Article Id
AL04530

AGRI- STARTUPS IN MODERNIZING AGRICULTURE AND IMPROVING FARM INCOME UNDER A CHANGING CLIMATE

Email

[1]Raghavendra Nargund* and [2]Raghunandan K.

raghavendra4449@gmail.com

[1]Division of Crop Production, ICAR-Indian Institute of Soybean Research, Khandwa Road, Indore-452001 (MP), India

[2]Crop Science Section, ICAR-Central Coastal Agricultural Research Institute, Ella, Old Goa, Goa-403402, India

Climate change has become one of the greatest challenges facing global agriculture in the 21st century. Agriculture is highly dependent on climatic conditions such as temperature, rainfall, humidity, and solar radiation. Any variation in these climatic factors directly affects crop growth, livestock productivity, soil fertility, and water availability. In recent years, the world has witnessed rising temperatures, erratic rainfall, frequent droughts, floods, cyclones, and heat waves due to climate change. These changes are adversely affecting agricultural production and productivity, threatening food security and farmers' livelihoods, particularly in developing countries like India, where agriculture is the backbone of the rural economy (Birthal et al. 2014). Indian agriculture is highly vulnerable to climate variability because a large proportion of cultivated land is rainfed and dependent on the monsoon. Delayed onset of monsoon, uneven rainfall distribution, prolonged dry spells, and unseasonal rainfall during harvesting stages often lead to severe crop losses.

Increasing temperatures accelerate evapotranspiration and reduce soil moisture, which negatively affects crop growth and yield. Heat stress during the flowering and grain filling stages reduces the productivity of crops such as wheat, rice, soybean, and maize. Similarly, changes in climate also increase the incidence of pests, diseases, and weeds, resulting in higher crop protection costs and reduced farm profitability (Swami et al. 2018). Climate change also affects natural resources that are essential for agriculture. Declining groundwater levels, deterioration of soil health, nutrient depletion, and reduced biodiversity are major concerns. Livestock production is equally affected due to heat stress, reduced fodder availability, and increased disease outbreaks. Fisheries and horticultural crops are also facing serious challenges because of changing environmental conditions. As a result, farmers are experiencing unstable yields, reduced income, and increased economic risk. Small and marginal farmers are the most

vulnerable because they have limited access to irrigation, technology, quality inputs, and institutional support (Oishy et al. 2025).

Role of Agri-Startups in Agricultural Transformation

In this challenging scenario, startups are emerging as important agents of change in modernizing agriculture and improving farmers' income. Agri-startups are using innovation, digital technologies, and scientific approaches to solve agricultural problems and make farming more resilient, productive, and profitable. These startups are bridging the gap between research institutions and farmers by delivering practical, affordable, and location-specific solutions.

Precision Agriculture and Digital Climate Advisory Services

One of the major contributions of startups is in the field of precision agriculture. By using technologies such as drones, sensors, artificial intelligence (AI), satellite imaging, and Internet of Things (IoT), startups help farmers monitor crop health, soil moisture, nutrient status, and pest infestation in real time. This enables farmers to apply water, fertilizers, and pesticides more efficiently, reducing input costs and increasing productivity. Precision farming also minimizes environmental pollution and promotes sustainable use of natural resources. Weather forecasting and climate advisory services provided by startups are highly beneficial for farmers. Mobile-based applications and digital platforms provide timely information on rainfall, temperature, humidity, pest outbreaks, and suitable crop management practices. Such advisories help farmers make informed decisions regarding sowing, irrigation, fertilizer application, and harvesting, thereby reducing climate-related risks (Aijaz et al. 2025 and Chen 2025).

Climate-Resilient Technologies and Sustainable Farm Practices

Startups are also promoting climate-resilient agricultural practices such as protected cultivation, hydroponics, organic farming, natural farming, conservation agriculture, and efficient irrigation methods like drip and sprinkler irrigation. These technologies improve resource-use efficiency, conserve water, and enhance productivity under adverse climatic conditions. Many startups are developing stress-tolerant seed varieties and bio-inputs that help crops withstand drought, salinity, and pest attacks.

Market Linkages and Supply Chain Management

Another important role of startups is improving market linkages and supply chain management. Digital marketing platforms connect farmers directly with consumers, retailers, processors, and exporters, reducing the role of middlemen and ensuring better prices for farm produce. Startups also help in aggregation, grading, packaging, cold storage, and transportation, which reduce post-harvest losses and improve profitability. E-commerce platforms and farmer producer organizations (FPOs) supported by startups are empowering farmers with better bargaining power and market access.

Agri-Fintech, Risk Management and Rural Entrepreneurship

Financial and insurance services offered by agri-fintech startups are also helping farmers manage risks and improve investment capacity. Digital credit facilities, crop insurance, mobile banking, and online payment systems provide easy access to financial support and reduce dependency on informal credit sources. Some startups are also facilitating carbon credit programs and sustainable farming certifications, which create additional income opportunities for farmers. Furthermore, startups are creating employment opportunities in rural areas through entrepreneurship, agri-services, custom hiring centers, and input supply chains. Youth involvement in agri-startups is encouraging modernization of agriculture and attracting educated individuals towards farming and agribusiness. Collaboration among startups, government agencies, research institutions, and private organizations can accelerate agricultural transformation and strengthen climate resilience (Amit et al. 2024, www.startupindia.gov.in).

Conclusion

Agri-startups play a critical role in advancing climate-resilient and income-oriented agriculture by integrating digital technologies, precision input management, climate advisories, bio-inputs, market linkages, and agri-financial services. These innovations can improve resource-use efficiency, reduce production and market risks, minimize post-harvest losses, and enhance farm profitability. Their wider impact, however, depends on affordability, scalability, farmer capacity building, and strong convergence among startups, research institutions, FPOs, government agencies, and private stakeholders.

Reference

Aijaz, N., Lan, H., Raza, T., Yaqub, M., Iqbal, R. and Pathan, M.S. (2025). Artificial intelligence in agriculture: Advancing crop productivity and sustainability. Journal of Agriculture and Food Research, 20,101762.

Amit Vatsyayan, Prakash Jayaram, Amit Bajaj, Deepika Saini, Ekant Vijay, Soumyajeet S Biswas. (2024). Agri-tech adoption for climate-resilient agriculture in India. Assocham India https://www.assocham.org/uploads/files/Agri-tech%20climate-resilient.pdf

Birthal, P.S., Khan, M.T., Negi, D.S. and Agarwal, S. (2014). Impact of climate change on yields of major food crops in India: Implications for food security. Agricultural Economics Research Review, 27(2),145-155.

Chen, X., 2025. The role of modern agricultural technologies in improving agricultural productivity and land use efficiency. Frontiers in Plant Science, 16,1675657.

Oishy, M.N., Shemonty, N.A., Fatema, S.I., Mahbub, S., Mim, E.L., Raisa, M.B.H. and Anik, A.H., 2025. Unravelling the effects of climate change on the soil-plant-atmosphere interactions: A critical review. Soil & Environmental Health, 3(1), p.100130.

Swami, D., Dave, P. and Parthasarathy, D., 2018. Agricultural susceptibility to monsoon variability: A district level analysis of Maharashtra, India. Science of the Total Environment, 619,559-577.

www.startupindia.gov.in: https://www.startupindia.gov.in/content/sih/en/bloglist/blogs/how-are-agritech-startups-revolutionising-farming-practices-in-india.html