Original Article
ISSN (Online): 2582-7472

ShodhKosh: Journal of Visual and Performing Arts
June 2024 5(6), 1831–1836

ROLE OF ARTIFICIAL INTELLIGENCE IN AGRICULTURE OF INDIA

Dr. Mahesh Kumar M. Barad[1]

[1] Principal and Associate Professor, School of Commerce, Birsa Munda Tribal University – Rajpipla India

DOI
10.29121/shodhkosh.v5.i6.2024.2604

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ABSTRACT

Integrating Artificial Intelligence (AI) in agriculture holds great promise for optimizing resource utilization, improving crop yields, and promoting sustainable practices. However, the responsible adoption of AI in agriculture is critical to addressing ethical challenges, ensuring Transparency and avoiding unintended negative consequences. The responsible adoption of AI in agriculture entails a conscientious and ethical approach to integrating AI into farming practices. This research explores Ethical concerns, Transparency and Sustainable resource management by proposing a novel ETS framework for the responsible adoption of AI in agriculture and a case study of its application to achieve this objective. This framework can be a helpful tool to maximize the benefits of technology while safeguarding ethical, transparent, and sustainable outcomes for all stakeholders and the environment.

Keywords: Agriculture Intelligence (AI), Agro –Market Agro-Computer, Artificial Intelligence (AI), Drone Technology (DT), Rural Agriculture.

1. INTRODUCTION

To some, innovation in farming in India has already arrived in form of Artificial Intelligence (AI). To others, AI applications in the agricultural industry in India appear superfluous and primitive, and likely carry limited potential at best.

In India, modern technology in agriculture, often written as Agtech or Agritech, represents hope. That's because traditional farming practices often fall sadly short when facing challenges like changing climate conditions and global warming.

Technology giants as well as start-ups are trying to combat several issues by building farming, irrigation and weather technology solutions. For example, Microsoft precision agriculture attempts to "democratizing AI for farmers around the world". Start-ups are finding ways so that farmers can receive various inputs and suggestions over feature phones – even a smartphone isn't required.

With the growing world's population and the demand for food rising, it is crucial to use efficient farming methods to increase production on the limited amount of land. AI is becoming more prevalent every day in agriculture, and AI-based devices are elevating the current farming system. Agriculture is dependent on a number of variables, including soil

nutrient content, moisture, crop rotation, rainfall, temperature, etc. Products based on artificial intelligence can use these variables to track crop productivity. In order to improve a wide range of agriculture-related tasks throughout the entire food supply chain, industries are turning to Artificial Intelligence technologies.

Applications and solutions that use AI in agriculture have been created to assist farmers in precise and regulated farming by giving them the right advice on water management, crop rotation, timely harvesting, the type of crop to be cultivated, optimal planting, pest attacks, and nutrition management.

2. THE PUSH BY THE GOVERNMENT OF INDIA

In September 2019, the Department of Agriculture GoI emphasized that technology is a major thrust area for the government. Sanjay Aggarwal, Secretary of Agriculture, said, "AI and big data are going to be a game-changer in the agriculture sector and the government is aiming to collate about 80% of such data by 2020."

To begin with, the government runs a number of beneficiary schemes for farmers. Data would help assess the efficacy of these schemes and improve better targeting.

He said the government is looking to collect data regarding soil health, crop insurance, and Kisan credit card. Considering that 85 million farmers have registered for the PM-KISAN scheme, the government should be in a strong position to collect, collate and leverage data.

All this makes it important to understand where India stands in AI. This article covers details of applications of artificial intelligence in agriculture and the future of AI in agriculture in India.

3. CONTEXT FOR AGRICULTURE AUTOMATION IN INDIA

Consider the following:

- The agriculture and the allied sector contributes less than 16% to its US$ 3 trillion economy today.
- Agriculture directly employs 41.1% of India's working age population.
- Nearly 50% of India's land is tilled

So here's the paradox: To create one-sixth of the total Indian economy, it takes nearly half of India's land, and that too while employing 2 of every 5 Indians.

This underlines the fact that Indian agriculture is nowhere close to being productive. While the government's initiatives like the Green Revolution have certainly made the nation self-sufficient in food grains, there is a long, long way to go for agriculture to catch up with other industries.

No prizes for guessing that the answer lies in automation in agriculture, deploying advanced agriculture technology like robotics, AI and Machine Learning (ML).

4. HOW AI COULD BENEFIT AGRICULTURE

Agritech has found a worthy partner in AI. In India, the role of artificial intelligence in agriculture can be much bigger than in any other field. That's because it can reduce costs, improve quality, increase productivity and optimally use resources.

Here are a few use cases that showcase the use of AI in agriculture in India and how self-evolving systems can take agriculture to the next level in India.

5. TECHNOLOGIES IN AGRICULTURE

Artificial intelligence and IoT based remote access micro-grid power farming has slowly started in India. Indian government organizations like C-DAC is providing facilities to farmers aimed at promoting agriculture. New technologies need to be implemented as the demand for agricultural products has increased over time. Crop productivity has increased over time as a result of advancements in information technology, which resulted in producing field yield seeds. The use of computers played a significant role in heavy crop production in the twentieth century. There is no doubt that artificial intelligence will play a role in the next decades. It is a fact that artificial intelligence offers ways to facilitate an increase in farmers' incomes, a rise in agricultural productivity and even waste reduction. Artificial intelligence plays a significant role in all these areas, thus preventing "agriculture as a service" from being a fragile segment. The uses of cognition are spread over eight main areas. This will benefit the Indian agricultural sector. They need to come up with technologies, especially artificial intelligence.

1. Internet of Things (IoT) led growth.
2. Image-based insight work.
3. Prepare suitable mixtures for agricultural products.
4. Strengthen crop health monitoring
5. Enable farmers to use irrigation and its maximum use.
6. Implement self-sustaining technology projects in agriculture.
7. Direct value-added products and manufacturing and enterprise marketing in the right direction.
8. Understand the right direction of the market.

The demand for data-driven framing and predictive analytics in agriculture is a guide after the post-COVID 19 worlds. The framers and agro-business owners are actively taking up precision farming methods supported by artificial intelligence and machine learning frameworks. These frameworks support farmers in crop and livestock management by removing the element of guesswork, forecasting yield, managing a supply chain network and assessing risks technology gives a transparent supply chain in various agriculture fields, starting from seed identification to harvest. It will provide popularity among the framers and systems regarding technical aspects, education, policies and regulatory frameworks.

6. CHALLENGES IN ADOPTING TECHNOLOGIES IN AGRICULTURE

The NitiAayog, Government of India, recently published a discussion paper It envisions solutions using artificial intelligence for key areas, including agriculture, industrialization, etc. In agriculture, technologically advanced machinery and built-in intelligence give farmers knowledge about soil quality, when to sow, spray herbicides, where pests occur, etc. If we built an intelligent system, then it can advise farmers on various best practices, India thus can see a new agricultural revolution. However, there is a strong challenge for that futuristic situation. The entire supply chain uses capacity expansion and cost reduction factors, which can backstab the Indian farming population. Even though built-in intelligence-based technologies have unique advantages, there are several challenges in adopting them in the agricultural sector.

1. Reliability of system and technology.
2. Security and acceptance of information.
3. Data privacy and storage and its use.
4. Social acceptance and recognition.
5. Live release, accessibility and use of reliable information.
6. Cost-effectiveness.
7. Ease of use and training.
8. Unethical stakeholders.

We must realize the realities of Indian agriculture and its market. Farmers are dependent on various external factors for agriculture and harvest and many a time, they are not guaranteed, which makes farming a high-risk activity. Even the market plays a vital role; since the products are mostly perishable, they have to accept whatever the market offers. Lack of quality storage facilities also is a reason why the farmers are getting exploited by the market. Certain agro-products like milk, egg, meat and vegetables will be damaged after a limited time. If artificial intelligence-based techniques were deployed, it would have given optimum solutions in cold storage, transportation and demand for these products. For

example, every place has its festivals. The market need of that time is different and if it can be predicted, then the demand and supply could be foreseen and a new market opportunity could be fetched.

Application of technology farmers in India has a very small landholding and they are unable to sustain the cost of buying the seeds and other essentials. Here, artificial intelligence for predicting the weather at a local level guides farmers to use sustainable techniques . This helps framers manage pests through ecology, robots for harvesting in a multi-crop farm, demand prediction available stocks, export, local needs, etc.

The importance of agriculture demands in the world increases because of impact issues after COVID 19. Technological advancements in agriculture farming and its marketing lead to International economic growth and the prevailing lockdown situation worldwide. It further resulted in food supply chain disruptions using predictive techniques.

AI-enabled systems make weather predictions, monitor agricultural sustainability, and assess farms for the presence of diseases or pests and undernourished plants using data like temperature, precipitation, wind speed, and sun radiation in conjunction with photographs taken by satellites and drones.

With equipment as basic as an SMS-enabled phone and the Sowing App, farmers without connectivity may profit from AI right away. Farmers with Wi-Fi connectivity can utilise AI apps to get a constantly AI-tailored plan for their farms, in the meantime. Farmers can meet the increased demand for food while growing output and revenues responsibly and without diminishing priceless natural resources with the help of IoT and AI-driven technologies. Climate variables include heat, precipitation, wind, and solar radiation.

There are many possible areas in which AI can help farmers such as:

Weather forecasting using AI:

Farmers find it challenging to determine the best time to sow seeds due to climate change and rising pollution. With the aid of artificial intelligence, farmers can analyze weather conditions by using weather forecasting, which helps them plan the type of crop that can be grown and when seeds should be sown.

Soil and crop health monitoring system:

The kind of soil and nutrition of the soil have a significant impact on the crops that are grown and their quality. The quality of the soil is deteriorating as a result of growing deforestation, making it difficult to assess.

AI Robotics:

Robots that can effortlessly carry out a variety of activities in farming fields are being developed based on AI. When compared to people, these robots are trained to harvest crops more quickly and in greater quantities while controlling weeds.

These robots are taught to harvest and pack crops while simultaneously inspecting the crops' quality and looking for weeds. These robots can also overcome the difficulties experienced by agricultural labourers.

Pests' detection using AI:

One of the deadliest enemies of farmers who cause agricultural damage are pests.

AI systems employ satellite photos and historical data to determine whether any insects have landed and, if so, which species—such as locusts, grasshoppers, and others—have done so. AI aids farmers in their battle against pests by sending alerts to their cell phones so that farmers may take the necessary precautions and employ the necessary pest management.

Crop health monitoring using drones:

Drone technology has had a lasting effect on the productivity of India's agriculture sector. The companies like Equinox Drones provide farmers with drone-powered solutions to boost productivity in a variety of farming operations, including precision farming, livestock management, pesticide application, crop stress identification, treatment planning, plant growth monitoring, and scouting.

In the future, AI will help farmers evolve into agricultural technologists, using data to optimize yields down to individual rows of plants.

7. CHALLENGE OF ARTIFICIAL INTELLIGENCE RESEARCH

One of the major challenges is how artificial intelligence research is carried out in our country. Current research and development initiatives are concentrated in top Indian institutions such as the Indian Institute of Technology (I.I.T), National Institute of Technology (N.I.T), etc. Here a community of 50 to 75 people works in this domain, and with this small workforce, they cannot pull off sufficient advancements. Thus, India lags far behind in bringing high-quality outputs in smart and intelligent computation. Space, lack of resource and administrative barriers, approach to research, poor computing facilities, lack of interpreted quality data have been cited as major pain affecting India's artificial intelligence research. The increase in Digital India's budget to US $ 477 million in 2018 to expand artificial intelligence research was a welcoming first step. But even with these funds, addressing institutional weaknesses continue to be a major challenge. It is also not clear how public agricultural universities and research institutes will benefit from such allocation. Artificial intelligence applications in the Indian agricultural sector need to grow, and the technologies need to be brought down to the root level. All stakeholders should be benefitted. Technologies should never remain in laboratories, and it should be handed down and tested in reality. Recommendation systems will benefit consumers and farmers in identifying the entire supply chain, which will quickly benefit both parties. If we adopt artificial intelligence-driven methodologies at different farming stages, we can witness an era of flourishing agricultural resources. This can only be achieved by advancing multiple research methods simultaneously.

8. CHALLENGES FACED BY FARMERS TO ADOPTING AI

1.Unequal access:While wealthy farmers accept the technology and use it, small and marginal farmers cannot afford the new technologies and are thus excluded.
2.Poor data security:Without a legal framework that promotes data security, the massive amounts of data that developing technologies acquire can be used unfairly by monopolies and transferred outside of the country.
3.Lack of infrastructure:A lack of infrastructure prevents the use of these technologies in rural areas, where uninterrupted electricity and Internet connectivity are essential.
4.Lack of know-how:In rural regions, poor connectivity, a lack of fundamental computer skills, high service fees, and illiteracy impede the quick development of electronic agriculture.
5.Human Resource shortage:Lack of skilled workers needed to conduct extension services for these technologies.
6.Poor land record management and land fragmentation:Due to cost-benefit analyses, these issues impede the implementation of developing technologies.

9. CONCLUSION

In the coming years, artificial intelligence will become increasingly important to humanity. That also applies to the agricultural sector. The ceiling for growth in the agricultural sector is extremely high because to the potential of machine learning and constantly advancing AI. Agriculture's future sustainability would be improved by the intelligent application of AI to the sector.
Today's world is moving to next-generation agriculture by using artificial intelligence framework, which can be termed as smart agriculture system. For better yield in agriculture, it is recommended,

1. Increase support for research and development activities in the area of artificial intelligence in agriculture.
2. Implementing expert guidance strategies, large scale research and application units.
3. Effective evaluation of equipment using artificial intelligence and related methodologies.
4. Improve interaction with all stakeholders at multiple levels of the supply chain.
5. Provision for agro educational research efforts.
6. A holistic system approach enables scalability and rapid response to changes in water, climate and employment availability, i.e., adopting anSoS framework.
7. Development of secure, adaptive and cohesive systems.
8. Understand the innovative and intelligent processes that take place at various agricultural universities and their impact on agriculture.

9. Understand the term "agricultural computer" on an experimental basis. That is, see the interaction of artificial intelligence and sub-sectors in the agricultural domain.
10. Adopt an integrated, multi-dimensional research approach in agriculture.

ACKNOWLEDGEMENTS

Authors are thankful to the healthcare practitioners working in GMC, Srinagar who helped directly or indirectly in the collection of data during the field work.

CONFLICT OF INTEREST

The authors declare no conflict of interest between them.

REFERENCES

Awasthi, Y. (2020). Press “a” for artificial intelligence in agriculture: A review. International Journal on Informatics Visualization, 4(3), 112–116.

Basnet, B., & Bang, J. (2018). The state-of-the-art of knowledge-intensive agriculture: A review on applied sensing systems and data analytics. Journal of Sensors.

Dharmaraj, V., &Vijayanand, C. (2018).Artificial intelligence (AI) in agriculture. International Journal of Current Microbiology and Applied Sciences, 7(12), 2122–2128.

Jha, K., Doshi, A., Patel, P. and Shah, M. (2019).A comprehensive review on automation in agriculture using artificial intelligence.Intelligence in Agriculture. 2: 1- 12.

Krishnan, A., &Swarna, S. (2020). Robotics, IoT, and AI in the Automation of Agricultural Industry: A Review (pp. 1–6). IEEE)

Liu, S. Y. (2020). Artificial intelligence (AI) in agriculture. IT Professional, 22(3), 14–15.

Ryan, M. (2022). The social and ethical impacts of artificial intelligence in agriculture: Mapping the agricultural AI literature (pp. 1–13). AI & SOCIETY.

Vinod Chandra, S.S., Anand, H.S. (2020). Artificial Intelligence: Principles and Applications, Printice Hall India, pp.428

Online website: https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1808332