4 AI-Supported Sustainable Entrepreneurial Practices in the Context of Indian Agriculture

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Abstract

Agriculture plays a pivotal role in the development of a nation. The Indian agricultural sector contributes to approximately 17% of the GDP (Gross Domestic Product) and engages 45% of its workforce. Agriculture in India has always been marked with low productivity, high dependence on the monsoon and poor technological advancement since independence. Moreover, the excessive use of chemicals like fertilisers and pesticides during the Green Revolution had adversely affected the quality of soil putting the ecology of the country in grave danger. It was in the early 2000s that the affordability of mobile phones, expansion of internet connectivity in rural areas and increasing demand for chemical free, organic food products led to a new wave for agricultural entrepreneurship in the country. Agricultural entrepreneurship ventured into areas like food processing, farm services and marketing. With the help of AI enabled technology like satellites, drones etc it has been possible to reduce the uncertainty related to agriculture. The start-ups in Indian agriculture have not only enhanced efficiency and sustainability but also increased the income of the farmers and reduced the rural-urban migration. The present paper traces the performance of the entrepreneurial practices and its impact in Indian agriculture using data from secondary sources. The chapter concludes that despite its strong growth performance in recent years, agricultural entrepreneurship in India still faces strong hurdles such as limited access to credit, low digital literacy among the farmers etc. Strong policy measures by the government, expansion of digital and physical infrastructure, and higher private investment are therefore highly recommended for the sustenance of entrepreneurial activities in the Indian agricultural sector.

Keywords: Agriculture, Sustainability, Entrepreneurship, Start-ups, Artificial Intelligence.

Introduction

Agriculture is the backbone of India's economy.It plays a pivotal role in the development of a nation as it ensures food and nutritional security. In India, approximately 17% of the GDP comes from agriculture and 45% of the population are engaged in it. Agriculture is the main source of livelihood for the people in the rural areas. The agricultural sector also acts as a driver of industrial growth. Moreover, it acts as a safety net during periods of unemployment as observed in the Covid period. Agricultural growth is also more efficient in bringing down poverty. The UN's Sustainable Development Goals are highly correlated with the growth of the agriculture sector. Unfortunately, the agricultural sector has not been paid its due attention by the policy makers. There was no proper agricultural policy in the country till 2000. There have been two main reforms related to agriculture-Institutional (Land Reforms) and Technological (Green Revolution). The Land reforms were introduced in the 1960's. However, Land Reforms could not be implemented properly across the country and proved to be a failure. Most importantly, Land Reforms could not solve the problem of deficiency in the production of food crops in the country. Thus, the country decided to usher in a technological revolution which started with the introduction of a new kind of High Yielding Variety Seed and a whole package of chemical fertilizers and pesticides along with modernisation and mechanization techniques. The Green Revolution was vital for the transformation of India into a strong self-sufficient country in crop production. With the introduction of the High Yielding Variety (HYV) seeds. the production of food grains increased to a large extent. However, the excessive use of chemicals had an adverse effect on the ecology and the environment of the country. There was depletion of soil nutrient and ground water depletion. Exposure to world market led to price fluctuations. Agricultural growth and productivity both declined post 1990’s. Low profitability, unpredictive markets increased rural indebtedness, often leading to farmer suicides. It was in early 2000s that a combination of technological advancements, policy reforms, and changing socio-economic conditions led to a new wave for agricultural entrepreneurship. In 2015, the United Nations introduced a set of seventeen Sustainable Development goals encompassing social, economic and environmental challenges that the world at large faces today. The present paper traces the performance of the entrepreneurial practices in India using data from secondary sources. Entrepreneurship in Indian agriculture has emerged as a transformative force in recent years, reshaping the traditional farming landscape, Agricultural entrepreneurship ventured into new areas like food processing, farm services and agro-marketing A direct application of AI (Artificial Intelligence) or machine intelligence across the farming sector could act to be an apotheosis of shifting of traditional farming practice today. Artificial intelligence technology is supporting different sectors in agriculture to boost productivity and efficiency even in the presence of hostile weather conditions. AI alsohelps inadverse environment conditions. . AI is shifting the way of food production where the agricultural sector's emissions have decreased by 20%. It promises to drive an agricultural revolution where the main objective is to produce more food using fewer resources. Indian agriculture is undergoing a structural transformation driven by climate volatility, market fluctuations, growing resource scarcity, and systemic inefficiencies. These challenges create a volatile, uncertain, complex, and ambiguous (VUCA) environment for smallholders and agribusiness entrepreneurs. VUCA in agriculture is marked by uncertainty in weather, complex process of obtaining inputs and the ambiguity of technological progress. AI has increased the efficiency in agriculture with the use of tools like sensors, satellites, drones etc .The government has played a supportive role in promoting entrepreneurship in this sector with its different schemes such as Start Up India, National Mission for Sustainable Agriculture (NMSA) and Rastriya Krishi Vikas Yojna (RKVY).The current chapter traces the evolution of India's traditional agricultural sector into a modern AI driven sector which focusses on self-reliance, efficiency and sustainability.

A Review of the Literature on Different Dimensions of Indian Agriculture

The literature on Indian agriculture can be classified into three categories. The first consisting of the body of work focusses on the condition of the situation of the Indian Agriculture pre–Green Revolution phase. The second strand highlights on the aftereffects of Green Revolution faced in the long run. The third strand of literature focusses on the discussion of sustainability and entrepreneurship in Indian agriculture using artificial intelligence. In this section, we shall mainly highlight on the ill effects of Green Revolution and the coming of age of the Indian agricultural sector with the use of AI.

Griffin (1979) while talking about the implications of the Green Revolution pointed out that while expensive technologies were affordable by the large and wealthy farmers, small and marginal farmers fell into debt trap while taking loans for these. Shiva (1991) and Singh (2000) both claimed that that there has been a reduction of soil fertility, depletion of nutrients due to overuse of chemical fertilizers, and ecological imbalance as the farmers had no prior training as how to use them. Pingali (2012) pointed the health risks from the use of these chemically grown crops. Continuing in the same vein, Frankel (2015) stressed on the regional imbalances caused post the Green Revolution. According to Frankel, better irrigated states like Punjab and Haryana gained much more than states which did not have much irrigational facilities, thereby widening state wise inequalities.

While these economists were raising their concerns about the ill effects of Green Revolution, there rose the" concept of Evergreen Revolution" (Swaminathan, 2006). Economists like Ramesh et al.(2010**)** advocated an approach that would integrate traditional knowledge with modern science while prioritising on soil health, water conservation, and protecting the local biodiversity. The IT revolution and the integration of the local market with the global one have led to a boom in the growth of start-ups in the country. Bhoosan and Sharma(2021) claim that a sizeable population is getting employed in these enterprises based on their skills and competencies. Entrepreneurs are making the agricultural products better in terms of their quality, packaging and branding which are crucial to increase the share in their exports. Ali et al (2025) point out that entrepreneurship in agriculture can revolutionize farming by overcoming factors like climate risks, lack of adequate resources and limited supply .

Lastly the growth of the agricultural start-ups would not have been successful without the supportive role of the government Policy initiatives such as the National Agroforestry Policy reflected this shift toward sustainable land-use systems that combine crops, trees, and livestock (Government of India, 2014).

Government interventions increasingly focused on income support, market access, and institutional strengthening rather than yield enhancement alone (Chand, 2017). The expansion of mobile connectivity and information and communication technologies (ICTs) marked the beginning of digital agriculture in India. ICT-based advisory services improved farmers' access to weather forecasts, pest alerts, and market prices, reducing information asymmetries (Kumar & Singh, 2020; FAO, 2018). Initiatives such as the Digital Agriculture Mission sought to create integrated digital infrastructure, including farmer databases, land records, and decision-support systems (Government of India, 2021, NITI Aayog, 2023). AI-enabled tools are increasingly used for crop disease detection, yield prediction, precision irrigation, and market intelligence (IBEF, 2023). These technologies save the time of the farmers, farm-specific, reduce input costs and environmental externalities (FAO, 2018; World Bank, 2020).

Application of AI in Agriculture

The current agricultural sector is witnessing a paradigm shift with the dawn of AI-based "digital farming," wherein traditional and reactive practices are gradually being substituted with proactive and data-based decisions. These systems, by combining the power of machine learning, computer vision, and internet networks, derive valuable decisions by interpreting complex data and optimizing resource allocation and logistics. This convergence of technology, also known as precision agriculture, relies on geographic and temporal data for making site-specific decisions, from gene sequencing to grading identification through advanced images.

AI-powered applications are classified into three main types of functionalities: agricultural robotics, soil and crop monitoring, and predictive analytics. Agriculture robotics involves developing drones and GPS sensors to automate farm functions such as sowing and harvesting. Monitoring involves the use of drones for monitoring crop health using deep learning techniques. Finally, predictive analytics involves

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developing digital intelligence concerning market pricing, agro-parameters, and allied services related to fintech and logistics. The USA has the largest number of startups followed by China and India respectively.

Table 1: Total funding and the annual growth rate of Agri-startups of selected countries

Country	No. of Agri - Startups	Total Funding (USD Millions)	Annual Growth Rate (%)
India	550	3200	18.2
USA	720	5400	15.3
Netherlands	150	1200	12.5
Brazil	300	2100	14.1
Kenya	180	950	20.4
Germany	220	1500	13.7
China	650	4800	16.9
South Africa	170	890	19.8

Source- Ali. J et al (2025)

Agri-tech startups have emerged as very critical drivers of economic growth, especially in countries like India as they open up new avenues of employment specially for the youth. It is believed that Indian startups alone have created some 120,000 direct jobs and 230,000 indirect jobs followed by the US and China.

Table 2: Sector wise investment

Sector	Investment (USD Millions)	Annual Growth Rate (%)
Precision Farming	1800	22.3
Agri-Fin Tech	1200	18.7
Agri-Biotech	950	15.6
Supply Chain	1100	16.9
AI & IoT in Farming	1300	20.1
Renewable Energy in Agriculture	850	12.4

Source- Ali. J et al (2025)

Precision Farming is now being accepted by the farmers and practiced widely. Precision agriculture helps to increase the crop yield as well as reduce the input cost. Thus, it draws the highest percentage of investment compared to other areas of digital agriculture. Precision agriculture requires the support of AI and IOT for predictions on weather and monitoring of the crops. Since farmers need easy access to financial credit for the use of any kind of technologies, the Agri Fin- Tech companies are also doing booming business with the second highest investment going to this sector. Investment is relatively low for sectors which have long gestation period like the Agri Biotech Companies. Even in Supply Chain Management, which plays a crucial role in reducing food wastage, investment is moderate as this sector is intrinsically linked to the infrastructural set up of a place. The Agri Bio Tech companies which work with genetically modified seeds, bio fertilizers receive lower investment because the returns can be accrued only in the long run. The Renewable Energy sub sector has the lowest investment because of high R& D and initial costs.

Some of the tools used by AI in agriculture are discussed below.

Agricultural drones can be of great use throughout the whole farm life cycle, starting with the creation of 3-D maps of the whole land, based on which it can be determined if the land is good for cultivation or not. Agricultural drones are also capable of providing necessary plant supplements like seeds and plant nutrients, which are sprayed over the soil. Since these drones can change their height according to the land, it helps them spray liquids accurately.

Complementing drones are the chatbots that use AI and which serve as virtual conversational assistants The instant response to any inquiry or expert advice given on certain agricultural problems help farmers if they face any difficulty.

Finally, the innovative digital assistant provides a platform for the interactive monitoring and observation of crops. The chatbots have the ability to bridge the gap between the data collected by the drones and how the farmers communicate. Therefore, the innovative combination between the data collected by drones and the use of chatbots provides a tremendous advancement in the management of farms.

Advanced automation includes driverless tractors that can carry out farm practices by itself. With the unification of commercially accessible technologies such as GPS radar, and sensors, agriculture opens new paths to enterprising independent farming. Again, in greenhouse management, AI addresses the impossible task on the part of humans to manually analyse all the factors that contribute to plant development and maturity. Since farm production is affected by so many environmental factors, AI systems create extremely high levels of accuracy in assessment and analysis of those growth factors that were previously unattainable. In this case, automation ensures optimum conditions for development that exceed human monitoring capability.

Finally, there are Support Vector Machines, which are crucial binary classifiers in the analysis of agricultural data. SVMs perform classification, regression, and clustering of image-based data by constructing linear separating hyperplanes. These tools solve overfitting by global optimization, using algorithms such as Support Vector Regression, Least Squares SVM, and Successive Projection Algorithm-SVM for effective processing of complex agricultural information.

To sum up, Artificial Intelligence leads to a considerable decrease in operational uncertainty with the help of Decision Support Systems (DSS), which integrate information related to the condition of the soil, the climatic conditions, and crops. The Agri Fin Tech firms help farmers with analysis for crop insurance claims, as well as the ability to predict crop yield and past Crop Performance, which ensures mitigation of risks. Thus, the Agri tech firms help the farmers attain the financial security required for the entrepreneurial pursuit of sustainable ventures.

Lastly, AI enhances food supply transparency with the use of blockchain technology. The integration of the two technologies ensures a high level of traceability on matters related to the safety of the food, and the carbon emissions. AI optimizes efficiency through the automation of grading and sorting, the optimization of cold storage, and the improvement of demand forecasts. It also helps with Environmental Impact Modelling in the way that it assesses significant sustainability factors like water footprint, and the long-term status of the soil. In-order to tackle the issues of ambiguity that exist within the farm, AI technology plays a crucially important role that brings clarity to pinpointing the cause and effect related to the failure of agricultural products. Thus, Artificial Intelligence helps to address the complexities associated with the agricultural industry.

Indian Agriculture from Independence to the Present

This section explores the trajectory of Indian agriculture from a country which relied on import of food items to feed its population to a country having one of the highest numbers of agro-based entrepreneurs and growing applications. Post independence, Indian agriculture was in a state of stagnation. Colonial policies had oriented Indian farming toward cash crops for export rather than food security, while exploitative land revenue systems such as the Zamindari system discouraged investment in land improvement. Productivity was extremely low: yields of staple crops like rice and wheat were among the lowest in the world. Irrigation infrastructure was limited, modern inputs were scarce, and scientific research was poorly integrated into farming practices. Food insecurity was the most pressing concern. The infamous Bengal Famine of 1943, which saw the loss of so many lives, exposed the susceptibility of India’s agrarian system to such disasters. Consequently, achieving food self-sufficiency and stabilizing agricultural production became a central objective of post-independence planning. One of the earliest priorities of the independent Indian state was agrarian reform. Land reforms aimed to abolish intermediaries, secure tenancy rights, and impose ceilings on landholdings. While abolition of the Zamindari succeeded in removing feudal intermediaries, other reforms such as tenancy regulation and land ceilings were unevenly implemented across states. As a result, land inequality persisted, especially in regions with weak administrative enforcement. India relied heavily on food imports under the PL-480 program from the United States to meet domestic demand. This dependence underscored the urgency of transforming agriculture to ensure national food sovereignty. Despite limitations, land reforms helped improve incentives for cultivators and laid the foundation for later productivity gains. The most decisive turning point in Indian agricultural history was the Green Revolution, initiated in the mid-1960s. It involved the adoption of high-yielding varieties (HYVs), chemical fertilizers and pesticides, rapid expansion of irrigation, as well as mechanization of agriculture. Punjab, Haryana, and western Uttar Pradesh emerged as the epicentres of this transformation. Wheat production increased dramatically, enabling India to achieve food self-sufficiency by the early 1970s. The economic liberalization of 1991 marked a shift towards market-oriented policies. While industry and services benefited significantly, agriculture experienced relatively slower growth. Public investment in agriculture declined, and input subsidies were gradually rationalized. Trade liberalization exposed farmers to global price volatility, particularly in commercial crops such as cotton and oilseeds. While some export-oriented farmers benefited, small and marginal farmers faced increased risks. The 1990s and early 2000s witnessed rising agrarian distress, reflected in farmer indebtedness, stagnating incomes, and, in some regions, farmer suicides. Structural problems such as fragmented landholdings, rising input costs, and inadequate access to institutional credit intensified vulnerabilities. In recent years, Indian agriculture has entered a phase of digital transformation. Technologies such as satellite imagery, mobile-based advisories, artificial intelligence, and data analytics are increasingly used for weather forecasting, crop monitoring, pest detection, and market linkage. Digital platforms allow farmers to have access to any kind of information on agriculture ranging from prices of inputs to various government benefits, reducing information asymmetry. Given India's vast agricultural heterogeneity—ranging from the rice paddies of the Indo-Gangetic Plains to the drylands of Rajasthan—AI's ability to tailor recommendations to specific contexts is especially valuable. AI-powered irrigation systems combine soil moisture data with weather forecasts to schedule water delivery efficiently, reducing wastage and improving yields. In Maharashtra's sugarcane fields, for example, such AI-based irrigation has led to a reported 20% increase in crop yield and 30% reduction in water use.

Researchers in India have developed various AI models that can detect diseases in crops by looking at imagery of leaves and using data from environmental sensors. The accuracy of such models is very high for a variety of crops, including maize and potatoes. The National Pest Surveillance System makes use of machine learning to detect outbreaks of pests that can be related to variations in climate. The response becomes timelier and more focused. Apart from the detection of pests, some robotic platforms are coming up to directly tackle the problem of pest pressure. For instance, an AI-enabled agricultural robot from IIT Kharagpur identifies diseased plants on its own and sprinkles pesticides for the same, thereby minimizing health risks among farm labourers and increasing precision in the process. Similarly, in several Indian states, predictive systems drawing on satellite data from the Indian Space Research Organisation and weather data have been piloted to support crop yield forecasting and advisory services. Overall, AI helped to increase productivity and resource use efficiency, climate adaptation and resilience leading to market efficiency.

Although the possibilities for AI are great, there are a few challenges that impede the adoption of AI technology in rural India. The adoption of AI technology, including drones, IoT devices, and automation technology, requires considerable expenditure, especially for small farmers in rural India. Since there are 80-85% small-scale farmers in the country, there would be a need for suitable funding for the adoption of AI technology. Besides, the availability of infrastructure like proper internet connectivity and electric supply is poor in rural India, thus inhibiting the use of cloud-based AI technology.

Moreover, the deployment of AI requires certain elementary levels of digital literacy and familiarity. A lack of training in the use of digital tools is widespread among farmers in rural India, and language can become a hindrance in efficiently using AI. There is a great need for training and simple interfaces in native languages.

AI models must be trained and tested using high-quality localized data in order to make effective predictions. Unfortunately, agricultural data in India tend to be unorganized or incomplete in a way that does not facilitate systematic data collection at a farm level in India.

Fragmented land ownership, credit constraints, and the pace of institutional support in some regions may inhibit investments in the adoption of AI solutions. Further, ownership issues of the data, trust in the recommendation systems, and the fear of disruptions act as inhibitors in the adoption of the above-mentioned solutions by the small farmers.

AI technologies enhance various agricultural functions:

- Pre-production: soil testing, crop planning, input optimization
- Production: irrigation management, pest/disease detection, drone mapping
- Post-production: logistics optimization, quality grading, price prediction
- Market linkage**:** matching supply-demand, dynamic pricing, traceability systems

Studies show AI can improve yields by 15–30% and reduce input usage by 20–50% in precision contexts (Mehta & Rana, 2021). Use of no tillage technique helps in lowering the overall losses of pesticides and herbicides .It is believed that average crop losses of up to 90% of total production occurred in the presence of weed infestation in the cropsearlier. In like manner, the average loss due to the pest is up to 19% (Dhaliwal et al, 2015). Pesticides and fertilisers contaminate the soil and the groundwater due to overuse.

Poor watering and soil care practices cause losing crops and reducing quality. AI-driven applications help analyse soil deficiencies, pest infestations and various diseases. Remote Sensing helps to construct crop matrix over large plots of cultivable farmland saving both time and effort. Using AI, data gets collected to ascertain the weed infestation area which helps the farmers to spray chemicals only where the weeds are present.

Selective Case Studies from Indian agriculture

With the gap between scarcity of resources and their ever-increasing demand widening, we should look for ways to maximise the productivity of farms. Along with the initiatives of the government, numerous startups have embraced this challenge. AI is being leveraged by these start-ups to save the agriculture industry, to help increase crop yield as well as control pests, monitor soil and check other conditions The following startups in Indian agriculture have employed AI with farming practices to bring revolutionary changes.

- **Fasal**

Shailendra Tiwari and Ananda Verma founded Fasal,a Bangalore based technology company in 2018 whose aim is to modernise horticulture using an integrated IoT and SaaS architecture. While countries such as Netherlands use data to derive maximum production on minimum land, the Indian farming sector’s productivity is not impressive. To address this challenge, Fasal has designed a methodology that treats farming like a disciplined industrial process. Rightnow there are 10,000 Fasal Sense devices stretching from Maharashtra to Himachal Pradesh covering approximately 150,000 acres.At the heart of the platform is the capability to convert actual environmental data into localized intelligence. Fasal offers two-week micro-climatic forecasts and ground moisture status to farmers using advanced machine learning and on-farm sensors. The deep granularity allows the irrigation and resource application to align itself with the crop’s growth stage from the very beginning Their latest addition "Fasal Kranti", a significant advancement in agro-tech automation is a modular plug-and-play system which uses more than 12 sensors to monitor everything from pest threats to soil health. The financial and environmental consequences of the technology are huge. Farmers using it have seen their yields rise 40% while also reducing their spending on pesticides by more than half. Fasal saves over 52 billion litters of water, which is very useful for the country, apart from increasing the income of the farmers. This shift towards sustainable practices that are supported by science will provide Indian agriculture an opportunity for self-sufficiency and sustainability.

- **DeHaat**

In 2012, Shashank Kumar, Amrendra Singh, Shyam Sundar and Adarsh Srivastav started DeHaat to make small-scale farming better in India. The founders of De Haatrealised that traditional farming is impacted by over-extended supply chains and lack of accurate data.This disconnects the growers from the modern market.

They took advantage of the uniqueness of the Indian landscape and successfully collated agricultural needs onto a scalable platform by creatinga full-fledged digital ecosystem. Today, DeHaat is an AI-based, full-stack solution that provides farmers with over 3200 types of agricultural inputs and customized agronomic support. The platform provides real-time intelligence on pest management, disease and weather forecasting via a combination of mobile technology and physical service centres. Farmers can enhance their ability to reduce risks and safeguard their livelihoods with this insightful information. This model is bringing all input suppliers to end buyers on a digital network together, effectively closing the gaps that have existed in the industry for years. In the future, DeHaat's creation of technology-logistics is going to be important for a sustainable and profitable agro-economy. With the climate changing and customers demanding traceable quality produce, AI-enabled platforms can make farming more resilient and easier to track. By scaling these innovations in advisory and market aggregation, DeHaat seeks to transform smallholder farmers from vulnerable bystanders to empowered central players in the economic growth of the country thereby creating a fairer value chain.

Conclusion

Agriculture has always been a prominent sector of the Indian economy for its influence over the GDP and the labour force. However, post-independence, India was hardly self-reliant in agriculture, rather it was dependent on other countries for the import of food grains. Two kinds of reforms were introduced to bring a change to this situation. The first reform- Land Reforms was partially successful in the sense that it could bring some uniformity in the pattern of land distribution. The second reform- The green Revolution introduced new ingredients in the Indian agriculture like High Yielding Variety Seeds which increased the production of crops like rice and wheat significantly. Even after this, Indian agriculture suffered from several bottlenecks like outdated technology, land fragmentation, uncertainty over crop yield ,erratic monsoon to name a few. On top of it, the Green Revolution had created a dent in the environment and ecological balance .It was in the 2000 that Indian agriculture saw a bunch of startups which started talking of sustainability. Agro entrepreneurs started relying on AI to navigate the volatility, uncertainty, complexity and ambiguity of the Indian agricultural market. AI helps mitigate volatility through predictive analytics, reduces uncertainty through decision-support systems, navigates complexity through integrated digital platforms and resolves ambiguity through diagnostic and market intelligence technologies. Startups like De Haat, Ninja Cart demonstrate how AI-supported models can improve resource efficiency, environmental outcomes, and farmer incomes. However, significant challenges remain like digital divides, cost barriers, fragmented data systems etc. To fully realize the potential of AI-driven sustainable entrepreneurship, India must invest in inclusive policies, strengthen digital infrastructure, promote farmer-centric training, and encourage research–industry collaborations. As India moves towards climate-resilient and market-responsive agriculture, AI will become a cornerstone of sustainable development, enabling farmers and entrepreneurs to thrive in an increasingly VUCA world.

Policy Recommendations

The following are some of the recommendations for the further growth of digitalisation and sustainability in agriculture.

Development of Rural Infrastructure

Since Indian agriculture is still primarily rural based, it is imperative that the government invests in rural digital infrastructure like broadband connectivity, reliable electricity, and digital access points. The government sector can also seek collaboration from the private sector to ensure AI services are spread equitably.

Higher Financial Inclusion and Incentives

To ensure that small scale farmers can have access to AI tools, they must be provided with subsidies, andlow-interest loans. Other incentives liketargeted financing schemes can also be very much beneficial. Community-based models (e.g, shared drones or cluster AI services) can lower costs per farmer and amplify benefits.

Capacity Building

Training programmes must be inducted to offer technical knowledge tailored to the needs of the industry to help potential businesses Curriculum design should integrate local languages so that farmers can understand and operate the tools with greater confidence

Data Ecosystems and Open Platforms

Creating standardized, open agricultural data repositories—while ensuring privacy and ownership rights—can accelerate AI model development tailored to Indian contexts. Data partnerships among research institutions, government agencies, and startups can enrich model training and localization.

Inclusive Innovation and Co-Design

Farmers should be partners in technology design. Co-design processes that incorporate feedback from end users can ensure AI solutions are practical, accessible, and aligned with ground realities.

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