Current Agriculture Trends: *e-Newsletter*

Catalyzing Agricultural Progress: Government Policies for Mechanization and Innovation

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INTRODUCTION

Agriculture remains the backbone of many economies, especially in developing countries like India, where more than 50% of the population depends on it for livelihood. Due to climate change, depleting resources and the growing need for food security, mechanization and technological advancement in agriculture is not only desirable – but also imperative. Recognizing this, governments around the world have taken several initiatives aimed at promoting the use of mechanization, modern agricultural techniques and smart technologies in agriculture.

India vs other developing nations
Farm mechanisation level (in %)

India: 47 China: 59.5 Brazil: 75
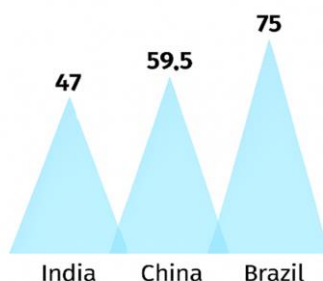
Advantages
- Saves 15-20% on seeds and fertilizers
- Improves seed germination by 7-25%
- Reduces time spent by 20-30%
- Cuts weed levels by 20-40%
- Lowers labour requirement by 20-30%
- Increases the number of crops grown per year by 5-20%

Fig.1 Farm Mechanization Level in % (*Source: Vinayak, 2024*)

Mechanization is important because mechanization involves the use of agricultural machinery and equipment to increase the productivity and efficiency of agricultural operations. Farm mechanization level and their advantages are shown in Fig.1, which helps in the understanding and need of advancement in the fields. The average farm power availability in India is 2.5 kW per hectare, with significant disparities among states among which Punjab has a high availability of 6 kW/ha, whereas Mizoram has only 0.7 kW/ha (Sundaram, 2023). Modern machinery also enables precision farming, reduces post-harvest losses and supports sustainable practices. It helps reduce fatigue, save time and increase crop yields.

The emerging technologies such as drones, Agri-bots, variable rate technology (VRT), artificial intelligence (AI), machine learning (ML), deep learning (DL), global positioning system (GPS), geographic information system (GIS), remote sensing (RS) and block chain technology, as shown in Fig. 2, boosts mechanization and advancement in agricultural fields.

Machine learning and deep learning, two subsets of artificial intelligence, have numerous applications in agriculture, transforming the way we cultivate crops, manage farms and care live stokes. Deep learning provides agricultural machinery the ability to "see" and "understand" their surroundings through computer vision (Pandey *et al.*, 2025).
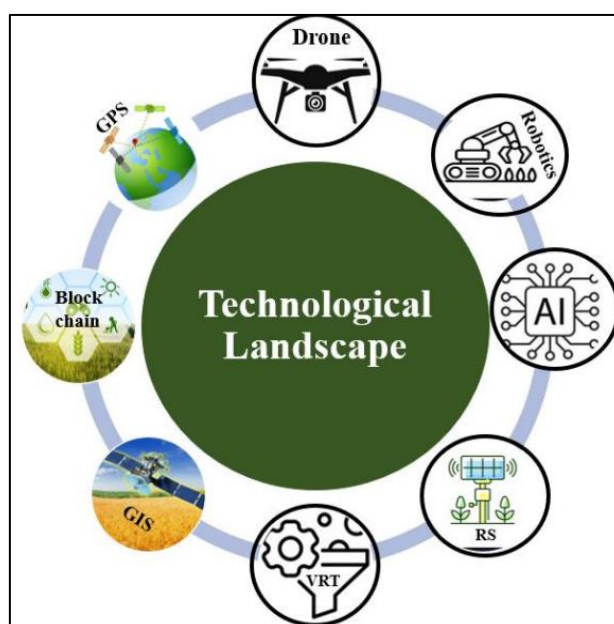

Fig.2 Emerging technologies in agriculture (Source: Pandey *et al*., 2025**)**

Government Initiatives to Boost Mechanization and Advancement in Agricultural

Government initiatives to enhance agricultural mechanization have increasingly focused on promoting advanced technologies to improve productivity and sustainability. These efforts include subsidies for farm machinery, the creation of custom hiring centers, and the integration of ICT tools in farming practices. By fostering public-private partnerships and supporting research-driven innovation, such programs aim to transition agriculture from labor-intensive to technology-driven systems, especially benefiting smallholder farmers (Sharma, 2024). Few of the government initiatives are discussed here:

❖ **Sub-Mission on Agricultural Mechanization (SMAM):** Launched in 2014-15, SMAM is one of the flagship schemes aimed at increasing and ease the reach of farm mechanization to small and marginal farmers. Under this initiative, the government provides financial assistance to farmers and cooperatives for purchasing machinery such as tractors, power tillers, harvesters, and other tools.

❖ **Custom Hiring Centers (CHCs):** To make expensive machinery accessible to small farmers, the government promotes the establishment of CHCs where farmers can rent equipment at subsidized rates. These centers are often set up at the village level and help bridge the gap between affordability and approachability. From 2014-15 to 2020-21, a total of 27,828 CHCs were established, with 9,432 added in 2020-21 alone by CHCs. Farmers receive up to 60% subsidy, 30%

loan assistance, and contribute only 10% of the total cost (DARE, 2023).

❖ **Agri-Start-up and Innovation Support:** Through initiatives like the Rashtriya Krishi Vikas Yojana (RKVY) and Agri-Clinics and Agri-Business Centers (ACABC), the government supports start-ups working on innovative agricultural solutions. These include AI-based crop monitoring, IoT-enabled irrigation systems, and app-based farm management tools.

❖ **PM-KUSUM Scheme:** The Pradhan Mantri Kisan Urja Suraksha evam Utthan Mahabhiyan (PM-KUSUM) promotes the use of solar energy in agriculture. It supports the installation of solar pumps and grid-connected renewable power plants, reducing farmers' dependence on diesel and electricity. Target was the installation of 30.8 GW of solar capacity by 2022, including 1.75 million standalone solar pumps and solarization of 1 million grid-connected pumps.

❖ **Namo Drone Didi Scheme:** The scheme was launched in March 2024 and aims to provide drones to 15,000 selected women SHGs for offering rental services to farmers. The implementation period spans from 2023-24 to 2025-26. Rs 500 crore has been earmarked for this initiative under the Union budget 2024-25. Drones will enhance farming efficiency through precision agriculture, leading to better crop management and yield optimisation (MoAFW, 2024).

New Policy Initiatives in Agriculture Sector
Government of India supports the efforts through appropriate policy measures and budgetary allocation under various schemes/ programmes. For faster and wider development of agriculture in the country, in the new Government the Union Cabinet has approved following programmes:

❖ **Clean plant programme:** the union cabinet, approved the clean plant programme (CPP) on 09.08.2024 with outlay of Rs. 1765.67 crore. The CPP aims to enhance the quality and productivity of horticulture crops by providing disease free planting material and will benefit dissemination and adoption of climate resilient varieties, with yield enhancement.

❖ **Digital Agriculture Mission:** The union cabinet approved the digital agriculture mission on 2.9.2024 with an outlay of Rs. 2817 crore, including the central share of Rs. 1940 crore. The mission is conceived as an umbrella scheme to support digital agriculture initiatives, such as creating digital public infrastructure, implementing the digital general crop estimation survey (DGCES), and taking up other its initiatives by the central government, state governments, and academic and research institutions.

❖ **National Mission on Edible Oils – Oilseeds (NMEO-oilseeds):** The union cabinet approved the national mission on edible oils – oilseeds (NMEO-oilseeds) on 3.10.2024 with total outlay of Rs.10,103 crore. It aims to boost domestic oilseed production and achieving self-reliance in edible oils. The mission will be implemented over a seven-year period, from 2024-25 to 2030-31.

❖ **National Mission on Natural Farming:** The union cabinet approved the national mission on natural farming (NMNF) on 25.11.2024 as a standalone centrally sponsored scheme. the scheme has a total outlay of 2481 crore (Government of India share – 1584 crore; state share – 897 crore) (MoAFW, 2024).

Pathways to Enhanced Farm Mechanization in India
To achieve 75–80% farm mechanization in India, further strategic measures are required, such as expanding access to modern machinery, increasing subsidies, and establishing more custom hiring centers (Gulati and Das, 2025). Additionally, fostering public-private

partnerships and enhancing farmer training programs will be crucial in bridging the current gaps.

- Offering subsidies or financial incentives for purchasing agricultural machinery.
- Encouraging research and development for locally relevant machinery is essential. 'Make in India' initiatives should focus on creating equipment suited to Indian soil conditions, crop types and farm sizes.
- Precision Farming Technologies such as GPS-guided tractors, drones, and sensor-based systems.

Infrastructure development:
- Improved rural infrastructure ensures smooth transportation of machinery to farms.
- Reliable electricity supply is critical for running electric-powered machinery.
- Promoting solar-powered solutions can address energy challenges.

Collaboration with private sector:
- Collaborating with private companies, especially farm equipment manufacturers, can accelerate innovation and technology adoption.
- Mahindra & Mahindra emphasises the importance of automation technologies, including self-driven tractors, can reduce manual interventions, enhance productivity, and minimise costs for farmers.

Policy reforms:
- Ensuring import restrictions on low-quality machinery while promoting domestic manufacturing.
- Tax breaks and grants for companies investing in R&D for farm equipment.

Promotion of agri-entrepreneurship:
- Encouraging youth to venture into Agri-mechanisation services can create a network of service providers.
- Establishing institutes that train technicians in farm machinery repair and maintenance.

Monitoring and evaluation:
- Regularly evaluating the impact of mechanisation programs helps identify gaps and refine strategies.
- Using data analytics to understand adoption rates, challenges, and success stories.

Impact and Challenges

These initiatives have had a measurable impact and support in the filed of agricultural techniques which increased availability of mechanized tools which boosted productivity in many regions. Smart farming solutions are helping to improve crop quality and reduce resource wastage. However, challenges are also there which includes:

- High initial costs of advanced machinery
- Training among farmers and Lack of awareness

To ensure the success of these initiatives, the government and private sector must work together to:

- Increase farmer education and training programs
- Invest in rural digital and physical infrastructure

CONCLUSION

Mechanization and technological advancement are pivotal to the transformation of agriculture into a modern, efficient, and sustainable sector. The government's steps in promoting these aspects reflect a forward-looking approach to farming that not only improves livelihoods but also ensures food security for future generations.

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