

SYNTHETIC SAPIENS: A CYBERNETIC ELYSIUM AND THE SHIFTING PARADIGM OF INTELLIGENCE

(EXPLORING THE FACETS OF ARTIFICIAL INTELLIGENCE)



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2024

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by Prof. (Dr.) Sreekala K.L. & Dr. P.K. Rajagopal

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First Published: January 2024

Design & Layout: Jabez, E-mail: onlineprinting.pala@gmail.com

Printed at :

Jyoti Printers, C - 12, Sector - 8, Noida, U.P. - 201301

Ph: 9289199317, e-mail: jyotiprinters.noida@gmail.com

Published by: Media House°

Regd Office:

375 - A, Pocket 2, Mayur Vihar Phase - I, Delhi - 110 091

Phone: 09555642600

E - mail: mediahousedelhi@gmail.com

Admin Office:

C - 12, Sector 8, Noida, UP - 201301

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E - mail: books.mediahouse@gmail.com

www.mediahouse.online

ISBN: 978-93-94507-82-1

Price: ₹ 1200/-

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HARVESTING SUSTAINABILITY: THE TRANSFORMATIVE IMPACT OF AI IN REVOLUTIONISING FOOD SYSTEM



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Abstract

The world is transitioning through the digitalization era in which most of our daily activities are highly dependent on innovative digital and computer technologies. In the last few years, while the COVID-19 pandemic affects food supply chains around the world, the agriculture sector also has faced many global problems, such as global warming, environmental pollution, climate

change, and weather disasters. Over the years, advancements in technology have revolutionized agriculture, leading to increased productivity, efficiency, and sustainability. One of the key drivers of this transformation is the integration of Artificial Intelligence (AI) in agricultural practices. In the ever-evolving landscape of agriculture, technological advancements have become the driving force behind increased efficiency and sustainability. Technological advancements have played a pivotal role in the development and improvement of agriculture throughout history. In recent years, advancements in information technology, data analytics, and AI have brought about a new era of innovation in agriculture. The integration of Artificial Intelligence (AI) technology in agriculture has emerged as a transformative force, revolutionizing the way farming and related practices are conducted. The advancements in AI has enabled farmers and agricultural stakeholders to make more informed decisions, optimize resource allocation, increase productivity, and promote sustainable practices.

Key words: artificial intelligence, sustainability, block c

Introduction

The world is transitioning through the digitalization era in which most of our daily activities are highly dependent on innovative digital and computer technologies. These contemporary technologies have got their applications in socio-economic, +environmental, sustainable, and climate research applications to enhance the productivity and efficiency of a given system (Balogun et al., 2020; Ceipek et al., 2020). In the last few years, while the COVID-19 pandemic affects food supply chains around the world, the agriculture sector also has faced many global problems, such as global warming, environmental pollution, climate change, and weather disasters. It has known that technological opportunities are available for human beings to get out of these predicaments, solving the interconnections between food-water-energy- climate nexus, and achieving agricultural transformation from traditional to digital. (Abegaz

B W, Datta T & Mahajan S M (2018).) The agricultural sector plays a vital role in providing food, fiber, and raw materials to sustain human civilization. Over the years, advancements in technology have revolutionized agriculture, leading to increased productivity, efficiency, and sustainability. One of the key drivers of this transformation is the integration of Artificial Intelligence (AI) in agricultural practices. In the ever-evolving landscape of agriculture, technological advancements have become the driving force behind increased efficiency and sustainability. Among these innovations, Artificial Intelligence (AI) stands out as a transformative power that holds the promise of revolutionizing the way we cultivate and harvest our crops. This blog will delve into the profound impact of artificial intelligence in agriculture, exploring its current applications, future potential, and the unprecedented benefits it brings to farmers and the global food supply chain.

As we stand on the brink of a new era in agriculture, the integration of artificial intelligence has become a beacon of hope for addressing the challenges that the industry faces. Artificial intelligence in agriculture encompasses a range of technologies, from machine learning algorithms to robotics, sensor networks, and data analytics. These innovations work in tandem to optimize farming practices, improve resource management, and ultimately increase yields.

Overview of the agricultural sector

The agricultural sector encompasses a wide range of activities involved in cultivating crops, raising livestock, and producing other agricultural commodities. It is a multifaceted industry that contributes to the overall economic growth of a nation and is crucial for ensuring food security and nutrition. The sector includes various sub-sectors such as crop production, animal husbandry, aquaculture, forestry, and agribusiness. Crop production involves the cultivation of plants for food, feed, fiber, or industrial purposes.

The agricultural sector is influenced by a range of factors, including climate, soil conditions, water availability, market dynamics, and government policies. It faces numerous challenges such as limited natural resources, climate change, population growth, and the need for sustainable practices. To address these challenges and meet the growing demand for food, technological advancements have become crucial. (Ahmad, L., & Nabi, F. (2021). The important advances of AI in traditional stages of production need to be expanded with intelligent planning for demand uncertainty and personalized needs of end-customers, storage optimization, waste reduction in the post-production phase (e.g., distribution and recycling), and boundary-spanning analytics. For theory, this work highlights mature areas for AI adoption in agri-food and identifies opportunities for future research in the extended agri-food supply chain. For practice, the review findings can inspire startups interested in extended agri-food ecosystems and incumbents in their pilot projects for the intelligent and sustainable digital transformation of agri-food. AI techniques can contribute to close the loop of sustainable agri-food supply chains.

Sustainable work is critical to overcoming present concerns, anticipated challenges (The United Nations, 2015), and meeting the consumer demand for sustainability in the food business (The United Nations, 2015). The future of food and agriculture, which argues for the premise in this paper by focusing on how “sustainable food and agriculture systems cannot be realised without major additional efforts,” supports the demand for sustainability. Because customers play such an important part in change, and most sustainable solutions will fail without market acceptance, the consumer’s perspective can be seen as a barrier to enterprises in the food industry pursuing sustainable development.

Importance of technological advancements in agriculture

Technological advancements have played a pivotal role in the development and improvement of agriculture throughout history. In recent years, advancements in information technology, data analytics, and AI have brought about a new era of innovation in agriculture. The importance of technological advancements in agriculture can be seen in several areas:

- **Increased productivity:** Technology has enabled farmers to increase their productivity by improving cultivation techniques, crop varieties, and animal breeds. Mechanization has reduced manual labour, increased efficiency, and allowed for larger scale operations.
- **Precision agriculture:** Technology has enabled precision agriculture, which involves the use of sensors, drones, and satellite imagery to monitor and manage crops with precision. Farmers can collect data on soil moisture, nutrient levels, and crop health to optimize resource allocation, reduce waste, and increase yields.
- **Efficient resource management:** Technology has facilitated efficient management of key resources such as water and fertilizers. Irrigation systems can be automated based on real-time data, minimizing water usage. Similarly, smart fertilization techniques can deliver nutrients precisely where and when they are needed, minimizing environmental impact.
- **Disease and pest management:** AI techniques can analyse large volumes of data to detect and predict disease outbreaks and pest infestations. Early detection allows farmers to take proactive measures, reducing crop losses and the need for excessive pesticide use.
- **Supply chain optimization:** Technology has improved logistics and supply chain management in agriculture. From farm to

fork, digital systems can track and trace products, ensuring quality, safety, and timely delivery. This transparency benefits both farmers and consumers.

Integration of AI with other emerging technologies

To further enhance the potential of AI in agriculture, integration with other emerging technologies is gaining traction. Two such technologies are blockchain and edge computing:

- **Blockchain:** Blockchain technology provides transparency, immutability, and security in data management. By integrating AI with blockchain, farmers can securely store and share agricultural data, including supply chain information, crop production history, and quality certifications. This ensures traceability, prevents fraud, and builds trust among consumers.
- **Edge Computing:** Edge computing involves processing data closer to its source, reducing latency and dependence on cloud infrastructure. In agriculture, AI algorithms can be deployed on edge devices such as sensors, drones, and farm machinery. This enables real-time analysis of data, facilitating prompt decision-making, and reducing the need for continuous internet connectivity.

Future Perspectives and Emerging Trends

Advances in AI for sustainable agriculture:

- **Precision Farming:** AI can analyse vast amounts of data from various sources such as satellite imagery, weather patterns, soil conditions, and crop health sensors. This enables farmers to make data-driven decisions about irrigation, fertilization, pest control, and optimal planting and harvesting times. Precision farming minimizes resource wastage, maximizes crop yields, and reduces environmental impact. By identifying potential issues at an early stage, farmers can take

preventive measures, reducing crop losses and the need for excessive pesticide or fertilizer usage.

- **Weed and Pest Control:** AI-powered systems can distinguish between crops and weeds, enabling precise targeting of herbicides. This reduces the reliance on harmful chemicals and promotes sustainable farming practices.
- **Agricultural Robotics:** AI transforming agriculture with the use of robots. Autonomous robots equipped with computer vision and ML algorithms can perform tasks such as seeding, planting, weeding, and harvesting with high precision and efficiency. This reduces labour costs, increases productivity, and improves overall farm management.
- **Crop Yield Prediction:** By analysing historical and real-time data, AI can predict crop yields with high accuracy. This information helps farmers in planning logistics, estimating future production, and optimizing supply chains. Accurate yield predictions contribute to better decision-making and resource allocation.

Conclusion

The integration of Artificial Intelligence (AI) technology in agriculture has emerged as a transformative force, revolutionizing the way farming and related practices are conducted. The advancements in AI has enabled farmers and agricultural stakeholders to make more informed decisions, optimize resource allocation, increase productivity, and promote sustainable practices. One of the key benefits of AI in agriculture is the ability to gather, process, and analyse vast amounts of data from various sources, such as weather patterns, soil conditions, crop health, and market trends. This data driven approach empowers farmers to make real-time decisions and take proactive measures to mitigate risks, maximize yields, and minimize environmental impact. By leveraging AI, farmers can accurately predict weather patterns, identify disease outbreaks, optimize irrigation schedules,

and efficiently manage crop rotation strategies. However, while the potential of AI in agriculture is vast, there are still challenges to overcome. Issues such as data privacy, access to reliable internet connectivity in rural areas, and the digital divide must be addressed to ensure equitable adoption of these technologies.

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