

Farm Mechanization in India and Perspectives -A Review Paper

Priyanka T. Yedk

Research Scholar

School of Commerce and Management Sciences, SRTM University, Nanded

Abstract: *Farm mechanisation refers to the enhanced farming technique requiring the least amount of time and resources. The agriculture industry has undergone numerous changes in the recent century. Tractors and other tractor-driven equipment have transformed farming techniques (Mechanical). However, crucial inputs that have been produced to boost output and productivity include seeds, fertilisers, and pesticides. Rising population, increased food demand, underdeveloped rural areas, and the pitiful socioeconomic situation of Indian farmers have been the country's agriculture sector's inescapable truths since Independence. Few states have emerged as the agricultural model state as a result of the growth of mechanisation in agriculture (Since Green revolution). Therefore, the purpose of this essay is to examine farm mechanisation in India from the perspectives of the past, present, and future. The paper's four main themes—Government initiatives for agricultural mechanisation, the impact of mechanical sources thus far, the impact of chemical catalysts, and the final future of farm mechanization—have all been widely supported by prior literature.*

Keywords: Farm Mechanization, Agricultural mechanization

I. INTRODUCTION

Agriculture in India is still developing slowly in the twenty-first century. Many states fall under this category, with the exception of a few, including Punjab, Haryana, and Karnataka, which have the highest rate of agriculture mechanisation adoption when compared to other Indian states. This essay tries to examine India's agriculture mechanisation history since independence. The two categories of farm mechanisation are separated. Utilizing machinery and high-tech mechanical tools in farming operations is the first step (Machine mechanization).

The use of High Yield Variety seeds, synthetic fertilisers, and pesticides is a second (Chemical mechanization). With the invention of the tractor in the 20th century, agricultural modernization had begun. Since then, numerous innovations in tractor-driven equipment have taken place, including the Rotavator, disc harrow, cultivator, and others. Chemical fertilisers and insecticides have since been proposed by agricultural scientists and experts for increased production.

Karl Marx and his supporters thought that increasingly mechanised farming practises would result in economies of scale similar to those found in manufacturing (Binswanger and Rosenzweig 1986). Thus, the goal of this review study is to emphasise the overall growth of farm mechanisation. To analyse the mechanisation of agriculture and its effects on output and productivity, the paper is divided into three themes.

- Various initiatives by Government for Farm Mechanization
- Impact of Farm mechanization – The mechanical way
- Future of farm mechanization

Since independence, the government's socialist approach to agriculture has been the driving force behind all plans and initiatives. However, the philosophy underlying the method was also changed to make agriculture and related activity more marketable after the 1980s, when India left Nehru's socialist era. Compared to the period before independence, agricultural progress has been impressive. In the last 50 years leading up to Independence, the growth rate was 1% annually; from 1951 to 2007, it averaged 2.57 % annually.

Let's go through each of these key points one at a time. Since Independence, we will outline the government's main agricultural development policies in this section. In order to discuss the plans made during this time, we further divided it into four phases: a) 1947 to the mid-1960s; b) 1960 to 1990; c) 1991 to 2014; and d) 2014 and beyond.

1.1 1947-mid 60's (Newborn India)

Prior to its independence, India had the greatest cropped acreage in the world, but after the partition, that area shrank by over a third. The net area that was irrigated in the 1950s was 20.9 million ha (gross irrigated area 22.6 million ha). In the first forty years of independence, the nation has invested over Rs. 45,000 crores in the construction of irrigation. Through government channels, irrigation was expanded from 7.2 million ha to 9.8 million ha between 1950–51 and 1965–66, representing an annual growth rate of 2.1 percent. Instead, PL 480 was the food aid provided by the USA in response to the serious food scarcity that existed in Independent India. Around 5% of the total amount of food grains accessible in the nation in the 1950s came from imports. When two severe droughts struck the nation in the 1960s, the situation got much worse because there was a rapid increase in the demand for food grains. As a result, imports climbed by over 7% of the total amount of food grains available. The zamindari system was abolished during this period, one of several institutional and structural changes in agriculture.

Despite the fact that it took the country almost 20 years to completely abolish this system, is land reform better or worse for global agricultural production? Benefits result from replacing inefficient large farms with effective small farms, but losses result from underperforming smaller farms.

Theoretical research by Binswanger and Rosenzweig from 1986 found that huge farms utilise their resources inefficiently. Large farms are less productive mostly because the owner utilises more hired labour and less family labour, which is less expensive than hired labour and also bears the risk of unpredictability.

Two things happened as a result of the land ceiling and land redistribution: on the one side, many former tenants now cultivate, and on the other, zamindars became substantial farmers and received excellent compensation for land settlement. Parameswari Bala (2016). According to C. H. Hanumantha Rao, small and medium farm owners supply considerably more job chances than large farmers because they have started to work hard on their fields.

During the 1970s, the influence and benefit of land distribution on the economic development of the impoverished class and an overall rise in production and employment were quickly apparent. This change gave many previously landless growers access to a tiny plot of land. This was a significant step toward lowering inequality.

India continued to rely on the rest of the globe to feed its growing population despite all of these efforts.

1.2 Mid 60's to Pre-Reform Period (Green Revolution and Parallel Changes)

In India, the Kharif crop marked the beginning of the New Agricultural Strategy. The years from the mid-1960s and the 1980s can be considered the second phase of Indian agriculture. During this time, the Green Revolution plan, a new agricultural approach, was effectively put into practise. A "New agricultural strategy" known as the Intensive Agriculture District Programme was launched as a pilot project in seven districts in the middle of World War II (IADP). In general, this programme is linked to HYVs, but ignoring the importance of chemical fertiliser would be unfair. IADP wanted to start looking into how HYV may increase productivity. Formerly known as the Imperial Council of Research, the Indian Council of Agricultural Research (ICAR) was reestablished in 1965. (16 July 1929). It is currently one of the largest national agricultural systems in the world with 101 ICAR Institutes and 71 Agricultural Universities. Through its study and development throughout the Green Revolution, this research facility evolved into the foundation for all later advancements in farming techniques. Since 1951, as a result of these studies, production of food grains has increased by 5.4 times, that of horticulture crops by 10.1 times, that of fish by 15.2 times, that of milk by 9.7 times, and that of eggs by 48.1 times. The creation of the fundamental infrastructure was required during the green revolution wave. In order to do this, the Command Area Development Programme was established in the fifth five-year plan (1974–1975), which also saw the start of the irrigation project for various agricultural sizes. Diversification from food grains to non-food grains, such as poultry, fisheries, vegetables, and fruits, rose in the late 1980s, which accelerated the GDP from agriculture between 1980 and 1990. 137.10 million ha (1985–1986) and 138.61 million ha (1990–1991) of land were planted in principal food crops, while 34.53 million ha (1985–1986) and 40.68 million ha were planted in non-food crops (1990-91).

A new era for Indian agriculture began with the establishment of the National Bank for Agriculture and Rural Development (NABARD) on the Shivaraman Committee's suggestion on July 12, 1982. The entity in charge of recommending the minimum support price based on the variable input price index is the Agricultural Price Commission 1965, now known as the CACP (Commission for Agricultural Costs and Prices). The output and productivity of

agricultural products were significantly impacted by the institutional and infrastructure changes that occurred between 1980 and 1990.

1.3 1991-2014 (Post Reform period)

The 1991 economic reform had a big impact on agriculture since it led to the emergence of many small-scale enterprises that were either directly or indirectly dependent on agriculture. Farmers now have access to a wider variety of markets. During this time, there was a boom in both exports of agricultural products and trade with the rest of the globe. Due to the new international trade agreement created in 1995 with the creation of the WTO, the domestic market became accessible to the rest of the globe. Local farmers and traders suddenly faced competition from the global market. The New Agricultural Policy of July 2000 resulted from this new challenge for policymakers. Private sector investment was promoted by this policy. Contract farming and land leasing were also well-liked strategies to draw in private players. Another factor in this regard was the legalisation of the transnational movement of agricultural goods. Examining the excise levy on agricultural equipment and chemical inputs. Later in the twenty-first century, rural electrification proceeded more quickly. All of these modifications affected the overall production and yield, either directly or indirectly.

1.4 2014- onwards (The Dream of New India)

Since independence, total production has grown by more than five times in this era. The total output of food grains increased more than five times from 51 million tonnes in 1950–1951 to 284 million tonnes in 2017–18, according to the fourth advance estimates of production of food grains for 2017–18.

However, there is still a long way to go because more than 50% of the workforce in India is employed in agriculture. It is extremely likely that such a share will have a favourable impact on India's level of income inequality. The country underwent numerous institutional changes after 2014, and the policies and methods used by these institutions were also modified. The 12th FYP was abandoned with the creation of NITI Aayog in the stead of the Planning Commission (2012-17).

In response to the Taskforce on Agricultural Development's suggestion, the Aayog unveiled a new three-year action plan. The action plan primarily concentrated on four areas:

- a) Remunerative prices by reforming APMC under eNAM (electronic National agricultural market), where small farmers can sell their produce in competitive market places.
- b) Boosting Productivity, by switching to high-value farm products; using the new farming technique for irrigation, Pradhan Mantra. For the purpose of providing loans, encouraging the private sector to produce and distribute seeds,
- c) resolving the question of land ownership, and d) providing disaster relief, the Krishi Sinchayi Yojna (PMKSY) was launched.

The government has been offering farm machinery subsidies up to 40% of machine cost in the sector of mechanisation. Karnataka, a state, set up 700–800 custom hiring shops to provide machinery for rent at reasonable prices. The in-situ management of crop residue, which was used in the states of Punjab, Haryana, Uttar Pradesh, and the NCT of Delhi under the central aid scheme, was the other significant action done to promote agricultural mechanisation. Management of crop residue and stubble is essential for environmental preservation and, according to agricultural specialists, will boost output. In this programme, private enterprises, self-help organisations, registered farmer's societies, and custom hiring centres received 80% of the financial aid for custom hiring, while individual farmers received 50% of the financial aid for the purchase of machines for stubble management. The government awards village/Gram panchayats for having zero straw burning as a way to promote this custom.

II. IMPACT OF FARM MECHANIZATION- THE MECHANICAL WAY

Farming-related mechanical tools gained prominence in the previous century. One of the most important technological advancements in this area is the tractor. India needs to develop its economy quickly after gaining independence in order to become self-sufficient in food grains. The only method to boost productivity at the appropriate rate in a conventional farming setting was through mechanisation. Given this reality and numerous government initiatives, policymakers have since the 1950s concentrated cooperative organisations on farm mechanisation. Punjab has the highest rate of farm



mechanisation adoption in India and has the country's most advanced agricultural sector. Agriculture grew more mechanised and productive as a result of the necessity of the farmers for machinery (Gyanendra 2000). The goal of increasing productivity per unit time dominated the adoption of new technology during the 1990s, which resulted in a rise in dependence on power (energy input). Punjabi farmers, in particular, embraced mechanisation and began using tractors and related equipment heavily. The employment of HYVs and tractors for practical operations such as harvesting and ploughing was important. One of the fundamental agriculture techniques was the usage of tractors.

However, several research, including Sapre (1969) and Binswanger (1978), found that it causes worker displacement. Farmers, on the other hand, claimed lower costs for weeding, ploughing, and transportation thanks to tractors and other tools and machinery like power tillers, combine harvesters, etc.

Government aid is available for the purchase of machinery in these areas, which are at the forefront of farm mechanisation. The opponent asserted that the use of tractors would eliminate the labour force, while the protagonist asserts that the use of tractors would encourage the practise of intensive cropping and diversification, which would not only eliminate labour but also shift labour and serve to boost employment (Dixit and Bhardwaj 1990). The socioeconomic factor, which has two different types of ground reality, is the other justification for mechanisation. According to one of the socioeconomic issues, using labor-saving techniques will boost farm productivity and efficiency (Murali and Balakrishnan, 2012). The opposing viewpoint is that technology lessens the laborious work that farms' disproportionately burdened women must do (Kishtwaria, and Rana 2012).

Pre green revolution era (before 1965)	Green Revolution Era (1965 – 1975)	Post Green Revolution Era (1975 -1990)	Post-Economic reform period (1990 onwards)
Farming with traditional Methods	HYVs, fertilizer, irrigation, Chemical inputs	Use of more scientific methods/machinery/implement s/precision	Agricultural sub-sector growth was tremendous.
Farm power availability was about 0.27 kW/ha	Farm power availability was about 0.47 kW/ha	Farm power availability was about 0.48 kW/ha	Farm power availability was about 2.02 kW/ha
Share of animate power sources were 98 percent	The Share of animate power sources decreased to 62percent	Share of animate power sources decreased to 21.7percent	Share of animate power sources decreased to 11.8percent
Low productivity of food grain (0.58 t/ha)	The productivity of food grain increased (0.95 t/ha)	The productivity of food grain was about 1.184 t/ha	The productivity of food grain was about 2.11
Enhanced production through increase in cultivated area	Improved production/ productivity through adoption of HYVs, fertilizer, irrigation and chemical inputs	Improved production/ productivity through adoption of upgraded farm machines/implements/precision in addition to the adoption of other agricultural inputs	Liberalization, privatization, and globalization encouraged to export more, and it reflects in the increased productivity.

TABLE: Progress of mechanization and power consumption in India

Source: Surendra Singh (2014); I.P. Abrol (2002). Post economic reforms tabulated by the researcher.

One level of the value chain process could be used to categorise how farm power is used. 60% of non-mechanized and 40% of mechanised sources are employed to prepare the soil and seedbed. Using machines accounts for 29% of the seeding and planting process. Indian farms have adopted substantial amounts of modern equipment for harvesting and threshing purposes, despite the fact that irrigation consumes 37% and harvesting & threshing employs 65% of mechanisation. However, extra consideration must be given to mechanising irrigation, planting, and seeding. A number of factors contribute to the lower initial adoption rate, but affordability is the most crucial one. More than 80% of cultivators work for small and marginal farmers, or those who have less than 5 Ha of land. It is the cause of India's lower adoption rate compared to other nations.

Compared to 95 percent in the USA, 75 percent in Brazil, and 57 percent in China, farm mechanisation in India is between 40 and 45 percent. When compared to other countries, Brazil contributes 5% to GDP, the USA only

contributes approximately 1%, and India contributes about 14% to GDP. This figure shows that compared to many industrialised and developing countries, the agriculture sector in India is still labor-intensive. Therefore, there is still much work to be done in terms of agriculture mechanisation, especially in Asian nations like India.

III. FUTURE OF FARM MECHANIZATION IN INDIA

The discrepancy in productivity can be attributed to large farmers' early adoption and practical acceptance of farm mechanisation as a response to growing labour costs (Foster and Rosenzweig, 2010). Today, the size of the farm is important and directly relates to mechanisation. In India, the majority of farms are small. Small and marginal farmers make up 83.3 percent of the agricultural sector in India. According to the 2018 Agricultural Census, India has over 145 million agricultural holdings in the years 2015–16. There were about 125 million marginal and small farmers. Between 1970 and 1971, the average size was 2.3 ha; between 2015 and 2016, it was 1.41 ha. As a result, India had huge land inequities that are still present today. Therefore, it is preferable to use it as a strength. Therefore, marginal and small farmers would be primarily responsible for India's future sustainable agricultural growth. Small farms have been identified as having a role in development and the eradication of poverty in one of Lipton's research from 2006. According to the global experience with growth and poverty reduction, GDP growth that originates in agriculture is at least twice as successful at decreasing poverty as GDP growth that originates from sources other than agriculture (WDR, 2008). Small holdings are crucial to improving agricultural growth and reducing poverty. Finding the barriers to agricultural mechanisation adoption, particularly for small and marginal farmers, should be the first step. Some of these include the size of the land, the affordability of mechanisation, the lack of access to the credit market, and the unavailability of machinery and equipment with limited capacity.

With the population growing and the amount of available land decreasing, it is obvious that increased production and productivity are necessary. Additionally, it has been noted that there are a shortages of agricultural workers during the agricultural industry's busiest season (due to migration of labourers to the urban area). This viewpoint makes adopting machines—which replace workers and need comparatively less time for work—extremely significant. However, it is also clear that owning such technology comes at a high expense. As a result, India has very low adoption rates. In general, the majority of farmers that operate automated farms employ harvesters and threshers for harvesting as well as tractors and tractor-driven equipment for preparing seedbeds. More workers and labour hours are still required for the remaining task. Only a small portion of this industry has recently seen the Jugaad Technique, an indigenous farming method. In this method, the farmers design the equipment with the assistance of a local mechanic, taking into account their needs and budget. Even still, these methods are not widely used because they were developed for specific geographical and agro-climatic conditions. However, for a developing agricultural region like Uttar Pradesh, Bihar, Jharkhand, Bengal, etc., additional modification of these machines is required. For these methods to be beneficial to the entire farming community, both the public and private sectors must work together.

The use of chemical fertilisers, insecticides, and HYV seeds, which became popular during the green revolution, is the other aspect of farm mechanisation. The primary factors behind that era's rapid acceptance of chemical treatments were their affordability (farmers bought according to their needs or budget) and their ability to provide results quickly within a single growing season.

In the 1990s, usage skyrocketed, and farmers continue to use it now as needed. However, a broad observation shows that the use of fertilisers necessitates more water for irrigation and that soil quality is declining annually. According to the DFI study from 2018, drip irrigation and sprinkler irrigation techniques fall under the category of irrigation management for micro irrigation. It demonstrates a large discrepancy between the actual area covered by this kind of irrigation and the prospective area. The potential area is 42.24 MN ha, of which only 7.73 MN ha are covered by micro irrigation. Due to a projected shortage of water supplies, it is important that the gap be filled. Therefore, increasing sustainable productivity will be a future goal of farm mechanisation in addition to increasing production and productivity. The future of the agriculture industry lies in research and development. It should be obvious from the fact that just 10242 agricultural scientists (full-time equivalents) are employed in a system that spends 3533 MN dollars (PPP), or just 0.4% of the agro-GDP (Termed as Research intensity).

Increased farm mechanisation will certainly result from this research's focus on sustainable development. Future studies on the viability of chemical mechanisation are therefore required. Finding appropriate strategies to raise the amount of machine mechanisation in farming is also necessary along with it.

REFERENCES

- [1]. Bala Parameswari, B. (2016). Abolition of Zamindari System and its Impact on Agriculture. *Imperial Journal of Interdisciplinary Research*, 2(4), 9-14.
- [2]. Binswanger, H. (1986). Agricultural mechanization: a comparative historical perspective. *The World Bank Research Observer*, 1(1), 27-56.
- [3]. Binswanger, H. P., & Rosenzweig, M. R. (1986). Behavioural and material determinants of production relations in agriculture. *The Journal of Development Studies*, 22(3), 503-539.
- [4]. Binswanger, H. P. (1978). *The economics of tractors in South Asia*. Agricultural Development Council, New York And International Crops Research Institute For The Semi-Arid Tropics, Hyderabad, India.
- [5]. Chand, R., & Pavithra, S. (2015). Fertiliser Use and Imbalance in India. *Economic & Political Weekly*, 50(44), 99.
- [6]. Chandrasekaran, M and Krishnamoorthy. S (1999), "A study pattern of growth of fertilizer use in Tamil Nadu-A spatial and temporal analysis", *Agricultural Situation in India*, Vol: LV, No: 11, February, pp. 665 - 670.
- [7]. Desai, G. M., & Singh, G. (1973). Growth of fertiliser use in districts of India: performance and policy implications (No. 41). Centre for Management in Agriculture, Indian Institute of Management.
- [8]. Dixit, V. K., & Bhardwaj, J. L. (1990). The impact of tractorisation on farm employment in Raipur district of Madhya Pradesh. *Agricultural Situation in India*, 45(4), 233-237.
- [9]. Foster, A., & Rosenzweig, M. R. (2010, September). Barriers to farm profitability in India: mechanization, scale and credit markets. In Conference Agriculture for Development-Revisited, University of California at Berkeley. October (Vol. 24, pp. 1-2).
- [10]. Inamke, N.M., Pokarkar, V.G., Kamble, S.S. and Nawale, S.K., (1996), "Productivity of sugarcane in Maharashtra : A zone wise analysis", *Maharashtra Journal of Agricultural Economics*, Vol. 3, No. 1, pp. 5-7.
- [11]. Jha, D., & Sarin, R. (1980). Fertilizer consumption and growth in semi-arid tropical India a district-level analysis. *Fertilizer consumption and growth in semi-arid tropical India a district-level analysis.*, (10).
- [12]. Khunt. K. A Gajipara. H.M and Golakia. B. A (2001), "Potash consumption in different zones of Gujarat: past, present and future pattern", Paper presented in International Seminar, New Delhi, pp. 3-5.
- [13]. Kishtwaria, J., & Rana, A. (2012). Intervention of gender friendly land preparation technologies for drudgery reduction of hill farm women. *Work*, 41(Supplement 1), 4342-4348.
- [14]. Krishnamacharyulu, T.V and Muralidhar, V (1981), "Interstate variations in trends of fertilizer use - A time series analysis", *Fertilizer Marketing News*, Vol. 12, No. 12, pp. 3-6
- [15]. Lipton, M. (2006). Can small farmers survive, prosper, or be the key channel to cut mass poverty?. *eJADE: electronic Journal of Agricultural and Development Economics*, 3(853-2016-56133), 58-85.