

Agricultural Mechanization and Its Impact on Production, Productivity and Employment of Labour

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Abstract: *Due to the country's strict inheritance laws and increased population density, over two-thirds of Indians live in rural areas. Which contributes to the country's agriculture being characterized by excessively small holdings? The estimated 142 m ha area is rain fed to a degree of over 62%. Both animate (people and draught animals) and inanimate (diesel engines, tractors, and electric motors) sources are significant sources of farm power. In the middle of the 1960s, India launched its carefully choreographed Green Revolution. It was brought about by the prompt government intervention as well as the adoption of larger and balanced amounts of biological, chemical, and mechanical inputs.*

Keywords: Farm Mechanization, Agricultural mechanization

I. INTRODUCTION

The government made sure that the necessary inputs, such as high yielding seed varieties, fertilizers, herbicides, water, and more advanced power sources and equipment, were readily available. It also established a minimum support price, made it simple to access marketplaces for buying goods, built rural roads, and other infrastructures that in some parts of the nation helped spark the green revolution. In turn, land productivity grew from 0.58 tons/ha/year to more than 2.14 tons/ha/year, and gross food production climbed from 50.8 M tones in 1950–51 to 199.3 M tones in 1996–97. Farm mechanization was frequently at the centre of controversy due to its impact on the employment of human labour in a labour-abundant economy, yet the quantum rise in production and productivity was caused by a mix of variables. This study covers the studies on the effects of farm mechanization on agricultural output and productivity, cropping intensity, employment on the farm for human labour, employment in related industries and off the farm, as well as gross farm income and net return.

1.1 Impact of Mechanization on Agricultural Productivity

To lessen human labour and increase agricultural productivity, farm mechanisation is viewed as a necessity. Farm mechanization's effects on agricultural output and productivity have been well-known in India since the end of the green revolution. Different States in India have reached varying degrees of mechanization depending on the utilization of various inputs including irrigation, high yielding seed varieties, chemical fertilizers, herbicides, and pesticides. As a result, three to four times gains in agricultural productivity and production have been observed. Numerous organizations and individuals have done studies that demonstrate the effects of agricultural mechanization on farm productivity and output.

According to Singh and Singh (1972), tractor farms outperformed non-tractor farms in terms of overall gross output per hectare and yields of wheat, paddy, and sugarcane. The values of annual farm output per hectare of net sown area at various levels of mechanization were compared by NCAER (1973). It was discovered that as the level of mechanization increased—from irrigated, non-mechanized farms to tube well, tractor-thresher fields—the output per hectare increased as well. Although tractor and tube well farms in the case of wheat had much higher yields than bullock farms, Singh and Chancellor (1974) found that a large portion of the difference was explained by differences in other factors, such as the intensity of irrigation. When compared to Persian wheel irrigation, the usage of tube wells was found to be associated with much greater yields. According to ITES, Madras (1975), tractor-owned farms boosted paddy,



sugarcane, and groundnut productivity by 4.1 to 28.3 percent, 13.1 to 34.2 percent, and 9.8 to 54.8 percent, respectively, with average values of 15.8 percent, 23.2 percent, and 31.8 percent. The average improvement in productivity on farms using tractors was also estimated to be 11.8 percent for paddy, 13.0 percent for sugarcane, and 16.0 percent for groundnuts.

Pathak et al. (1978) conducted a survey on five different types of farms in the Punjabi province's Ludhiana District to see how power sources affected output and productivity. According to reports, tractor farms produce more paddy than bullock farms do. On tractor farms compared to bullock farms, the yield of wheat was much higher following paddy or maize. Tractor use increased agricultural productivity because seed-bed preparation was better, operations were completed on time, and seed and fertiliser distribution and placement were precise thanks to the use of seed-cum-fertilizer drills. In seven States belonging to three major agro climatic zones, NCAER (1980) performed a survey on farms owning tractors, utilizing tractors on custom-hire, and possessing bullocks. From 85 villages, a sample of 815 farming households was randomly chosen. It was claimed that an average tractor-owning farm produced greater yields than a bullock farm, with yields varying by crop and ranging from 72% for sorghum to 7% for cotton. Comparing tractor users to bullock farms, larger yields were also achieved.

Without statistical testing, the majority of research found an association between higher irrigation and fertilizer use and higher yields on tractorized farms. The study by Kahlon (1976) in Punjab was an outlier, which revealed no statistically significant yield effects. Fertilizer usage increased in one location where wheat yields rose noticeably. The effect did not hold true for all farms in the two other locations. There were no discernible changes for rice cultivars with high yields. In one region, cotton and maize both showed considerable differences. In Delhi Territory, according to Motilal (1971), paddy (13.7%), wheat (15.9%), and sugarcane (29.7%) yields all climbed significantly.

Tractors could not be solely blamed for these gains because tractor farms utilized 35% more fertilizer. Tractors improved yields by 17.6% in sugarcane and 41% in wheat in Uttar Pradesh, however significance tests and fertilizer inputs were not given (Singh & Singh, 1972). The NCAER study (1980) found that the consumption of fertilizer increased along with yield improvements when tractors were used, however sample sizes were small. Other regions had significant increases in yields for groundnuts in Coimbatore (23.9%), summer paddy in Bihar (28.6%), desipaddy in kharif, and high yielding paddy. Application of fertilizer, however, was also higher (Bihar, 31.8%; Andhra Pradesh, 36.3%; Coimbatore, 28.7%). The regression analysis conducted by Singh and Chancellor (1974) on 26 maize farms in the Meerut District revealed that tractorization had no appreciable impact on productivity.

1.2 Impact of Mechanization on Cropping Intensity

Cropping intensity has increased significantly as a result of agricultural mechanization. The expansion of irrigated land and the density of tractors have directly affected cropping intensity. The results of earlier studies are briefly reviewed to show the role that mechanization plays in increasing crop intensity.

In 1974, Chopra conducted research on a sample of Punjabi farms. He compared the situation on farms that had tractors before and after the invention of tractors. The introduction of tractors was said to have increased cropping intensity. In nine Indian States, NCAER (1974) studied tractor- and non-tractor-operated farms. According to the study, farms with tractors had a greater cropping intensity, at 137.5%, compared to farms without tractors, which had a cropping intensity of 131.8%.

On small farms, it was discovered that cropping intensity was often higher. The Punjab had the highest cropping intensity of the States studied, followed by Uttar Pradesh, Tamil Nadu, and Rajasthan. Maharashtra and Rajasthan had the lowest cropping intensity among tractorized fields.

According to a study by Pathak et al. (1978) on a sample of 115 farms in the Ludhiana district, bullock farms have greater average cropping intensities with fodder crops than tractor farms. For tractor farms, however, the cropping intensity was significantly higher without a fodder crop. on farms with a population of 6 to 12.

Hectares, the tractor farms' cropping intensity with a fodder crop was 180%, compared to 174.5% for the bullock farms. Tractor farms had a 153.9 percent cropping intensity without a fodder crop, compared to bullock farms' 149.6 percent. On bullock farms compared to tractor farms, the cropping intensity with feed was higher, whereas the cropping intensity without fodder was lower. The tractor farms, however, were in a stronger position when comparing the cropping intensities in the two groups with medium-sized holdings (6 to 12 hectares), since their cropping intensities

with and without fodder were 3.2 and 2.8% greater than those on bullock farms, respectively. The higher intensity was attributed to tractor farms having access to more mobile power than bullock farms had.

1.3 Impact of Mechanization on Employment of Human Labour

Mechanization of agriculture has raised concerns and sparked discussion, notably in India, a nation with a labour excess. The research that is now available indicates that mechanization contributed to an overall rise in the employment of human labour. An analysis of "Tractorization in Kanjhawala Block in Delhi Territory" by Rao and Singh (1964) revealed that both tractor and non-tractor farms had an average of 8.2 people per farm, and the labour force at their disposal was neither excessive nor insufficient.

Tractorization increased labour demand by enabling more intense farming, according to GIPE, Poona (1967). As a result, after tractorization, little to no human labour was lost. According to UPAU (1969), mechanization had a positive impact on employment together with the application of new seed technology and the use of contemporary agricultural techniques. According to Kahlon (1969–1970), compared to bullock-operated farms, the aggregate labour decrease on tractor-operated farms with tube wells was only 1.3%. In 1970, Billing and Singh examined variations in the demand for labour. The cumulative effect of implementing the enhanced technologies in Punjab led to an 11.5% decrease in the use of human labour when compared to the level at which it was previously. The reduction in Maharashtra was minimal, at 0.2%. However, the study did not calculate the potential rise in employment of human labour resulting from the increase in cropping intensity followed by mechanical agriculture.

An average cropped hectare on a tractorized farm required 87.6 man-days of labour, compared to 113.9 man-days on custom-hiring farms, 120.6 man-days on bullock-operated farms, and 3.10 percent on tractorized farms, according to Singh and Goswami's (1977) study of tractorized and bullock-operated farms in the Purnea district of Bihar. Tractorized farms required a higher percentage of labour than bullock-operated farms did for intercultural, watering, harvesting, and threshing operations. It wouldn't be out of place to add that the majority of mechanization studies were carried out in the 1960s and 1970s, in the early years of the introduction of tractors. The results of some of these studies, which showed that the differences in timeliness of operations and productivity per hectare did not come out to be statistically significant on tractor farms as compared to bullock farms, formed the basis for the opposition to this technology and particularly to the introduction of tractors. The shortcomings of inadequate infrastructure for machinery maintenance and repair and the time it needed to develop the mechanical abilities, which significantly influenced these outcomes, were readily overlooked while quoting such findings. In light of this, it would be incorrect to assume that tractorization did not enhance secondary and tertiary employment or raise the timeliness and production of farm activities.

1.4 Impact of Mechanization on Gross Farm Income and Net Return

Farm mechanization has made a significant contribution to the farming community's overall economic improvement. Studies done on how mechanization affects farm income mostly support this viewpoint. In 1970 and 1971, AERC carried out a number of studies on the economics of mechanization. These studies showed that mechanized farms had higher gross incomes than non-mechanized farmers. With only a slight difference, the gross crop output per cultivated acre was reported to be Rs. 3144 for tractor-operated farms and Rs. 2677 for bullock-operated farms. According to NCAER (1974), tractor farms generated 21% higher revenue per hectare of gross cultivated area than bullock farms. Due to superior resource management, tractorized farms saw higher net returns per hectare of gross cropped area or net cultivated area than non-tractorized farms.

Another study by NCAER (1980) found that tractor users and owners made more money per hectare overall than bullock farms. A typical tractor-owned household had a gross income per hectare that was 63% greater than a household that only used bullock labour. As a whole, households that utilise tractors made 31% more money per acre than bullock farms did. On a cultivated hectare, the average net return from a tractor-owning farm was 152% higher than a bullock farm's. A farm that used a tractor also made a net 84% more money than a farm using bullocks. A tractor-owning farm spent 62% more on labour and 57% more on materials than a bullock farm. Despite incurring more cultivation costs than a bullock farm, an average tractor owner and user generated higher net income per cropped hectare. However, this shouldn't be only credited to the use of tractors as other elements including hybrid seeds, fertilizer, and irrigation also played a role. According to Patil and Sirohi's (1987) study in an irrigated area of

Maharashtra's Ahmednagar district, tractor-owning farms typically had a gross return that was 33 to 34% greater than bullock-operated farms.

According to Balishter and colleagues (1991), the net return per hectare from mechanized farms with tractors and tube wells and from partially mechanized farms with only tubewells was 49% and 29% greater than those from non-mechanized farms, respectively.

II. CONCLUSION

Tractorization displaced primarily bullock labour up to around 60% in some cases, but its influence on manpower was much less, with the displacement being less than 15%, according to a common conclusion from numerous research. Numerous researches came to the conclusion that mechanization should not be evaluated in isolation due to the relatively minimal displacement of human labour that was unavoidable. Indeed, mechanization created additional opportunities for human work, including management and supervision positions as well as driving, maintaining, and repairing the machines. Therefore, advised near entire mechanization in operational holdings larger than 20 ha, which accounted for 13% of the cultivated land, and selected mechanization in a progressive way for farms between 5-20 ha groups, which formed 40% of the area under cultivation.

Animal, mechanical, and electric power tasks were all viewed by NCA as complementary. For time-sensitive tasks like sowing, planting, especially in rain-fed areas where the operations needed to be finished quickly while the rain fell, harvesting, and threshing, as well as for non-repetitive tasks like land reclamation, leveling, terracing, eradicating wild-shrubs and perennial weeds like kans (*Saccharum spontaneum*), as well as for command area development tasks, the NCA advocated tractorization. Numerous other organizations and people have also done studies on the effects of farm mechanization on agricultural inputs and outputs. The majority of these investigations came to the general results listed below.

- (i) Farm mechanization raised input costs due to greater areas, higher average cropping intensities, and improved farm labour productivity.
- (ii) Farm mechanization enhanced agricultural production and profitability because it operated more quickly, produced better work, and used inputs more effectively.
- (iii) Farm mechanization only slightly increases on-farm labour, but it significantly increases off-farm labour, such as industrial manufacture of tractors and ancillaries.
- (iv) Farm mechanization reduced the amount of time needed for farm operations while replacing animal power to the tune of 50% to 100%.

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