case studies by Balasubramaniam et al. (2023) highlight successful government-private collaborations, such as the use of drones for pesticide spraying in Thanjavur district.

Emerging Trends: AI in Agriculture: Predictive analytics for crop yield and pest management.Digital Cooperatives: Farmer Producer Organizations (FPOs) using WhatsApp and social media for group marketing.Sustainability: Digital solutions enabling organic farming and climate-resilient agriculture.Youth Involvement: Increased participation of educated youth as agripreneurs using digital tools.Studies like Kumar et al. (2023) suggest that Tamil Nadu’s youth play a pivotal role in driving digital agripreneurship by embracing technology and innovative farming practices

3. DIGITAL REVOLUTION IN AGRICULTURE

India's digital revolution has significantly transformed governance and service delivery in recent years by creating digital identities, secured payments and transactions. This progress has paved the way for a thriving digital ecosystem across various sectors, including finance, healthcare, education, and retail, positioning India as a leader in citizen-centric digital solutions.

For a similar transformation of the Agriculture Sector, the Union Cabinet Committee, chaired by Prime Minister NarendraModi approved the 'Digital Agriculture Mission' with a substantial financial outlay of Rs. 2,817 Crore, including a central government share of Rs. 1,940 Crore, on September 2, 2024.

The Digital Agriculture Mission is designed as an umbrella scheme to support various digital agriculture initiatives. These include creating Digital Public Infrastructure (DPI), implementing the Digital General Crop Estimation Survey (DGCES), and supporting IT initiatives by the Central Government, State Governments, and Academic and Research Institutions.

The scheme is built on two foundational pillars:

- Agri Stack
- Krishi Decision Support System.

Additionally, the mission includes '*Soil Profile Mapping'* and aims to enable farmer-centric digital services to provide timely and reliable information for the agriculture sector.

AgriStack is designed as a farmer-centric Digital Public Infrastructure (DPI) to streamline services and scheme delivery to farmers. It comprises three key components:

1. Farmers' Registry

2. Geo-referenced village maps

3. Crop Sown Registry

A crucial feature of AgriStack is the introduction of a 'Farmer ID', similar to Aadhaar card, serving as a trusted digital identity for farmers.

These IDs, created and maintained by the State Governments/ Union Territories, will be linked to various farmer-related data, including land records, livestock ownership, crops sown, and benefits availed.

The implementation of AgriStack is progressing through partnerships between the Central and State Governments, with 19 states having signed MoUs with the Ministry of Agriculture. Pilot projects have been conducted in six states to test the creation of Farmer IDs and the Digital Crop Survey.

The six states include Uttar Pradesh (Farrukhabad), Gujarat (Gandhinagar), Maharashtra (Beed), Haryana (Yamuna Nagar), Punjab (Fatehgarh Sahib), and Tamil Nadu (Virudhnagar).

The Krishi Decision Support System (DSS) will integrate remote sensing data on crops, soil, weather, and water resources into a comprehensive geospatial system.

Under the mission, detailed soil profile maps on a 1:10,000 scale for approximately 142 million hectares of agricultural land have been envisaged, with 29 million hectares of soil profile inventory already being mapped.

Further under the Digital Agriculture Mission, the Digital General Crop Estimation Survey (DGCES) will be used for crop-cutting experiments to provide precise yield estimates, enhancing agricultural production accuracy.

The mission is expected to create direct and indirect employment in agriculture, providing opportunities for around 2,50,000 trained local youth and KrishiSakhis.

By leveraging modern technologies like data analytics, AI, and remote sensing, the mission will improve service delivery for farmers, including streamlined access to government schemes, crop loans, and real-time advisories.

Digital Public Infrastructure for Agriculture the Government, in partnership with states, will implement Digital Public Infrastructure (DPI) for agriculture over the next three years.

This initiative will cover farmers and their lands, with a digital crop survey for Kharif planned for 400 districts this year. The goal is to update registries with details of 6 crore farmers and their lands.

Tamil Nadu government has vowed to take the digital revolution to the farm sector to help farmers avail all services without time lag. A new portal, GRAINS (Grower Online Registration of Agriculture Input System), will be set up, where details of bank accounts, Aadhar numbers of landowners and cultivators, land details and crop cultivation details will be collected and digitised to provide one-stop solution to the farmers in need of government assistance.

“GRAINS” portal will be designed to enable the farmers to easily get benefits of various government schemes such as crop loan, incentive for paddy and sugarcane, relief assistance under state disaster response fund and benefits from 13 agriculture and allied departments, which will be useful not only to farmers but also to government departments.

Following its successful implementation of cashless transfer of benefits in 37 agricultural extension centres, the agriculture department is all set to expand the service to all 385 block agricultural extension centres across 37 districts next year. The department will also set up e-service centres in 385 agricultural extension centres in coordination with Tamil Nadu e-governance agency. WhatsApp groups of farmers at block levels will be formed to facilitate instantaneous sharing of information on technologies, conditions of market, weather forecast, subsidies, pests and disease attacks.

4. FUTURE OF DIGITAL AGRICULTURE IN INDIA

Agriculture 4.0 in transforming urban and rural farming through smart technologies like IoT, vertical farming, and mobile apps. This innovation enhances food security, optimizes resource use, and boosts farmer incomes, positioning India as a leader in sustainable agriculture.Agriculture 4.0 technologies significantly boost crop yields through precision farming techniques.

- For instance, the use of IoT sensors and data analytics enables farmers to optimize inputs like water, fertilizers, and pesticides based on real-time soil and plant conditions.

- In India, the adoption of precision agriculture techniques has led to yield increases of up to 30% in some crops.
- A notable example is the partnership between Microsoft and ICRISAT, which developed an AI-powered sowing app that increased groundnut yields by 30% in Andhra Pradesh.

- Resource Efficiency and Sustainability: Agriculture 4.0 promotes sustainable farming practices by optimizing resource use.
  - Smart irrigation systems, for example, can reduce water consumption by up to 50% compared to traditional methods.
  - In water-stressed regions of India, drip irrigation coupled with IoT sensors has shown remarkable results.
  - The Tamil Nadu Precision Farming Project demonstrated water savings of 40-50%.
    - Furthermore, precision application of fertilizers guided by soil health data and crop requirements has led to a reduction in fertilizer use by 15-20%.
- Climate Resilience and Risk Mitigation: Advanced weather forecasting and early warning systems integral to Agriculture 4.0 help farmers adapt to climate change and mitigate risks.
  - For instance, the CRIDA's 'Meghdoot' app provides location, crop, and livestock-specific weather-based agro-advisories to Indian farmers.
  - This technology has been crucial in helping farmers make informed decisions about planting, harvesting, and pest control, reducing crop losses due to extreme weather events.
- Supply Chain Optimization and Market Access: Agriculture 4.0 technologies are revolutionizing agricultural supply chains, reducing post-harvest losses and improving market access for farmers.
  - Blockchain-based supply chain solutions, for example, enhance traceability and transparency, building trust among consumers and fetching better prices for farmers.
  - In India, the eNAM (Electronic National Agriculture Market) platform, which leverages digital technology to connect farmers with buyers across the country, has enrolled over 1.69 crore farmers.
- Data-Driven Decision Making and Predictive Analytics:The integration of big data and AI in agriculture enables predictive analytics, helping farmers and policymakers make informed decisions.
  - For instance, satellite imagery combined with machine learning algorithms can predict crop yields months before harvest with over 90% accuracy.
  - In India, the FASAL project (Forecasting Agricultural output using Space, Agrometeorology and Land based observations) uses such technologies to provide pre-harvest crop estimates for major crops, aiding in national food security planning.

- Democratization of Agricultural Knowledge: Agriculture 4.0 is making expert agricultural knowledge more accessible to smallholder farmers through mobile apps and AI-powered chatbots.
  - In India, platforms like KisanSuvidha and IFFCO Kisan have reached millions of farmers, providing them with personalized advice on crop management, pest control, and market prices.
  - Agritechstartup DeHaat's revenue is likely to grow by over 80% on sales of farm inputs to farmers.

5. IMPLEMENTATION OF DIGITAL AGRIPRENEURSHIP

Tamil Nadu has taken several measures for digital agripreneurship, including:

- Improved Crop Yield And Productivity: Digital technologies like remote sensing, GIS (Geographic Information System), and Artificial Intelligence (AI) can help farmers to optimize their practices, leading to increased yields.
- Enhanced Decision-Making for Farmers: Access to timely and accurate information helps farmers make better decisions about planting, harvesting, and crop management.
- Efficient Resource Management: Precision agriculture techniques enable optimal use of water, fertilizers, and pesticides.Advanced technologies like GPS (Global Positioning System) and remote sensing help optimize inputs, leading to better crop yields and efficient farming practices.
- Improved Supply Chain Management: Digital platforms facilitate better coordination between farmers, traders, and consumers, reducing post-harvest losses.
- Financial Inclusion: Digital technologies enable better access to credit, insurance, and other financial services for farmers.
- Crop Insurance: Digital platforms facilitate easier enrollment and claim processing for crop insurance schemes like the PradhanMantriFasalBimaYojana (PMFBY). Digital records help in faster processing of claims and more accurate assessment of losses.
- Agri-Tech Startups: Platforms like DeHaat and AgroStar offer farmers digital tools for accessing market information, advisory services, and direct sales channels, which can improve their bargaining power and income.
- Weather Forecasting: Advanced weather forecasting tools provide farmers with timely information about weather conditions, helping them plan better and mitigate risks.
- E-Learning Platforms: Digital platforms offer training and educational resources to farmers, helping them adopt modern agricultural practices. For example, KisanSuvidha app has a simple interface and provides information on five critical parameters- weather, input dealers, market price, plant protection, and expert advisories.

- Tamil Mann Valam: A portal that provides farmers with soil fertility status, soil health cards, and cultivation recommendations

6. SUGGESTION

To maximize the benefits of digital agripreneurship in Tamil Nadu, a strategic approach addressing the key challenges and leveraging available opportunities is essential. Below are actionable suggestions for better implementation:

- Strengthening Digital Infrastructure: Expand affordable broadband and mobile internet access in rural areas through public-private partnerships. Establish digital kiosks in villages where farmers can access digital services, e-marketplaces, and training resources. Invest in 5G networks and IoT devices to enable precision farming and real-time monitoring of farm conditions.
- Capacity Building and Skill Development: Conduct regular workshops and training on using mobile apps, e-market platforms, and digital tools for farming. Develop user-friendly applications and educational materials in Tamil, tailored to the needs of different farming communities. Encourage youth participation by offering entrepreneurship programs focused on agritech solutions and digital tools.
- Enhancing Farmer Access to Digital Platforms: Provide subsidies for purchasing smartphones, sensors, and IoT-enabled devices. Strengthen Farmer Producer Organizations (FPOs) and cooperatives to collectively adopt and use digital tools. Reward farmers and agripreneurs who successfully implement digital practices, motivating others to follow.
- Building Robust Digital Marketplaces: Integrate local markets into national platforms like eNAM, enabling small farmers to access larger markets. Implement blockchain technology to ensure transparency in supply chains, particularly for high-value crops and organic produce. Develop apps that provide real-time price updates and predictive analytics to help farmers make informed selling decisions.
- Collaboration Between Stakeholders: Facilitate collaborations between the government, agritechstartups, and research institutions for innovation. Engage NGOs to bridge the gap between farmers and digital tools through grassroots campaigns. Tamil Nadu Agricultural University (TNAU) can act as a hub for research and pilot projects in digital agripreneurship.
- Policy and Financial Support: Provide grants, tax benefits, and seed funding to agritechstartups working on farmer-centric solutions.Design digital platforms for crop insurance and credit that Integrate weather data and farm analytics for risk assessment. Create policies to streamline data-sharing among stakeholders while ensuring privacy and security.
- Leveraging Emerging Technologies: Deploy AI-based solutions for crop health monitoring, pest prediction, and yield forecasting. Promote the use of drones for spraying fertilizers and pesticides and robotics for labor-intensive tasks. Use digital tools to disseminate climate-resilient farming practices, such as weather forecasting and drought-resistant crops.

- Monitoring and Evaluation: Develop a framework to measure the adoption and impact of digital tools in agripreneurship. Set up a real-time feedback system for farmers to report issues and share their experiences with digital platforms. Use data from impact assessments to refine tools and policies for better outcomes.
- Promoting Awareness: Use television, radio, and social media to promote the benefits of digital agripreneurship among farmers. Create model digital farms in each district as demonstration sites for local farmers. Highlight stories of successful agripreneurs who have leveraged digital tools to inspire widespread adoption.

7. CONCLUSION

Digital agripreneurship represents a transformative pathway for the future of agriculture in Tamil Nadu. By integrating advanced technologies such as IoT, AI, and blockchain into farming practices, the state can address critical challenges such as climate variability, resource inefficiencies, and market unpredictability. Digital tools empower farmers to enhance productivity, optimize resource use, and access broader markets, ensuring higher profitability and sustainability.

The future of Tamil Nadu's agriculture lies in fostering a collaborative ecosystem where farmers, startups, researchers, and policymakers work together. With the state's proactive policies, strong agricultural foundations, and increasing digital adoption, Tamil Nadu is well-positioned to lead the nation in digital agripreneurship. However, success hinges on by addressing infrastructural gaps, building digital literacy, and fostering collaboration among stakeholders, Tamil Nadu can create an enabling ecosystem for digital agripreneurship. The above steps will empower farmers to embrace technology, enhance agricultural productivity, and ensure sustainable rural development. A concerted effort to build capacity, enhance connectivity, and promote innovative solutions will ensure that digital agripreneurship becomes the cornerstone of a resilient and sustainable agricultural future in Tamil Nadu.

Reference

1. Chand, R., & Kumar, A. (2021). *Digital Transformation in Indian Agriculture: Opportunities and Challenges*. International Food Policy Research Institute (IFPRI). Retrieved from https://www.ifpri.org/publication/digital-transformation-indian-agriculture-opportunities-and-challenges
2. McGowan, M. T. (2020). *Digital Agriculture: Farmer 4.0*. New York: Springer.
3. NASSCOM &AgFunder. (2020). *The State of AgriTech in India 2020*. National Association of Software and Service Companies (NASSCOM). Retrieved from https://nasscom.in/knowledge-library/state-agritech-india-2020
4. McKinsey & Company. (2021). *Digital Agriculture: The Future of Farming*. Retrieved from https://www.mckinsey.com/industries/agriculture/our-insights/digital-agriculture-the-future-of-farming
5. Government of India, Ministry of Agriculture and Farmers' Welfare. (n.d.). *National Portal for Farmers*. Retrieved from http://agricoop.nic.in

6. Digital India Initiative. (n.d.). *About Digital India*. Retrieved from https://www.digitalindia.gov.in
7. Satyanarayana, K. V. V. (2019). *Agricultural Entrepreneurship: Strategies for Sustainable Development*. New Delhi: Springer.
8. Jain, R., & Sharma, S. (2022). How Digital Tools are Revolutionizing Indian Agriculture. *Agricultural Technology Review*. Retrieved from https://www.agritechreview.com/articles/digital-tools-indian-agriculture
9. Gupta, R. (2023). The Future of Agriculture: How Technology is Changing Farming. *Harvard Business Review*. Retrieved from https://hbr.org/2023/02/the-future-of-agriculture
10. Singh, A. (2021). The Role of Digital Technologies in Agriculture: A Study of Agri-Tech Startups in India. *International Journal of Agricultural Management*, 10(2), 120-135. doi:10.1016/j.ijam.2021.03.004
11. https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2051719
12. http://timesofindia.indiatimes.com/articleshow/98893222.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
13. https://www.drishtiias.com/daily-updates/daily-news-editorials/agriculture-4-0-the-next-farming-revolution
14. R. Sathya; V.C. Bharathi; S. Ananthi; T. Vijayakumar; Rvs Praveen; Dhivya Ramasamy, **"**Real Time Prediction of Diabetes by using Artificial Intelligence," 2024 2nd International Conference on Self Sustainable Artificial Intelligence Systems (ICSSAS), DOI: 10.1109/ICSSAS64001.2024.10760985
15. 10. Rvs Praveen;B Vinoth;S. Sowmiya;K. Tharageswari;Purushothapatnapu Naga Venkata VamsiLala;R. Sathya, "Air Pollution Monitoring System using Machine Learning techniques for Smart cities," 2024 2nd International Conference on Self Sustainable Artificial Intelligence Systems (ICSSAS), DOI: 10.1109/ICSSAS64001.2024.10760948
16. 11. RVS Praveen;U Hemavathi;R. Sathya;A. Abubakkar Siddiq;M. Gokul Sanjay;S. Gowdish, "AI Powered Plant Identification and Plant Disease Classification System," 2024 4th International Conference on Sustainable Expert Systems (ICSES), DOI: 10.1109/ICSES63445.2024.10763167
17. 12. Neeraj Kumar;Sanjay Laxmanrao Kurkute;V. Kalpana;Anand Karuppannan;RVS Praveen;Soumya Mishra, "Modelling and Evaluation of Li-ion Battery Performance Based on the Electric Vehicle Tiled Tests using Kalman Filter-GBDT Approach" 2024 International Conference on Intelligent Algorithms for Computational Intelligence Systems (IACIS), DOI: 10.1109/IACIS61494.2024.10721979
18. 13. Tushar Dhar Shukla;G. Radha;Dharmendra Kumar Yadav;Chaitali Bhattacharya;Rvs Praveen;Nikhil N. Yokar, "Advanced Student Success Predictions in Higher Education with Graph Attention Networks for Personalized Learning", 2024 First International Conference on Software, Systems and Information Technology (SSITCON), DOI: 10.1109/SSITCON62437.2024.10796791
19. 14. V. Yamuna;Praveen RVS;R. Sathya;M. Dhivva;R. Lidiya;P. Sowmiya, "Integrating AI for Improved Brain Tumor Detection and Classification" 2024 4th International Conference on Sustainable Expert Systems (ICSES), DOI: 10.1109/ICSES63445.2024.10763262
20. 15. Rvs Praveen;Aktalina Torogeldieva;B Saravanan;Ajay Kumar;Pushpa Rani;Bhimanand Pandurang Gajbhare, "Enhancing Intellectual Property Rights(IPR) Transparency with Blockchain and Dual Graph Neural Networks" 2024 First International Conference on Software, Systems and Information Technology (SSITCON), DOI: 10.1109/SSITCON62437.2024.10795998
21. 16. Sarthak Sharma;Suman Vij;RVS Praveen;S. Srinivasan;Dharmendra Kumar Yadav;Raj Kumar V S, "Stress Prediction in Higher Education Students Using Psychometric Assessments and AOA-CNN-XGBoost Models," 2024 4th International Conference on Sustainable Expert Systems (ICSES), DOI: 10.1109/ICSES63445.2024.10763288
22. 17. RVS PRAVEEN et al.: NEXT-GENERATION CIRCUITS FOR INDUSTRY 4.0 USING INNOVATIONS IN SMART INDUSTRIAL APPLICATIONS, ICTACT JOURNAL ON

MICROELECTRONICS, OCTOBER 2024, VOLUME: 10, ISSUE: 03, DOI: 10.21917/ijme.2024.0323