

Strategies for future pathway to farm mechanization in India

S.C. Vijayashree, Dr. A. Saravanadurai

Research Scholar, Department of Economics, Periyar University, Salem-636011

Professor, Department of Economics, Periyar University, Salem-636011

Abstract- Mechanization is crucial in the context of the growing commercialization of agriculture. The application of farm machineries is increasing continuously in Indian Agriculture as it contributed to the increase in productivity due to timeliness of operations and increased precision in input application. When compared to industrialized economies, where farm mechanization has exceeded 90%, India's farm mechanization level is still between 40 and 45%. The adoption of farm mechanization among the Indian farming community is highly imperative and need of the hour for continuing and sustainable development. The adoption of mechanized solutions in Indian agriculture is being driven by a number of macroeconomic and inherent factors, including the growing population, urbanization, surge in Agri exports like tractors, improved flow of agricultural credit, labor migration, and shortages, in addition to the agricultural, social, and economic growth drivers of mechanization. In the contemporary scenario, farm mechanization start-ups, especially those built on the farming as a service (FAAS) model, are rapidly integrating technology with an emphasis on precision agriculture in India. In order to increase the effectiveness of their equipment and obtain a competitive advantage, the majority of agriculture equipment manufacturers are currently concentrating on integrating various technologies, such as robotics, Global Positioning System (GPS), and navigation systems.

1. INTRODUCTION

Agriculture has evolved over the past few decades into a very diversified and complicated sector globally, with operating units ranging from small, subsistence-based farm holdings to massive large farm holdings. The importance of the agriculture industry to the Indian economy cannot be overstated. Malnutrition and food insecurity have been major global problems brought on by the growing population, particularly in developing economies. By 2050, the world's

population is anticipated to be close to 10 billion people at the current and expected growth rates (FAO, 2017). Despite the fact that technological developments and investments in agriculture have significantly increased productivity levels, the growth in yields has not been sufficient to meet these new challenges and future demands. The utilisation of animal and human power for farm operations has significantly come down in Indian agriculture. The Green Revolution led to spectacular successes like self-sufficiency, but despite these successes, the expanding population and associated challenges highlight the need for a sustained increase in per-unit production from an existing piece of farmland (Ranguwal and Sachdeva, 2022). Therefore, hastening the growth of agriculture production is must to meet the growing demand for food alongside of increasing the incomes of farmers to ensure inclusiveness. Increasing mechanization of farming operations is one of the viable options to meet this ever-increasing demand from agriculture and was pursued by government as well as farmers. Farm mechanisation is using machinery and technology to increase output, productivity, and profitability. The availability and wise application of farm power by farmers affects farms' production significantly. By facilitating timely farm operations, better input management, increased work quality, and a decrease in post-harvest losses, agricultural machines maximise the productivity of land and labour. Farm mechanisation is a catalyst for increased production and productivity in agriculture by transforming many subsistence farmers who worked on small holdings with animal and human power into vibrant commercial farmers using mechanised sources of farm power. Mechanization not only makes a significant contribution to multiple cropping and agricultural diversification, but it also makes it possible to use inputs like seeds, fertiliser, and

irrigation water efficiently (Singh and Sahni, 2019). 2. Status of Farm Mechanisation in India India's farm mechanisation is still quite low, with a mechanisation level between 40 and 45%, when compared to industrialised economies, where mechanisation has reached beyond 90%. Also, there is differences in quality of mechanization especially in terms of use of ICT integration, use of greener technologies etc. In addition to ensuring the best possible use of resources like land, labour, and water, farm mechanisation also saves farmers time and lessens drudgery. According to the Economic Survey, there is a direct link between farm mechanisation and crop productivity since farm mechanisation increases crop output and farm income while saving time and labour, reducing drudgery, lowering production costs over the long term, and reducing post-harvest losses (Gurung et al., 2017). The use of upgraded farm machinery has the potential to boost production by up to 30 per cent and cut cultivation costs by up to 20 per cent. Compared to former years, Indian farmers are currently adopting farm mechanisation at a quicker rate. Tractor sales in India are not the only indicator of farm mechanisation, but they do provide a good indication of the degree of mechanisation. India now has the largest tractor industry in the world, producing nearly one-third of all tractors produced worldwide. One of the top ten engineering achievements of the 20th century was the farm mechanisation. Farm mechanisation has earned positive attention from people all around the world as one of the key components of modernising agriculture. The degree and proper selection of farm mechanisation directly improve labour and land productivity, the effective use of agricultural inputs, farm income, and the standard of living of farmers.

2. DRIVERS OF FARM MECHANISATION IN INDIA

India as a whole has seen an increase in agriculture consumption and a decline in the use of animate power. Farm mechanisation is a crucial technological development to achieve the needed productivity boost. The major driving factors to promote farm mechanisation in India are discussed below. These driving factors can be classified into three segments: social, agricultural and economic factors. Other factors contributing to farm mechanisation in India include a decrease in labour availability owing to

migration and a rise in the number of women working in the fields.

A. Social Driving Factors

1. Increased participation of women: — In particular in poorer states, the migration of males seeking improved prospects in non-farm opportunities has made farming a woman's burden. Mechanization is required for routine, physically challenging tasks like weeding, which are more difficult for women to complete.

2. Drudgery of farm activities: Farm operations should be mechanised to alleviate the drudgery on farm and excite labourers in the field. Farm operations must be completed on time, and there is a limited window of time in which to do these tasks. Work-intensive tasks like paddy transplanting, dribbling, and harvesting are also physically challenging. This work is done by female labourers all over the nation, and there is a great need and opportunity for reducing drudgery.

3. Status issues: The manual handling of operations causes the succeeding generations of a farming family to occasionally give up farming. — Farm mechanisation can be a strategy to halt this crucial "hand drain" from the agricultural sector to the non-agricultural sector.

B. Agricultural and Agronomic Driving Factors

i. Increasing Cropping Intensity: Increased cropping intensity results in more crops being grown in a given field, increasing yields per acre. Because of this, there is less time between two crops, making timely completion of agricultural operations more crucial.

ii. Increasing farm production: States and countries with higher agricultural mechanisation have been found to have higher crop yields.

III. Enabling contract farming — The use of equipment and machinery on the fields is increasing as more corporations participate in farming through contract farming agreements.

IV. Contingency Farming: Farmers are prone to extreme weather and climatic aberrations; in this situation, farm mechanization aids farmers in reducing climate risk by completing farming operations in a brief period of time or during a appropriate window.

C. Economic Driving Factors

i. Cost and Time Efficiency: Without a doubt, mechanising farm operations saves time and money, increasing the profitability of farming.

ii. Service/manufacturing sector growth:

Due to rising pay and a greater need for labour in the secondary and tertiary sectors, there has been a major shift in workers from farm to non-farm activities.

Over time, the proportion of agricultural labour in India's workforce has decreased, and this tendency is projected to continue in the near future. This naturally creates a need for automation. In addition to the agricultural, social, and economic imperatives, other macroeconomic and internal factors make the use of mechanised solutions in Indian agriculture essential for long-term and sustainable growth.

The majority of Indian agricultural and agro-climatic patterns may be explained by these parameters. These below-listed growth drivers are some of them.

- Population and demand growth
- Increase in food grain productivity
- Urbanization Upsurge in Agri exports
- An increase in institutional lending to agriculture and related industries
- A rise in labor migration and a lack of workers

3. MECHANISATION THE FUTURE OF AGRICULTURE

In addition to the aforementioned national driving indicators, a strong focus on technological integration in agricultural mechanisation would expand the sector's growth opportunities. In the Indian context, these technological advancements have been referred to as Mechanisation 2.0, and the same has been covered below.

Agriculture will soon experience the same technological innovation that is currently thriving in India's key economic sectors. Technology developments in the form of technical farming knowledge, soil condition assessment, weather forecasting, yield forecasting, and any other activity resulting in yield enhancement would be very beneficial to the agricultural industry. 'AgriTech start-ups' are commonly used to refer to businesses that provide such technical interventions or supporting technology solutions in agriculture and related industries.

India is one of the top six nations in the world for the volume of agricultural technology transactions. According to leading industrial research, India is home to one out of every nine AgriTech start-ups worldwide.

India presently houses more than 450 start-ups in the aggrotech industry, growing at a rate of 25% each year (NASSCOM, 2019).

With the expansion in emphasis and scope of technology integrations in the farm mechanization sector, four specific areas of Aggrotech themes applicable to the Farm Mechanization sector have been identified. The next phase of evolution in farm mechanization and the nation's entire agriculture sector will be driven by the advancement of technologies in these categories (FICCI, 2019). The four identified categories are

1. Farming as a Service (FAAS)
2. Big data-based mechanization technologies
3. Internet of Things (IoT) mechanization technologies
4. Artificial intelligence (AI) mechanization technologies Collectively,

1. Role of Mechanisation 2.0 in developing Farming as a Service (FAAS)

One important category among agriculture start-ups in India is Farming as a Service (FAAS). FAAS start-ups establish particular farming techniques that offer technologically innovative services, such as renting farm equipment. FAAS seeks to offer technologically advanced and affordable farm machinery for effective and efficient farming. By transforming fixed costs into variable costs, start-ups in the FAAS category aim to provide small and marginal farmers with more economical farming techniques.

FAAS frequently functions through the development of an app-based farmer-to-farmer aggregation platform in order to bridge the demand and supply gap of machinery or equipment requirements. Tractor and farming equipment owners can connect with customers using this platform. By addressing the demand and supply issues for both tractor owners and people in need of services, this distinctive strategy boosts farmers' revenue on both sides. A true win-win situation is one in which neither party needs to invest in new implements, saving money, while the owner of the present tractor or machine increases the equipment's economic realisation, increasing income.

1. Mechanisation 2.0 around big data

Big data capturing in the agricultural sector entails gathering specific information from various sources, such as rainfall, fertiliser requirements, soil moisture, market prices, selling locations, etc., and using the information to support farmers in making informed decisions that can lead to problem-solving and

lucrative returns. For instance, a farmer can make an informed decision about which crop to plant and when, how much land to plant it on, when to harvest it, and which market would be best for selling the produce by using historical data on crop yields, input needs, soil nutrient status, current weather patterns, available farm equipment, market linkage options, and current and forecasted prices.

2. Mechanisation 2.0 around Internet of Things (IoT)

The Internet of Things (IoT) is a collection of interconnected IT-related technologies, including remote sensing, drones, GPS, sensors, automated hardware, and robotics. The yield improves when IoT-based smart agriculture is used in farming operations. India places a lot of attention on precision agriculture. Thus, the majority of equipment manufacturers are making sure to incorporate the aforementioned technologies to increase the efficiency of their products and get a competitive edge in the market.

4. Mechanisation 2.0 around Artificial Intelligence (AI)

The goal of Artificial Intelligence (AI) is to create machines and computers that can behave or respond intelligently like people. Algorithms that have been designed using extensive knowledge, historical data, and current data can therefore aid with precision or intelligent farming techniques on the farm. AI may be used to automate a variety of farming tasks, such as weeding, spraying, and harvesting, increasing productivity and accuracy. The application of AI in agriculture is still in its early stages, but it is gaining speed due to demands for increased production at lower costs.

4. STRATEGIES FOR FUTURE PATHWAY TO FARM MECHANIZATION IN INDIA

- Development of individual farm equipment for small and marginal farmers at the affordable prices
- Ease of financing to purchase or to establish Custom Hiring Centres (CHCs) at the grassroots. There should be a significant rise in the number of custom hiring centres, particularly in areas with small and marginal land holdings.
- Farm machinery quality must be guaranteed as it increases farmer confidence and adoption of farm mechanisation. Advanced and modern farm

machinery should be demonstrated by farm machinery manufacturers.

- Enhanced support for Research and Development (R&D) services, testing and standardization, human resource development in support of farm mechanization. Manufacturing facilities should be developed especially in areas with low level of farm mechanization by providing incentives to manufacturers establishing such facilities in these areas (Tiwari et al., 2019).
- As the proportion of women working in agriculture rises steadily, efforts should be made to develop equipment that is genderneutral.
- Cooperative farming should be encouraged in regions with modest holding sizes in order to offer farmers affordable mechanization alternatives. It is desirable to pursue skill development in the area of farm machinery operation, maintenance, and repair.

5. CONCLUSION

The progress of farm mechanization in India is hindered by some of the attributes of Indian agriculture such as fragmented land holdings, huge number of small and marginal farmers, unavailability of advanced farm technology and the practice of subsistence agriculture. Agriculture mechanization is essential for modernizing and commercializing the sector since it boosts efficiency and productivity in agricultural operations, supports value addition, lowers cultivation costs, and facilitates adaptation to climate change. In India, agricultural mechanization is anticipated to expand quickly in light of national driving factors in relation to global driving forces. Therefore, there is no question that mechanization needs to be improved in order to increase agricultural productivity and stabilize the economy. In light of the existing demand, modern agricultural machinery has enabled farmers to finish seed-to-seed tasks as quickly as possible and even free up equipment for special-order hiring by neighbours. A strong focus on integrating science and technology into farm mechanisation would open up new avenues for opportunity and accelerate the development of agricultural mechanisation toward Mechanisation 2.0, which combines automation with the farm mechanisation.

REFERENCE

- [1] FAO. (2017). The future of food and agriculture – Trends and challenges (p. 163). FAO. <https://www.fao.org/3/i6583e/i6583e.pdf>
- [2] FICCI. (2019). Farm mechanisation: Ensuring a sustainable rise in farm productivity and income (p. 53). PwC. https://ficci.in/spdocument/23154/Online_Farmmechanization-ficci.pdf
- [3] Final Report on Monitoring, Concurrent Evaluation and Impact Assessment of Sub-Mission on Agricultural Mechanization. (2018). farmech.dac.gov.in. Retrieved October 26, 2022, from <https://farmech.dac.gov.in/SMAM/Evaluation%20Report%20SMAM/Final%20Report%20M&E%20SMAM%20.pdf>
- [4] Gurung, T.R., Kabir, W., & Bokhtiar, S.M. (2017). Mechanization for Sustainable Agricultural Intensification in SAARC Region. In SAARC Agriculture Centre, Dhaka, Bangladesh (p. 302). SAARC Agriculture Centre (SAC). <http://www.sac.org.bd/archives/publications/Mechanization%20for%20Sustainable%20%20Agricultural%20Intensification.pdf>
- [5] Ranguwal, S. & Sachdeva, J. (2022). Status and Utilisation Pattern of Farm Tractors in Punjab. *Agricultural Situation in India*, 78(11), 11-20. Singh, R.S. & Sahni, R.K. (2019). Transformation of Indian Agriculture through Mechanization. *Economic Affairs*, 64(2), 297-303.
- [6] Tiwari, P.S., Singh, K.K., Sahni, R.K., & Kumar, V. (2019). Farm mechanization – trends and policy for its promotion in India. *Indian Journal of Agricultural Sciences*, 89(10), 1555-1562.