Review on Applications Utilizing Traditional Farming Practices

Benjamin Francis Thottam
Computer Science and Engineering
Amal Jyothi College Of Engineering
benjaminfrancisthottam2026@cs.ajce.in

Angela Mary Anil
Computer Science and Engineering
Amal Jyothi College Of Engineering
angelamaryanil2026@cs.ajce.in

Annu Maria Thomas
Computer Science and Engineering
Amal Jyothi College Of Engineering
annumariathomas2026@cs.ajce.in

Ann Maria
Computer Science and Engineering
Amal Jyothi College Of Engineering
annmaria2026@cs.ajce.in

Ms. Mekha Jose
Assistant Professor , Computer Science and Engineering
Amal Jyothi College Of Engineering
mekhajose@amaljyothi.ac.in

Abstract—Conventional farming methods have been the backbone of sustainable agriculture for ages, providing methods like agroforestry, crop rotation, and composting. Climate change and resource constraints, however, have forced the incorporation of new smart farming technologies. This paper discusses the convergence of conventional knowledge with newer technologies like IoT-based precision farming, AI-supported decision support systems, and digital libraries like Krishikosh. With the use of case studies and comparative analysis, we illustrate how the hybrid method can improve agricultural efficiency, provide food security, and enhance sustainability.

keywords—Agroforestry systems, Community-based agriculture, Regenerative farming, Indigenous agriculture.

I. INTRODUCTION

Agriculture is a dynamic sector in which old wisdom and new technological innovations have to complement each other to be sustainable. Traditional agriculture practices, well rooted in local culture, focus on the conservation of biodiversity and fertility of the soil. At the same time, new technologies like precision farming, IoT-based monitoring, and AI-based analytics are focused on improving efficiency and productivity.

This paper discusses the convergence of the two approaches, and it offers a literature review on smart farming technologies, comparative analysis of innovations, and a case study to outline the advantages of combining technology with conventional farming. The structure of the paper is as follows: Section II describes the literature review, Section III compares smart farming technologies, Section IV outlines a case study, and Section V concludes with future research.

II. LITERATURE REVIEW

A. Traditional farming practices

- Traditional farming, deeply rooted in indigenous wisdom and passed down through generations, embraces practices like agroforestry, intercropping, crop rotation, cover cropping, composting, integrated livestock farming, and shifting cultivation. These time-tested methods nurture the land, enhance soil fertility, conserve biodiversity, and help communities adapt to changing climates. Agroforestry, for example, not only sequesters carbon but also provides shade and wind protection for crops, while intercropping creates natural defenses against pests and boosts yields. Composting breathes new life into soil by recycling organic matter, reducing dependence on chemical fertilizers. However, traditional farming also comes with challenges—lower productivity, labor-intensive processes, and vulnerability to climate shifts. In some cases, practices like shifting cultivation, if not carefully managed, can lead to deforestation and soil degradation. While some argue that modern farming is more efficient, a balanced approach that blends traditional knowledge with modern advancements can offer the best of both worlds. By embracing both wisdom from the past and innovations of the present, we can create a sustainable future where farming not only feeds people but also nurtures the planet.[1]

- Natural farming, often called ”zero-budget natural farming,” is gaining recognition as a sustainable way to cultivate crops while working in harmony with nature. By relying on traditional knowledge and minimizing external inputs, this approach nurtures soil health, conserves biodiversity, and builds resilient ecosystems. It offers a promising solution to pressing agricultural challenges like soil degradation, water scarcity, and climate change while also improving farmer livelihoods. However, widespread adoption faces hurdles such as initial yield declines, limited awareness, and insufficient policy support. To make natural farming more viable,

DOI: 10.5281/zenodo.15529623

experts emphasize the need for farmer education, supportive policies, and scientific innovations that complement traditional wisdom. By blending age-old practices with modern advancements, natural farming can pave the way for a more sustainable and food-secure future[2]

- In today's ever-changing agricultural landscape, resilience and sustainability have become essential for ensuring long-term food security while protecting the environment. Resilience in farming means the ability to withstand and adapt to challenges like extreme weather, pests, and economic shifts, while sustainability focuses on maintaining a balance between ecological health, economic viability, and social well-being. Research highlights that practices such as organic farming, agroecology, permaculture, and regenerative agriculture not only improve soil health and biodiversity but also help farmers manage water resources more effectively. However, despite these benefits, challenges like climate change, limited resources, and market barriers make large-scale adoption difficult. Experts emphasize the importance of supportive policies, institutional backing, and modern technologies in expanding these practices. As we look to the future, innovative approaches like precision farming and global collaboration are becoming key to creating a more resilient and sustainable agricultural system. Blending traditional wisdom with cutting-edge solutions offers a promising path forward, ensuring that farming remains productive while safeguarding the planet for future generations[3]

B. Applications utilizing traditional farming practices

- SMART farming, powered by the Internet of Things (IoT), is transforming agriculture by making it more efficient, sustainable, and productive. With real-time monitoring of soil health, weather conditions, and crop growth, farmers can optimize resources, reduce waste, and improve yields. Technologies like precision agriculture, automated irrigation, and drone-assisted farming are helping reduce costs while increasing efficiency. However, widespread adoption faces challenges, including high initial investment, data security concerns, and the need for technical expertise. Despite these hurdles, advancements in machine learning, big data, and cloud computing are expected to further enhance the potential of IoT in farming. To fully realize its benefits, collaboration between farmers, technology developers, and policymakers is essential, ensuring that SMART farming is accessible, scalable, and beneficial for both agriculture and the environment[4].

- FarmBot represents a significant advancement in precision agriculture, integrating automation, robotics, and open-source technology to enhance small-scale farming. Developed as a fully automated, customizable system, FarmBot utilizes a universal tool mount, seeding mechanisms, and a water and nutrient delivery system to optimize plant care with minimal human intervention. Research in precision farming highlights the benefits of automation in improving efficiency, reducing resource wastage, and enabling precision based plant care. Studies on robotic farming systems emphasize their ability to increase productivity while promoting sustainable practices, such as targeted watering and fertilization. However, challenges such as high initial costs, maintenance complexities, and the need for technical expertise hinder widespread adoption. Future advancements in AI, machine learning, and IoT integration could further enhance FarmBot's adaptability and accessibility, making smart farming more viable for diverse agricultural settings. A collaborative approach between developers, policymakers, and farmers is essential for the widespread implementation of automated precision farming solutions[5].

- The Decision Support System for Agrotechnology Transfer (DSSAT) is a powerful tool that has transformed agricultural research and decision-making. Developed by an international team of scientists, DSSAT helps farmers, researchers, and policymakers simulate crop growth, predict yields, and assess the impact of soil, weather, and management practices on farming outcomes. By incorporating models for multiple crops, it allows for better planning of crop rotations, irrigation strategies, and fertilization schedules, ultimately leading to more efficient and sustainable agriculture. Over the years, DSSAT has been widely used in precision farming, climate change impact studies, and resource optimization. Its modular design makes it adaptable to new scientific advancements, fostering interdisciplinary collaboration in agronomy. However, while DSSAT provides valuable insights, its complexity, extensive data requirements, and high computational demands pose challenges for widespread adoption. Researchers continue to refine the system, integrating artificial intelligence, big data analytics, and remote sensing technologies to improve its accuracy and accessibility. As agriculture faces increasing challenges from climate change and food security concerns, DSSAT remains a vital tool for helping farmers make informed, science-based decisions that ensure productivity while preserving natural resources[6].

- BioMA (Biophysical Model Applications) is a powerful tool that has revolutionized agricultural and environmental modeling by providing a flexible and modular framework. Designed to simulate crop growth, climate impacts, and environmental changes, BioMA helps researchers and decision-makers make informed choices for sustainable agriculture. Its three-layer architecture—the Model Layer (ModL) for core calculations, the Composition Layer (CompL) for integrating models, and the Configuration Layer (ConfL) for adapting simulations to real-world conditions—ensures accuracy and adaptability across different scenarios.

BioMA has been widely used to assess crop production, predict the effects of climate change on agriculture, and model the spread of plant diseases. Its applications range from estimating soil properties and optimizing irrigation to improving farming strategies through datadriven insights. Recent advancements have even enabled BioMA to run in cloud-based environments, making large-scale simulations more accessible and efficient. As climate change and resource constraints continue to challenge global agriculture, tools like BioMA are essential for creating smarter, more resilient farming systems that balance productivity with sustainability[7].

- Launched by Farmerline in March 2024, Darli is an AIpowered chatbot designed to assist small-scale farmers with personalized guidance on regenerative farming. With support for 27 languages, including Twi, Swahili, and Yoruba, Darli ensures accessibility across diverse regions. It provides crop-specific recommendations on fertilization, pest control, harvesting, and crop rotation, helping farmers optimize their yields. Additionally, its AI-driven disease diagnosis tool allows users to upload images of diseased crops for instant identification and treatment suggestions.

  By offering real-time, data-driven insights, Darli empowers farmers to make informed decisions, reducing reliance on external consultations and promoting sustainable practices. Recognized on TIME's 2024 Best Inventions List, it is set to play a crucial role in tackling food security, climate change, and resource management. As AI continues to transform agriculture, Darli represents a key innovation in bridging technology with traditional farming methods[8].

- Farm Management Information Systems (FMIS) are digital platforms that help farmers make data-driven decisions by integrating technologies such as GPS, remote sensing, and AI-driven analytics. These systems optimize resource use, improve productivity, and support sustainability by offering insights into crop management, soil health, irrigation scheduling, and financial planning. Despite their advantages, challenges such as high initial costs, data privacy concerns, and the need for technical expertise can hinder widespread adoption. Future advancements in artificial intelligence (AI), the Internet of Things (IoT), and cloud computing are expected to enhance FMIS capabilities, making them more accessible and effective for farmers worldwide. As agriculture moves toward greater digitalization, FMIS will play a key role in improving efficiency and resilience in modern farming[9].

- Krishikosh, developed by the Indian Council of Agricultural Research (ICAR), is transforming the way agricultural knowledge is shared and preserved. As a centralized digital repository, it provides researchers, educators, and policymakers with seamless access to a vast collection of theses, research papers, technical reports, and institutional publications. Built on opensource DSpace technology, Krishikosh ensures global accessibility, making agricultural insights available to millions worldwide. By bridging the gap between research and practice, it plays a vital role in strengthening agricultural education, innovation, and sustainable farming practices[10].

III. DISCUSSION

With the growing adoption of technology in agriculture, various digital tools and platforms have emerged to enhance efficiency, sustainability, and decision-making in farming. The comparison table presents a detailed overview of Smart Farming, FarmBot, DSSAT, BioMA, Darli, Farm Management Information Systems (FMIS), and Krishikosh, highlighting their functions, technologies, benefits, and challenges.

Feature	Purpose	Technology	Users
Smart Farming	Precision Agriculture	IoT, AI	Farmers, Agronomists
FarmBot	Automated Farming	Robotics, AI	Hobbyists, Small Farmers
DSSAT	Crop Simulation	Models	Researchers, Agronomists
BioMA	Environmental Modeling	Data Analytics	Scientists, Policymakers
Darli	Crop Decision Support	AI, ML	Farmers, Researchers
FMIS	Farm Management	GIS, Analytics	Large &Small Farms
Krishikosh	Digital Agricultural Repository	Database, Digital Library	Researchers, Students, Farmers

TABLE I
COMPARISON OF SMART FARMING TECHNOLOGIES

IV. CASE STUDY

A case study in Tamil Nadu, India, shows the effect of combining technology with conventional agriculture. Farmers in the state used IoT-based soil sensors to monitor moisture levels, allowing for optimized irrigation schedules that saved 35 percent of water AI-based pest detection systems gave real-time alerts, avoiding crop loss and raising yields by 25 percent. Besides that, access to Krishikosh's electronic agricultural database informed farmers about best practices, climate-resilient crops, and market information, enhancing profitability and decision-making.

Outside Tamil Nadu, comparable smart farming programs have been seen elsewhere, including in Maharashtra and Punjab, where drone-based monitoring, blockchain-based supply chain tracking, and machine learning-based yield forecasting have shown encouraging outcomes. These examples highlight the promise of a hybrid farming method in meeting modernday farming challenges while maintaining economic sustainability.

V. Conclusion

The combination of conventional farming methods and smart agriculture presents a green and effective way forward. By integrating digital technologies, IoT, AI, and agrotechnology repositories, farmers can maximize productivity, improve resource use efficiency, and reduce environmental stresses. However, the adoption of this hybrid approach depends on cooperation among farmers, researchers, and policymakers to make it accessible and scalable. Subsequent research ought to concentrate on further developing such technologies to suit multiple farming systems to ensure innovation supplements but not replaces conventional know-how. That will secure food production worldwide without undermining the past and agricultural tradition for generations yet to come.

References

[1] Hamadani, H., Rashid, S. M., Parrah, J. D., Khan, A. A., Dar, K. A., Ganie, A. A., Gazal, A., Dar, R. A., Ali, A. (2021). Traditional Farming Practices and Its Consequences. Springer.

[2] Ashoka, P., Nagangoudar, M. B. (2025). Challenges and Future of Natural Farming. In Natural Farming: Principles and Practices. ResearchGate..

[3] Singh, S., Khatana, K., Singh, Y., Mishra, A. K. (2025). Enhancing Resilience and Sustainability in Farming Practices. In Transition to Regenerative Agriculture. Springer Nature Singapore.

[4] Singh, A. K. (2021). SMART Farming: Applications of IoT in Agriculture. In Handbook of Smart Materials, Technologies, and Devices. Springer Nature Switzerland.

[5] Cruz, J., Herrington, S., Rodriguez, B. (2014). FarmBot: Final Design Report. California Polytechnic State University, San Luis Obispo.

[6] Jones, J. W., Hoogenboom, G., Porter, C. H., Boote, K. J., Batchelor, W. D., Hunt, L. A., Wilkens, P. W., Singh, U., Gijsman, A. J., Ritchie, J. T. (2003). DSSAT cropping system model. European Journal of Agronomy, 18(3-4), 235-265.

[7] Donatelli, M., Bellocchi, G., Habyarimana, E. (2010). BioMA (Biophysical Model Applications): A modular framework for agricultural and environmental modeling. Environmental Modelling Software, 25(7), 887-898.

[8] BIS Research. (2024). Darli: The chatbot transforming smart farming with AI to support small-scale farmers. BIS Research Reports.

[9] Fountas, S., Sorensen, C. G., Tsiropoulos, Z., Cavalaris, C., Vatsanidou, A., Liakos, V., ... Tisserye, B. (2015). Farm management information systems: Current situation and future perspectives. Computers and Electronics in Agriculture, 115, 40-50.

[10] Kumar, A., Verma, N., Veeranjaneyulu, K., Pandey, P. S. (2022). Krishikosh: A new dimension of digital repository in agriculture. The Indian Journal of Agricultural Sciences, 92(2), 158-163.