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RESEARCH ARTICLE

AN ECONOMIC ANALYSIS ON COSTS OF FARM MECHANIZATION IN WEST BENGAL

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ABSTRACT

An attempt has been made in this paper to examine the costs of mechanization vis-à-vis marketed surplus and value of output for the different crops grown in the study region. It has been observed that small size and scattered holdings of the farmers stand in the way of mechanization and farm machinery generally remains underutilized. Majority of small cultivators are poor and cannot purchase the costly machinery like tractors, combine harvesters etc. Still animal power is used extensively on different farm operations, besides manual, electrical and tractor power in West Bengal. In fact, the major cost items in farming operations comes out to be ploughing which is mostly operated using animal power. This is followed by irrigation operations which is entirely carried out using electrical power and transportation and marketing which is mostly done using tractor power. It also comes out from the analysis that among the various operations performed with various power sources, tractor power is the highest used power source followed by animal power, electrical power and manual power. Hence it appears that in various farming operations, both tractor power and animal power remains crucial, while use of manual power is negligible. Use of electrical power however is limited and used for specific activities. The study highlights that full scale farm mechanization is still an unreal proposition in the farm sector in West Bengal. However, operation specific farm mechanization may be crucial at this stage.

INTRODUCTION

The technological improvements in Indian agriculture since mid-sixties have brought about revolutionary increase in agricultural production. Interestingly, the growth rate of food grain production particularly in case of wheat and rice was much higher than the growth rate of population. The country was facing acute food shortages till eighties has now become not only self-sufficient but also a net exporter of food grains. This has been made possible due to evolution of high yielding crop varieties, increased use of chemical fertilizers, development of irrigation facilities and plant protection measures accompanied by effective price support programmes of farm products. The increased use of purchased inputs in agriculture necessitated to raise their use efficiencies though mechanization. The increase in the use of human and bullock labour and rising wage rates and cost of up-keep of bullock further made the case of farm mechanization still stronger. Farm mechanization has been helpful to bring about a significant improvement in agricultural productivity. Thus, there is strong need for mechanization of agricultural operations. The factors that justify the strengthening of farm mechanization in India can be numerous. The timeliness of operations has assumed greater significance in obtaining optimal yields from different crops, which has been possible by way of mechanization (Singh, 2009). This is also correct for other farm operations like hoeing, irrigation, harvesting, threshing and marketing which need to be performed at appropriate time otherwise the yield and farm income is affected adversely. Secondly, the quality and precision of the operations are equally significant for realizing higher yields. The various operations such as land levelling, irrigation, sowing and planting, use of fertilizers, plant protection, harvesting and threshing need a high degree of precision to increase the efficiency of the inputs and reduce the losses. However, when these operations are performed through indigenous methods, their efficiency is reduced. Thirdly, the time taken to perform sequence of operations is a factor determining the cropping intensity. So as to ensure timeliness of various operations, it is quite inevitable to use such mechanical equipments which have higher output capacity and cut down the number of operations to be performed. This has helped in increasing area under cultivation and increase in cropping intensity.

Broadly speaking, mechanization means using machinery to perform tasks or to assist humans in performing tasks. Mechanization is the use of modern implements as well as motorized equipment like plough, harrow, ridger and also the use of agro-chemicals like insecticides, herbicides, fertilizers and improved seeds in the farm. However, while

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mechanization reduces labour costs (Anonymous, 2013) on the other hand, it increases capital expenses for machinery and equipment. As farmers in general are too poor to be able to buy the expensive machines, mechanization of farming often appears to them too costly to practice. Further, degree of mechanization depends much upon the specific requirements of the crops grown, nature of the crops, as also the season in which the crops are grown. Thus that capital costs incurred for mechanization in relation to marketable surplus and value of output remains crucial for the spread of mechanization, particularly in a country like ours where majority of the farms perform at the subsistence level. Here, an attempt has been made to examine the costs of mechanization vis-à-vis marketed surplus and value of output for the different crops grown in the study region.

DATA BASE AND METHODOLOGY

The study has been conducted based on primary data. For collection of primary data, all districts in West Bengal have been sub-divided into two groups based on density of tractors i.e. highest and lowest. Accordingly, one district from highest density i.e. Hooghly and other from lowest density i.e. Purulia have been selected randomly. Similarly by following the same methodology, one block in each district has been selected. The list of farmers of each block has been collected and the farmers have been sub-divided into three categories based on size of holdings i.e. marginal, small and medium. Then fifty farmers have been selected based on probability proportional to size. Thus all total 100 farmers have been selected to form the ultimate sample size of the study. The reference year of the study is 2011-12.

RESULTS AND DISCUSSION

In order to examine the costs of mechanization for different crops grown in the study region, first costs on account of various inputs applied in cultivation is compared across different crops. It can be observed that a total cost per hectare of land is highest for potato, followed by summer paddy, kharif paddy and mustard (Table -1). The costs of inputs in

Table 1. Input costs (Rs/ha.)

Input	Costs (Rs./ha) by major crops				
	Kharif paddy	Boro paddy	Potato	Mustard	Wheat
Seed	1168.46	926.20	17422.93	374.64	2668.71
Irrigation	502.23	2485.21	12584.68	1477.72	1492.31
Organic manure	1237.97	0.00	2997.20	1981.60	1507.47
Fertilizer	3114.73	4015.40	16392.71	2342.96	1674.72
Hired labour					
Bullock	1397.04	999.95	3709.04	891.09	0.00
Manual	11202.91	15458.37	23271.63	7496.87	946.09
Total	12599.94	16458.32	26980.67	8387.96	946.09
Hired machinery cost					
Tractor	3013.25	3103.15	5316.11	1999.26	1753.98
Carriage	3669.73	0.00	3223.83	3747.13	0.00
Total	6682.97	3103.15	8539.94	5746.39	1753.98
Pesticides/ weedicides	704.27	1242.71	3035.87	819.00	795.62
Total	26010.58	28231.00	87954.00	21130.27	10838.91

Source: Field Survey

wheat cultivation have been the lowest among the crops cultivated in the study region. Among the various cost components, expenses on account of human labour claim a major share for almost all the crops concerned, except for wheat (which is cultivated mainly with family labour). Costs on account of hired machinery, however, varies from crop to crop, from less than 10 per cent in case of potato to more than 27 per cent in case of mustard (Table- 2). In case of the main crop, viz. kharif paddy, costs on account of hiring of machinery accounts for about ¼ of the total input costs incurred. In absolute terms, however, the highest cost incurred on account of hiring of machinery is the highest for potato, followed by kharif paddy and mustard. It should be noted here that as proportions to value of output, cost of machinery is the maximum (about 33 per cent) for mustard, followed by kharif paddy (about 18 per cent) and potato (about 11 per cent). This in turn indicates that a major share (about one-thirds) of value produced in mustard cultivation is lost on account of use of various machines in the process of production. In case of the main crop kharif paddy, about 18 per cent of the value produced is lost on account of use of machines. As such it comes out that mechanization of farming constitute a major component of expenditure in input application, especially for mustard and kharif paddy.

Table 2. Percentage distribution of input costs

Input	Costs by major crops (%)				
	Kharif paddy	Boro paddy	Potato	Mustard	Wheat
Seed	4.49	3.28	19.81	1.77	13.77
Irrigation	1.93	8.80	14.31	6.99	13.77
Organic manure	4.76	0.00	3.41	9.38	13.91
Fertilizer	11.97	14.22	18.64	11.09	15.45
Hired labour					
Bullock	5.37	3.54	4.22	4.22	0.00
Manual	43.07	54.76	26.46	35.48	8.73
Total	48.44	58.30	30.68	39.70	8.73
Hired machinery cost					
Tractor	11.58	10.99	6.04	9.46	16.18
Carriage	14.11	0.00	3.67	17.73	0.00
Total	25.69	10.99	9.71	27.20	16.18
Pesticides/weedicides	2.71	4.40	3.45	3.88	7.34
Total	100.00	100.00	100.00	100.00	100.00

Source: Field Survey

Further, as compared to marketed surplus of the crops produced, it comes out that for mustard; cost on account of machine use is more than (110 per cent) the amount of marketed surplus (Table 3). This for kharif paddy accounts for about 30 per cent of marketed surplus. It should be noted here that in case of mustard, value of marketed surplus works out to be only about 30 per cent in relation to value of output, in turn indicating higher a proportion of retention for farm family consumption. Again, in case of the main crop, viz. kharif paddy, it is observed that ratio of marketed surplus to value of output works out to be about 60 per cent, which means that 60 per cent of value produced in kharif paddy is actually marketed. Costs on account of machine use constitute a share of 30 per cent in relation to marketed surplus and 18 per cent in relation to value of output. Mechanization of farming involves a wide range of activities performed in various stages of production. The machines in use may be operated by a number of power sources like, manual, animal, electrical, etc. In this section we attempt to examine the costs incurred on mechanization according to farming operations. A detailed break up of costs incurred on machines shows us that operations like plant protection and threshing is done

Table 3. Costs of mechanization vis-à-vis value of output (Rs./ha.)

Crop (1)	Value of output (VoO) (2)	Hired machinery costs (Total) (3)	Marketed surplus (4)	% of machinery costs to VoO - (3) as % of (2)	% of machinery costs to MS - (3) as % of (4)	% of MS to VoO - (4) as % of (2)
Kharif Paddy	37234.48	6682.97	22146.36	17.95	30.18	59.48
Boro Paddy	46103.13	3103.15	38844.09	6.73	7.99	84.25
Potato	80666.54	8539.94	70330.51	10.59	12.14	87.19
Mustard	17422.90	5746.39	5221.07	32.98	110.06	29.97
Wheat	18336.88	1753.98	12832.83	9.57	13.67	69.98

Source: Field Survey

Table 4. Operation-wise costs of mechanization

Particulars	Operation-wise cost of mechanization (Rs./ha.)								
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Animal operated									
Hire charges	6865.22	0	0	0	0	161.03	0	480.04	0
Input costs	0	0	0	0	0	10.67	0	0	0
Service & maintenance	0	0	0	0	0	0	0	50.43	0
Total cost	6865.22	0	0	0	0	171.70	0	530.47	0
Manually operated									
Hire charges	0	0	0	0	48.76	402.10	587.64	0	0
Input costs	0	0	0	0	0	0	0	0	0
Service & maintenance	0	0	0	0	22.08	24.13	51.82	0	0
Total cost	0	0	0	0	70.84	426.23	639.46	0	0
Power operated									
Hire charges	0	0	3783.27	0	0	0	0	0	0
Input costs	0	0	869.19	0	0	0	0	0	0
Service & maintenance	0	0	283.03	0	0	0	0	0	0
Total cost	0	0	4935.49	0	0	0	0	0	0
Tractor operated									
Hire charges	4836.83	0	0	0	0	0	0	2756.68	0
Input costs	0	0	0	0	0	0	0	0	0
Service & maintenance	0	0	0	0	0	0	0	0	0
Total cost	4836.83	0	0	0	0	0	0	2756.68	0
Any other									
Hire charges	0	0	0	0	0	0	0	0	0
Input costs	0	0	0	0	0	0	0	0	0
Service & maintenance	0	0	0	0	0	0	0	0	0
Total cost	0	0	0	0	0	0	0	0	0
Total									
Hire charges	11702.05	0	3783.27	0	48.76	563.13	587.64	3236.72	0
Input costs	0	0	869.19	0	0	10.67	0	0	0
Service & maintenance	0	0	283.03	0	22.08	24.13	51.82	50.43	0
Total cost	11702.05	0	4935.49	0	70.84	597.93	639.46	3287.15	0

Note: X_1=Ploughing; X_2 = Sowing; X_3 = Irrigation; X_4 = Weeding; X_5 = Plant protection; X_6 = Harvesting; X_7 = Threshing; X_8 = Transportation & marketing; X_9 = Other

Table 5. Percentage distribution operation-wise costs of mechanization

Particulars	Operation-wise cost of mechanization (%)								
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Animal operated									
Hire charges	58.67	0	0	0	0	28.60	0	14.83	0
Input costs	0	0	0	0	0	100	0	0	0
Service & maintenance	0	0	0	0	0	0	0	100	0
Total cost	58.67	0	0	0	0	28.72	0	16.14	0
Manually operated									
Hire charges	0	0	0	0	100	71.4	100	0	0
Input costs	0	0	0	0	0	0	0	0	0
Service & maintenance	0	0	0	0	100	100	100	0	0
Total cost	0	0	0	0	100	71.28	100	0	0
Power operated									
Hire charges	0	0	100	0	0	0	0	0	0
Input costs	0	0	100	0	0	0	0	0	0
Service & maintenance	0	0	100	0	0	0	0	0	0
Total cost	0	0	100	0	0	0	0	0	0
Tractor operated									
Hire charges	41.33	0	0	0	0	0	0	85.17	0
Input costs	0	0	0	0	0	0	0	0	0
Service & maintenance	0	0	0	0	0	0	0	0	0
Total cost	41.33	0	0	0	0	0	0	85.17	0
Any other									
Hire charges	0	0	0	0	0	0	0	0	0
Input costs	0	0	0	0	0	0	0	0	0
Service & maintenance	0	0	0	0	0	0	0	0	0
Total cost	0	0	0	0	0	0	0	0	0
Total									
Hire charges	100	0	100	0	100	100	100	100	0
Input costs	0	0	100	0	0	100	0	0	0
Service & maintenance	0	0	100	0	100	100	100	100	0
Total cost	100	0	100	0	100	100	100	100	0

Note: X_1=Ploughing; X_2 = Sowing; X_3 = Irrigation; X_4 = Weeding; X_5 = Plant protection; X_6 = Harvesting; X_7 = Threshing; X_8 = Transportation & marketing; X_9 = Other

completely manually, while irrigation operations are completely performed using electrical power. Harvesting operations are carried out using both animal and manual power sources. Other activities like ploughing, transportation and marketing are carried out using either animal operated or tractor power. It thus comes out on the one hand that animal power is used extensively on different farm operation, besides manual, electrical and tractor power. In fact, the major cost items in farming operations comes out to be ploughing (Rs.11,702/- per hectare) (Table-4) which is mostly operated using animal power (58.67 per cent). This is followed by irrigation operations (Rs.4935/- per hectare), which is entirely carried out using electrical power, and transportation and marketing (Rs.3287/- per hectare), which is mostly done using tractor power (85 per cent) (Table -5). On the other hand, it comes out that among the various operations performed with various power sources, tractor power is the highest used power source (Rs.7593/- per hectare) followed by animal power (Rs.7567/- per hectare), electrical power (Rs.4935/- per hectare) and manual power (Rs.1136/- per hectare). Hence it appears that in various farming operations, both tractor power and animal power remains crucial, while use of manual power is negligible. Use of electrical power however is limited and used for specific activities.

Summary and Conclusion

Small size and scattered holdings of the farmers stand in the way of mechanization and farm machinery generally remains underutilized. Majority of small cultivators are poor and cannot purchase the costly machinery like tractors, combine harvesters etc. However, it has been observed that animal power is used extensively on different farm operation, besides manual, electrical and tractor power in West Bengal. In fact, the major cost items in farming operations comes out to be ploughing which is mostly operated using animal power. This is followed by irrigation operations which is entirely carried out using electrical power and transportation and marketing which is mostly done using tractor power. It also comes out from the analysis that among the various operations performed with various power sources, tractor power is the highest used power source followed by animal power, electrical power and manual power. Hence it appears that in various farming operations, both tractor power and animal power remains crucial, while use of manual power is negligible. Use of electrical power however is limited and used for specific activities. Similarly, it has been also observed during the course of investigation that lack of proper knowledge of farmer to purchase, operate and maintain farm machinery leads to wrong choice and makes it uneconomical and risky too. Due to the seasonal nature of agriculture, the farm machinery remains idle for much of the time causing high depreciation cost (unless proper alternate use of such machinery in the off-season is made). There are also problems relating to farm mechanization viz., lack of service centre near rural areas, quality and reliability of farm machinery being manufactured and supplied by various agencies and scale of manufacturers yet to gain confidence of common farmer. Therefore, full scale farm mechanization is still an unreal proposition in the farm sector in West Bengal. However, operation specific farm mechanization may be crucial at this stage.

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