

AG-TECH INSIGHTS

Modernizing Agriculture in India







Agriculture has long been the backbone of India's economy, intricately woven into the cultural and social fabric of the nation. Employing a significant portion of the population, with over half of the workforce engaged in this sector, agriculture contributes substantially to India's GDP. As the demand for food surges with a growing population, the need for sustainable and efficient agricultural practices becomes more critical than ever. In the pursuit of ensuring food security, technology emerges as a pivotal player in modernizing India's age-old agricultural practices.

The integration of technology, commonly known as ag-tech, has the potential to revolutionize the sector by addressing the challenges faced by farmers and enhancing overall productivity. The pressing need for technological innovation in agriculture becomes evident when considering the challenges faced by Indian farmers, ranging from unpredictable weather patterns to the need for efficient resource utilization.

TECHNOLOGIES IN AGRICULTURE

Many innovative solutions can reshape traditional practices and address pressing challenges faced by farmers, such as:

S.No.	Technology	Usage
1	<p>Precision Agriculture: Tackling Water Scarcity and Soil Degradation</p> 	<ul style="list-style-type: none"> Leveraging technologies such as GPS-guided tractors, sensor-based irrigation, and variable rate technology, precision agriculture optimizes resource utilization. GPS-guided tractors: enable farmers to navigate fields with unprecedented accuracy, minimizing overlaps and reducing fuel consumption. Sensor-based irrigation systems: ensure that water is distributed precisely where and when it is needed, preventing wastage. Variable rate technology: allows for customized application of fertilizers and pesticides, optimizing yields while minimizing environmental impact.
2	<p>Smart Farming: IoT Solutions</p> 	<ul style="list-style-type: none"> IoT devices facilitate real-time monitoring and management of crop health, soil conditions, and weather patterns. These interconnected systems empower farmers with actionable insights, enabling timely interventions to enhance crop productivity. For instance, soil sensors can provide data on nutrient levels, while weather monitoring devices offer valuable information for crop planning.
3	<p>AI and Machine Learning: Transformative Crop Management</p> 	<ul style="list-style-type: none"> Help analyse vast datasets to identify patterns and forecast potential disease outbreaks, allowing farmers to implement preventive measures. Provide personalized advice to farmers based on regional and crop-specific insights.
4	<p>Blockchain in Indian Agribusiness: Ensuring Fair Compensation</p> 	<ul style="list-style-type: none"> Important tool to reduce inefficiencies and corruption in Indian agricultural markets. By establishing transparent and tamper-proof digital ledgers, blockchain ensures fair compensation for farmers by minimizing intermediaries and guaranteeing the authenticity of transactions. Enhances traceability in the supply chain, assuring consumers of the quality and origin of agricultural products.

S.No.	Technology	Usage
5	<p>Vertical Farming and Controlled Environments: Nurturing Urban Agriculture</p> 	<ul style="list-style-type: none"> • In urban settings, where arable land is limited, vertical farming and controlled environments offer a sustainable solution. • These technologies enable the cultivation of crops in vertically stacked layers or enclosed environments, allowing for year-round production independent of external climatic conditions.
6	<p>Genetic Technologies: Genetically modified Organisms</p> 	<ul style="list-style-type: none"> • Involve the manipulation and modification of plant and animal DNA to enhance desirable traits: • Such as increased yield, pest resistance, and improved nutritional content. • This can lead to the development of genetically modified organisms (GMOs) with characteristics that contribute to agricultural sustainability and productivity.
7	<p>Nano Technology: Nano Agriculture</p> 	<ul style="list-style-type: none"> • Focuses on the application of nanoparticles to enhance crop protection, nutrient delivery, and soil health. • Nano-sized materials can be used to develop smart delivery systems for pesticides and fertilizers, improving their efficiency and reducing environmental impact. • Holds potential for precision farming through nano sensors that monitor soil conditions and crop health at a microscopic level.
8	<p>Remote-Sensing: Precision Monitoring</p> 	<ul style="list-style-type: none"> • Involve the use of satellites, drones, and other aerial platforms to collect data on soil conditions, crop health, and environmental factors. • This data is invaluable for precision agriculture, enabling farmers to make informed decisions about resource management, irrigation, and pest control. • Remote sensing contributes to increased efficiency, reduced costs, and sustainable farming practices by providing real-time and high-resolution information from a distance.

The integration of these innovations not only addresses immediate challenges but also paves the way for a resilient and dynamic agricultural sector in the years to come.

TECHNOLOGY IN PRACTICE

Between 2013 and 2023, the agricultural technology (ag-tech) sector in India experienced remarkable growth, expanding from fewer than 50 start-ups to over 3,000. This surge can be

attributed to heightened farmer awareness, increased internet penetration in rural India, and a growing demand for enhanced efficiency in the agricultural domain. With optimal

nurturing, the ag-tech ecosystem has the potential to boost Indian farmers' incomes by 25% to 35%, contributing a substantial \$95 billion to the Indian economy.

This transformative impact is anticipated through reductions in input costs, heightened productivity and price realization, access to more affordable credit, and the creation of alternative income streams.









Source: "India's turning point: An economic agenda to spur growth and jobs", Mckinsey Global Institute, Aug 26, 2020





Further, countries such as the United States have also sought to utilise ag-tech such as precision agriculture that has led to increased productivity, reduced fertiliser and pesticide usage and optimal water utilisation for a wide array of crops including wheat, sorghum, soy and cotton.

The crop yield increased an estimated 4% with a 7% improvement in fertilizer placement efficiency and a 9% reduction in use of herbicides.

These findings indicate that the implementation of precision agriculture, such as remote sensing and variable rate technology, can significantly enhance farmers' income. This improvement stems from a dual effect: a notable boost in productivity and a simultaneous reduction in input costs. Moreover, the savings incurred in input costs and the subsequent increase in yield contribute to farmers recovering the initial expenditures associated with adopting this technology.

Some notable ag-tech start-ups from India are:

Sector	Start-Up
Farmer Knowledge 	
Sustainability 	
Input Provision 	

Sector	Start-Up
Output Marketing 	
Nanotechnology 	

Despite the promising projections, the existing data on technology adoption rates reveals a starkly different scenario. Even though internet penetration in rural India is on the rise with close to 57% of rural users using internet daily, reports indicate that **the current market penetration of ag-tech is exceptionally low, merely 1% of its potential, and only a negligible percentage (2%)** of Indian farmers are actively engaging with apps in their field operations. These minimal rates of adoption have detrimental consequences for ag-tech start-ups, hindering their scalability and leading to unsuccessful investments.

INDIA'S AG-TECH LANDSCAPE: INVESTMENT

In 2022, the landscape of India's ag-tech sector witnessed a notable downturn in investments, with total funding experiencing a **significant 33% year-over-year decline**. This dip in capital infusion had a cascading effect across different stages of investment within the sector.

Late-stage investments, typically crucial for scaling operations and expanding market reach, registered a substantial 34% drop, reflecting a more cautious approach from investors. Early-stage investments, which play a pivotal role in nurturing nascent ag-tech innovations, saw an even steeper decline of 46%. This decline in early-stage funding could potentially impact the incubation and development of ground-breaking technologies in agriculture.

Despite the promising trends observed in the earlier years (2018-2021), the reduced investment activity in 2022 hinted at potential challenges and uncertainties influencing investor sentiment. The ag-tech sector often involves longer gestation periods for research, development, and market adoption. Investors, seeking relatively quicker returns on their investments, may find the extended timelines associated with ag-tech projects less appealing. Further, the inherent complexity of agricultural practices, varying across regions and crops along with regulatory challenges and policy uncertainties within the sector pose challenges for scalable and uniform technology solutions.

CHALLENGES

Several challenges have emerged, hindering the seamless adoption of agricultural technologies across diverse landscapes.

Cost of technology poses a significant barrier for many farmers, especially smallholders.

Digital literacy and training present another formidable challenge. Despite the increasing penetration of digital technologies, a substantial portion of the farming population lacks the necessary skills to effectively navigate and utilize these tools. Further, the language barrier poses another significant obstacle for farmers, limiting access to information, hindering training efforts, and complicating the use of technology interfaces.

Infrastructure and connectivity issues impede the smooth functioning of digital tools.

Interoperability issues, wherein different technologies struggle to work seamlessly together, present another hurdle. Lack of standardized protocols and compatibility between various agricultural tools and platforms can create inefficiencies and limit the holistic benefits of technology adoption.



Overcoming these challenges is essential for ensuring that the benefits of agricultural technology reach every farmer, irrespective of their scale or location.

WAY FORWARD

For Government:

Financial Support Programs: Introduce targeted subsidies and financial support programs to alleviate the economic burden on farmers, making advanced agricultural technologies more accessible.

Digital Literacy Initiatives: Launch comprehensive digital literacy and training programs to empower farmers with the necessary skills to navigate and maximize the benefits of ag-tech solutions.

Inclusion of Universities: Reprioritize institutional research in agriculture by encouraging universities to study a spectrum of crucial aspects, including genetics, technology adoption, and inclusive practices.

National Standards and Certification: Develop national standards and certification processes for agricultural technologies, ensuring interoperability and maintaining high-quality standards in the sector.

Incentivizing Innovation and Ag-tech Funding: Offer a combination of incentives, including tax breaks and research grants, while simultaneously establishing a dedicated fund providing low-interest loans and grants, to incentivize innovation, enhance competitiveness, and bolster the growth of ag-tech start-ups in India.

For Industry:

Financial Support Programs: Design user-friendly interfaces for digital platforms and applications, ensuring that ag-tech solutions are accessible and easy to use for farmers with varying levels of technological literacy.

Adaptive Technologies: Adapt technologies to suit diverse regional and crop-specific needs in India, recognizing the unique challenges and requirements of different agricultural contexts.

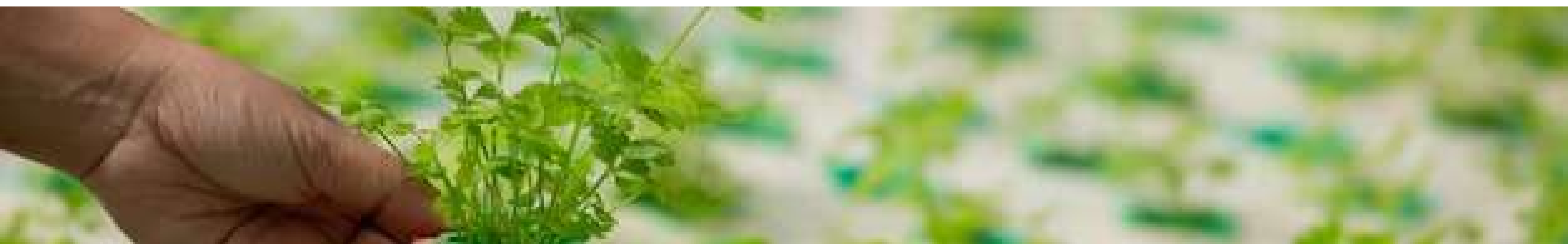
- Encourage development of ag-tech solutions in regional languages, offer training in local dialects, establish support centers with multilingual assistance, and implement localized communication strategies.

Collaborations and Partnerships: Seek collaborations and partnerships with government agencies, universities, NGOs, and local communities to create a collaborative ecosystem that fosters innovation, knowledge exchange, and efficient implementation.

Support for Ag-tech Start-ups: Establish and support accelerators focused on ag-tech, providing start-ups with funding, mentorship, and access to industry networks, fostering a culture of innovation and entrepreneurship.

- Integrate a Corporate Social Responsibility (CSR) program within these accelerators, focusing on community engagement, sustainable farming practices, and environmental considerations.

By implementing these measures, the government and industry can work together to create an environment conducive to the growth and success of ag-tech in India, ultimately driving sustainable and technologically advanced agricultural practices across the country.





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