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## An economic analysis of farm mechanization in Sivagangai district of Tamil Nadu, India

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### Abstract

The study was undertaken in Sivagangai district of Tamil Nadu, India with a comparison of owned and hired machine labour. Yield, input cost, crop income and off-farm income of own farms showed an increase of 19.37 per cent, 15.66 per cent, 17.83 and 321.37 per cent over hired farms respectively. The breakeven point for thresher was highest with 2496.57 hrs/ annum. Partial budgeting showed that all machineries have net gain. The determinants of mechanization included human labour cost and input cost for own farms and human labour cost, input cost and productivity for hired farms. The existing plan included crops of Paddy, Sugarcane and Groundnut with a net income of Rs. 138320/ha. The income realized in the optimal plan was 45.99 per cent higher as compared to the existing plan. Mechanization could be adopted by the farmers since all the machineries resulted in higher income and higher net gain.

**Keywords:** Breakeven point, partial budgeting, multiple regression, linear programming and optimal plan

### Introduction

Human labor is becoming unavailable and especially with the launching of Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS) in rural areas and in construction works in urban areas. Farm mechanization had a considerable impact on enhancing the food-grains production in the country (Shekhar and Bhatt, 2014) [3]. Therefore mechanization is the need of the hour and hence the present study was taken up. Past studies also reported that there exist significant gains of mechanization on input cost, productivity and income. Also, the studies reported that machine labour is cheaper than human labour. Hence to examine these issues, the study was taken up. With this preamble, the following objectives were developed for the study.

### Objectives

1. To study the pattern of mechanization operation wise
2. To study the impact of mechanization on input cost, productivity, income and employment
3. To study the comparative economics of machine labour and human labour and to work out the break even hours for different machineries
4. To study the determinants of adoption of farm mechanization
5. To develop optimal farm plan with mechanization
6. To study problems in adoption of farm mechanization and to suggest policy measures to overcome the same

### Methodology

The study was undertaken in Singampunari block of Thirupathur Taluk and Manamadurai block of Manamadurai Taluk in Sivagangai district and the study covered paddy crop. A sample size of eighty farmers was adopted for the study.

### Tools of Analysis

#### a. Conceptual framework

A comparison of owned and hired machine labour was adopted for the present study

#### b. Analytical / empirical framework

The Pattern and impact of mechanization was studied using Percentage analysis.

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The Comparative economics of human and machine labour was studied with Partial budgeting and Breakeven hours. The determinants of mechanization was studied using multiple Regression, The Optimal Farm Plan was developed using linear programming. The constraints and benefits were studied using percentage analysis.

### c. Sampling framework

The crop covered was paddy with a sample size of 80 farmers

### d. Data collected

Primary data collection of Machinery cost, Operational cost, Human labour cost, Input cost, Total cost and returns, Machine hours, Total hours of operation, Gross and net income, Employment, Productivity, Price of output and problems and benefits in adoption of mechanization were collected

## Result and Discussion

### 1. Share of Machine hours in Total hours of operation

The share of machine hours in total hours of operation is presented in Table 1. It could be seen from the table that machine hours in both owned and hired farms were similar with 23.55 hrs./ha. and 22.61 hrs./ha. The share of machine hours in total hours of operation revealed the same situation with both owned and hired farms were having similar proportion with 3.44 per cent in own farms and 3.09 per cent in hired farms.

**Table 1:** Share of Machine hours in Total hours of operation (/ha.)

S. No.	Particulars	Hours	
		Own	Hired
1	Machine hours	23.55	22.61
2	Human hours	661.85	710.12
3	Total Hours	685.40	732.73
4	Share of Machine hours in Total hours of operation (%)	3.44	3.09

### 2. Share of Machine cost in Operational Cost and Total Cost

The share of machine cost in operational cost and total cost is presented in Table 2. It could be seen from the table that machine cost in total operational cost was similar with 42.40 per cent in own farms and 44.18 per cent in hired farms. The machine cost was imputed for hired farms. The share of machine cost in total cost was less in both the farms and similar. The proportion was 30.93 per cent in own farms and 31.61 per cent in hired farms. On comparison with proportion of machine hours of operation and machine cost of operation, the proportion of cost of operation to total cost was higher. Both own farms and hired farms showed no difference in machine cost.

**Table 2:** Share of Machine cost in Operational Cost and Total Cost (/ha.)

S. No.	Particulars	Cost	
		Own	Hired
1	Machine	14116.64	14512.79
2	Operation	19179.57	20729.12
3	Total Operational Cost	33296.21	35241.91
4	Share of Machine Cost in Total Operational Cost	42.40	44.18
5	Input Cost	12348.52	10667.35
6	Total Cost	45644.73	45909.26
7	Share machine cost in total cost	30.93	31.61

## 3. Impact of Mechanization

The impact of mechanization by comparing own farms and hired farms is presented in Table.3. It could be seen from the table that yield, input cost, crop income and off-farm income of own farms showed an increase of 19.37 per cent, 15.66 per cent, 17.83 and 321.37 per cent over hired farms respectively which showed the supremacy of own farms as compared to hired farms. Such a positive impact of mechanization on production, productivity, cropping intensity, income and employment generation was obtained by Verma, 2005 <sup>[4]</sup> in his meta analysis on mechanization. Also, both the input cost and crop income was higher for own farms as compared to hired farms which revealed the cost intensiveness of own farms but at the same time it was having higher returns. One remarkable feature was the off-farm income with custom hiring of machinery was high in own farms by 321.37 per cent as compared to off-farm income with hiring of labour in hired farms. Also, in hired farms, the marginal decline in crop income and the high decline in off-farm income were compensated by enhanced livestock activities and non-farm activities.

**Table 3:** Impact of Mechanization /ha

S. No.	Benefit	Own/ha.	Hired/ha.	% increase
1	Productivity	6168.99	5167.91	19.37
2	Input Cost	12336.92	10666.08	15.66
3	Income			
i	Crop	98703.88	83769.44	17.83
ii	Live Stock	17676.95	22291.46	-20.70
ii	Off Farm	51549.54	12233.84	321.37
iv	Non-Farm	7077.36	25467.56	-72.21
	Total	175007.74	143762.29	21.73

### 4. Break even analysis for different machineries

The break even analysis for different machineries for own farms was worked out and the results are furnished in Table 4. It could be seen from the table that the breakeven point for thresher was highest with 2496.57 hrs/annum and it was lowest for power tiller with 175.02 hrs/annum. The breakeven point for power sprayer was second highest with 1235.36 hrs/annum followed by combined harvester with 594.39 hrs/annum. The breakeven point for tractor was second lowest with 232.89 hrs/annum. Also, a comparison of breakeven point with actual usage in own farms is presented in the table. The actual usage in own farms was very lower as compared to breakeven point and hence the own farm farmers resorted to custom hiring activities to attain the breakeven point and more.

**Table 4:** Break Even point (in hours/ annum)

S. No.	Machineries	Breakeven point	Actual usage in own farms
1	Tractor	232.89	14.98
2	Combined Harvester	594.39	3.24
3	Thresher	2496.57	2.94
4	Power sprayer	1235.56	12.09
5	Power Tiller	175.02	14.98

### 5. Partial budgeting of Machinery usage

The partial budgeting of machinery usage is presented in Table 5. It could be seen from the table that all machineries have net gain especially combined harvester with Rs.16760/ha. This was followed by thresher with Rs. 14907/ha. and power sprayer with Rs.14413/ha. The net gain was lowest for tractor and power tiller with Rs. 10004/ha.

each. Hence the farmers in the region can adopt mechanization since all machineries yielded net gain.

**Table 5:** Partial budgeting of Machinery usage

S. No	Machineries	Added return/ha.	Reduced cost/ha.	Net gain/ha.
1	Tractor	-	10004	10004
2	Power tiller	-	10004	10004
3	Power sprayer	13178	1235	14413
4	Combined harvester	13178	3582	16760
5	Thresher	13178	1729	14907

## 6. Determinants of Mechanization

The determinants of mechanization are presented in table 6. It could be seen from the table that machine cost was influenced

**Table 6:** Determinants of Mechanization

S. No.	Particulars	Own	P-value	Hired	P-value
1	Intercept	1.75 (3.78)	0.65	2.24 (2.46)	0.37
2	Human Labour cost	0.23 * (0.10)	0.03	0.24** (0.09)	0.01
3	Input cost	0.18** (0.06)	0.01	0.12 * (0.06)	0.06
4	Price of output	0.36 (0.48)	0.46	0.01 (0.26)	0.97
5	Productivity	0.14 (0.09)	0.12	1.00 ** (0.19)	0.00001
6	Adjusted R <sup>2</sup>	0.36		0.49	

## 7. Optimum farm plan with mechanization

A detail of the existing plan in the representative farm of Sivagangai district for 3.70 acres is given in Table 7. The existing plan included crops of Paddy, Sugarcane and Groundnut with the land, labor and capital constraints. The net income realized from the existing plan was Rs. 138320/ha. The optimal plan I maximizes the net income with the given constraints in the model and the results are given in Table 8. Optimal plan indicated that by optimization of available resources, an higher net income of Rs. 201937.32/ha. could be attained with the increased area of 0.06 ha. The income realized in the optimal plan was 45.99 per cent higher as compared to the existing plan.

**Table 7:** Details of existing plan in Sivagangai district

S. No	Crops	Area (ha.)	Labour (mandays)	Capital (Rs.)	Net income (Rs.)
1.	Paddy	0.49	177.84	111150	37050
2.	Sugarcane	0.45	703.95	358150	83239
3.	Groundnut	0.57	160.55	61750	18031
	Total	1.50	1042.34	531050.00	138320.00

**Table 8:** Details of Optimal plan in Sivagangai district

S. No	Crops	Area (ha.)	Labour (mandays)	Capital (Rs.)	Net income (Rs.)
1.	Paddy	1.04	458.8272	286767	95514.9
2.	Sugarcane	0.52	901.056	458432	106422.42
3.	Groundnut	-	-	-	-
	Total	1.56	1359.88	745199.00	201937.32

## 8. Constraints for Non Adoption

The constraints for non -adoption of Rotavator, Transplanter and cono-weeder are presented in Table 9. It could be seen from the table that high cost was the major constraint for non-adoption of Rotavator in both own and hired farms as cent per cent of the respondents reported this as the major constraint. In case of transplanter, special skill and high cost was the major constraint in own farms as 48.84 per cent of the respondents reported this as the major constraint. In hired

by human labour cost and input cost for own farms. One per cent increase in human labour cost and one per cent increase in input cost above the mean level would increase the machine cost by 0.23 per cent and 0.18 per cent respectively. Hence the human labour and inputs were significant determinants of mechanization on own farms. In hired farms, human labour cost, input cost and productivity influenced the machine cost. One per cent increase in human labour cost, one per cent increase in input cost and one per cent increase in productivity above the mean level would increase the machine cost by 0.24 per cent and 0.12 per cent and 1.00 per cent respectively. In hired farms, human labour cost, input cost and productivity were significant determinants of mechanization. Such a positive influence of human labour cost, price of output and productivity was obtained by Narayana Moorthy *et al.*, for the panel data of different states in India.

farms, high cost was the major constraint as 54.05 per cent of the respondents reported this as the major constraint. This finding was in line with the finding of Nagraj *et al.*, (2013) [1] who have showed that high investment cost was the constraint in adoption of machineries in Paddy production in Thungabadhra area of Karnataka In cono weeder, row/machine transplanting was the major constraint in both own and hired farms.

**Table 9:** Constraints for Non Adoption

S. No.	Constraints	Own	Hired
<b>1. Rotavator</b>			
i	High cost	100.00	100.00
<b>2. Transplanter</b>			
i	Special Skill	32.56	32.43
ii	high cost	18.60	54.05
iii	Special Skill & High cost	48.84	13.51
<b>3. Cono-Weeder</b>			
i	Row/Machine transplanting	46.51	91.89
ii	Lack of awareness	18.60	8.11
iii	Row/Machine transplanting & Lack of Awareness	34.88	0.00

## 9. Benefits of Mechanization

The benefits of mechanization are presented in Table 10. It could be seen from the table that the benefits of mechanization included efficiency, time saving and drudgery reduction. Time saving was the major benefit as it was reported by 65.12 per cent of respondents in own farms and 56.76 per cent of respondents in hired farms. Drudgery reduction was the next major benefit as it was reported by 34.88 per cent of respondents in own farms and 37.84 per cent of respondents in hired farms

**Table 10:** Benefits of Mechanization

S. No.	Benefits	Own	Hired
1	Efficiency	0.00	5.41
2	Time saving	65.12	56.76
3	Drudgery reduction	34.88	37.84

## Summary and Conclusion

### Summary of findings

- The share of machine cost in total cost worked out to 30.93 per cent in own farms and 31.61 per cent in hired farms
- On comparisons of own and hired farms, yield, Input cost, crop income and off-farm income of own farms showed an increase of 19.37 per cent, 15.66 per cent, 17.83 and 321.37 per cent over hired farms respectively.
- The breakeven point for thresher was highest with 2496.57 hrs/annum and was lowest for power tiller with 175.02 hrs/annum
- Partial budgeting analyses showed that all machineries have net gain especially combined harvester with Rs.16760/ha.
- The determinants of mechanization included human labour cost and input cost for own farms and human labour cost, input cost and productivity for hired farms.
- The existing plan included crops of Paddy, Sugarcane and Groundnut with the land, labor and capital constraints. The net income realized from the existing plan was Rs. 138320/ha. The income realized in the optimal plan was 45.99 per cent higher as compared to the existing plan.
- The major constraint for non-adoption of Rotavator included high cost, transplanter included special skill and high cost and for cono weeder included row transplanting
- Benefits of mechanization included efficiency, time saving and drudgery

### Conclusion

The mechanization could be introduced in Sivagangai district as it had resulted in higher crop income and off-farm income with custom hiring of machineries. It had also higher net gain as compared to human labour. Further, the break-even point was higher for all machineries as compared to actual usage in farms. High cost of machineries was the major reason cited by respondents for non-adoption of rotavator and transplanter and hence enhanced subsidy should be given to farmers for the farmers of the district.

### Policy Implications

- Mechanization could be adopted by the farmers since all the machineries resulted in higher net gain and higher breakeven point. This mechanization is the need of the hour especially with collective farming introduced by the Tamil Nadu Government.
- Majority of the farmers reported high cost of machineries as the constraint for non-adoption and hence enhanced subsidy should be given to farmers from the present 50 per cent to 75 per cent.

### References

1. Nagaraj PS, Dhananjaya Swamy, Madhushree A, Vidyadhara B. A Study on Knowledge and Adoption of Farm Mechanization by Paddy Grower in Tungabhadra Project Area, Karnataka. *International Journal of Agriculture and Food Science Technology*. 2013; 4:385-390
2. Narayanamoorthy, Bhattarai M, Suresh R, Alli P. Farm Mechanisation, MGNREGS and Labour Supply Nexus: A State- Wise Panel Data Analysis on Paddy and Wheat Crop. *Indian Journal on Agricultural Economics*. 2014; 69:10-20.

3. Sekhar CSC, Yogesh Bhatt. Effect of Farm Mechanization on Agricultural growth and Comparative Economics of Labour and Machinery in India. Institute of economic growth, New Delhi, 2014.
4. Verma SR. Impact of Agricultural Mechanization on Production, Productivity, Cropping Intensity Income Generation and Employment of Labour. College of Agricultural Engineering, Punjab Agricultural University, Ludhiana, 2005.