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MODERNISATION OF PADDY CULTIVATION: AN ANALYSIS OF MECHANISATION AMONG PADDY GROWERS IN PALAKKAD DISTRICT OF KERALA STATE

Dr. Promodh . S

Research Scholar, Department of Economics, Government Arts College,
Bharathiar University, Coimbatore, Tamil Nadu, India.

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Keywords: Paddy; Modernisation; Mechanisation; Technology adoption, farm practices

ABSTRACT: The concept of Modernisation cannot be measured in absolute terms. What is modern now may not be considered modern tomorrow. Concept of modernisation may be different for different countries. Modernisation in agriculture could be defined either as modern or traditional using certain specific indicators. Farm mechanisation is an important indicator of modernisation (Kannaiyan, 2001). For the past several years the demand for agricultural machinery has increased substantially. Coming years, the major thrust would be mechanisation of farms and efficient use of available resources. Mechanisation is used as a proxy in estimating the level of technology in the agricultural sector. Mechanisation is an essential input like any other input such as fertilisers, seeds, and crop protection chemicals. It is one of the vital tools as a farmer has available to increase production and profitability and also reduce the drudgery of the human-powered output. Modern technology use in cultivation influence wellbeing of the farm communities in the district.

Keywords: Paddy; Modernisation; Mechanisation; Technology adoption, farm practices

1.INTRODUCTION:

During 1960's Seed- fertiliser technologies were successfully implemented, and national food security met in many Asian countries termed as Green Revolution.
There are two major challenges in the rice production sector, one is food security needs with declining natural resources base, and other is the scarcity of land and water. Freshwater resources are widely used in rice cultivation which is twofold higher than other grain crops. Drought is one of the main constraints to high yield in many areas. In Most Asian counties increasing population with limited land, availability leads to the adoption of yield increasing technologies. Technology development plays a crucial role in helping millions of small rice farmers to break out a poverty trap in many Asian countries. (Ronald, 2004).

Technology means the application of knowledge for a practical purpose. Agricultural technology in this context refers to the dissemination knowledge to farmers through extension programmes to solve problems in production, management, and marketing at all levels of farmers and crops. Adoption of recommended technology will help to create a positive impact on the farm sector. Research outcome indicates that by adopting appropriate technologies in the proper time will increase productivity by 12-34 per cent. Savings in seeds, fertilisers, enhancement in cropping intensity, and increase in gross income are the direct positive impacts of technology adoption. Agricultural technology is a package of new farm practices which helps to enhance the production of crops to satisfy people's food requirement. In ancient days the agricultural works were performed by human beings, and animals give ways to machinery, which drastically increased the farm output and also influenced the lifestyles of farmers. The tractor is a good example for agriculture machinery (Banerji & Banerji, 2010).

The impact of technology adoption in paddy cultivation is crucial for understanding the present situation of the farming system. This study concentrates on the adoption behaviour and challenges faced by farmers in the selected study area. The Survival of farm community depends mainly on available technology which supports their livelihood activities. The Impact Assessment is a measure of intervention on socio-economic and environmental factors to identify the actual effect on economic development. It helps to know the extent of welfare activities to be implemented in society. Socio-economic impact study assesses the sustainability, economic prosperity and welfare of the community (Roy, 2011).

The focal point of this study is on the various aspect of the extent of mechanisation in the rice sector among the farmers in Palakkad district of Kerala.

II METHODOLOGY

An empirical study was undertaken to gather information about socio-economic status, farm practices, problems faced by farmers and modern technology adoption among farmers relating to the objectives of the study area. A structured questionnaire was prepared for this purpose and used in the field survey. The direct personnel interview method was adopted to collect the required information for this study

Palakkad is the largest district in Kerala. It ranks first in the share (41.59 per cent in 2016) of paddy production in the state. This district lies in the midland of the state and spread over 4400 sq.km area; it is conducive for the cultivation of paddy crop. Out of Thirteen blocks, top five paddy producing blocks which comprise 77 per cent of total paddy production of the district were selected for the

study. A multi-stage purposive random sampling was administered for the survey. The selected five blocks covered a total of 600 farmers and the farmers who were selected belong to the category of small, medium and large farmers equally. This sample size is chosen also represents the village population in the respective block areas.

More than 70 per cent of the people of the Palakkad district depend on paddy cultivation as their livelihood. The studies and literature have shown that it has not been done a survey of such kind particularly the impact of technology with particular reference to paddy cultivation in Kerala. Therefore, it is very curious to understand the effect of mechanisation in paddy cultivation among the farmers.

The present study focuses on the existing paddy production practices in Palakkad district of Kerala. Empirical research is attempted for analysing technology adoption in paddy production. Government's policies and programmes are mainly focused on technology dissemination to farmers and thereby making farm activities profitable and sustainable. The extent of mechanisation and technology adoption has been analysed to arrive at a valid conclusion.

111. ANALYSIS

In this part extent of technology adoption, factors influence mechanisation, Average score analysis of technology adoption based of farmers response, Mean usage of mechanisation based on farmer category, Factors influence mechanisation, the extent of mechanisation in various blocks and descriptive analysis on the proportion of Machine labour and human labour ratio were examined.

The following table describes the extent of using modern technology in the paddy cultivation.

Table 1. Extent of using Modern Technology by the Respondents

GE – Great Extent, SW – Somewhat, VL – Very Little, NA – Not at All

The extent of using modern technology	GE	SW	VL	NA
Seeds (HYV)	600	0	0	0
	(100.00)	(0.00)	(0.00)	(0.00)
Fertilisers				
Chemical fertilizer	571	29	0	0
	(95.17)	(4.83)	(0.00)	(0.00)
Organic manure	165	277	2	156

	(27.50)	(46.17)	(0.33)	(26.00)
Plant protection				
Pesticides	472	108	2	18
	(78.67)	(18.00)	(0.33)	(3.00)
The extent of using modern technology	**GE**	**SW**	**VL**	**NA**
Weedicides	324	126	4	146
	(54.00)	(21.00)	(0.67)	(24.33)
Irrigation(Canal/Motor)	596	2	0	2
	(99.33)	(0.33)	(0.00)	(0.33)
Mechanisation				
Ploughing (Tractor)	600	0	0	0
	(100.00)	(0.00)	(0.00)	(0.00)
Sowing (paddy Seeders)	0	0	3	597
	(0.00)	(0.00)	(0.50)	(99.50)
Seedling (in trays/Sheets)	0	0	3	597
	(0.00)	(0.00)	(0.50)	(99.50)
Transplanting (Transplanter)	0	0	3	597
	(0.00)	(0.00)	(0.50)	(99.50)
Harvesting (Combine harvester)	595	0	0	5
	(99.17)	(0.00)	(0.00)	(0.83)
Post Harvesting	0	3	294	303
	(0.00)	(0.50)	(49.00)	(50.50)

Source: Primary Data

Note: Figure within parentheses indicate the percentage

It is observed from the above table that the respondents were using modern technology for the selected factors as follows; great extent (100 per cent) for sowing seeds, great extent (95.17 per cent) for chemical fertilisation, somewhat (46.17 per cent) for launching organic manure. The respondents were using modern technology at great extent (78.67 per cent) for pesticides, great extent (54 per cent) for weedicides, great extent (99.33 per cent) for irrigation. The respondents were using mechanisation in the paddy field at great extent (100 per cent) for ploughing, not at all (99.50 per cent) using for sowing, not at all (99.5 per cent) using for seedling, not at all (99.5 per cent) using for transplanting, great extent (99.17 per cent) using for harvesting, and not at all (50.50 per cent) using for post-harvesting.

The key finding states that the respondents were using modern technology at great extent for seeds, chemical fertiliser, organic manure, pesticides, weedicides, irrigation, ploughing, and harvesting.

The following table describes the factor influences for mechanisation in paddy cultivation.

Table 2. Factors Influences for Mechanisation

Factors influence to Select Mechanisation	Rank-1	Rank-2	Rank-3	Rank-4	Rank-5	Rank-6
Replacement of labour	265	162	117	41	10	5
	(44.17)	(27.00)	(19.50)	(6.83)	(1.67)	(0.83)
Quality of work	18	31	119	292	66	74
	(3.00)	(5.17)	(19.83)	(48.67)	(11.00)	(12.33)
Minimizing the wastage	68	127	225	96	50	34
	(11.33)	(21.17)	(37.50)	(16.00)	(8.33)	(5.67)
Quicken the process time	239	252	56	27	18	8
	(39.83)	(42.00)	(9.33)	(4.50)	(3.00)	(1.33)
Better price of goods	2	12	30	57	183	316
	(0.33)	(2.00)	(5.00)	(9.50)	(30.50)	(52.67)
Better yield	8	16	59	87	265	165
	(1.33)	(2.67)	(9.83)	14.50 %	(44.17)	(27.50)

Source: Primary Data

Note: Figure within parentheses indicate the percentage

The above table depicts the respondents' preference towards mechanisation in paddy cultivation. The result states that 44.17 per cent of the respondents preferred rank-1 for replacement of labour, 42 per cent of them chose rank-2 for quicken the processing time, 37.5 per cent of them preferred rank-3 for minimising the wastage, 48.67 per cent of them preferred rank-4 for quality of work, 44.17 per cent of them preferred rank-5 for better yield, and 52.67 per cent of them preferred rank-6 for a better price of goods.

The key finding states that most (44.17 per cent) of the respondents preferred mechanisation in paddy cultivation for the replacement of human labour (rank-

Average Score Analysis

The following table depicts the weighted average score analysis to predict the extent of using modern technology among the list of factors considered for evaluation.

Table 3. Average Score – Extent of using Modern Technology in Paddy Cultivation

Extent of using Modern Technology	Avg. Score	Final Rank
Base		
Seeds (HYV)	4.00	1
Fertilisers		
Chemical fertilizer	3.95	1
Organic manure	2.75	2
Plant protection		
Pesticides	3.72	2
Weedicides	3.05	3
Irrigation (Canal/Motor)	3.99	1
Mechanisation		
Ploughing (Tractor)	4.00	1
Sowing (paddy Seeders)	1.01	4
Seedling (in Trays/Sheets)	1.01	4
Transplanting (Transplanter)	1.01	4
Harvesting (Combine harvester)	3.98	2
Post Harvesting (Machines)	1.50	3

The above table illustrates the weighted average score analysis of the extent of using modern technology in paddy cultivation in the study area. The paddy seed is considered as a base and noticed that farmers are using the High Yield Variety (HYV) seeds to great extent. Similarly, the farmers are using chemical fertiliser at a great extent (3.95) and organic manure at somewhat extent (2.75) in the paddy field. With reference to the plant protection factor, irrigation (3.99) and pesticides (3.72) are great extents using

through modern technology, whereas weedicides (3.05) is somewhat extent using modern technology. Finally, the mechanisation covers six activities and among the list ploughing (4.0), harvesting (3.98) are great extent using through modern technology. Combine harvester done both harvesting and post-harvesting operation. So, the post-harvesting process by using other machinery (1.5) is in a minimal ratio and other activities such as sowing, seedling, and transplanting are not at all using through modern technology.

The key finding states that farmers are a great extent using seeds, chemical fertiliser, irrigation, ploughing, and harvesting through modern technology

ANOVA

The following table depicts the analysis of variance between the mean usage of mechanisation for farm practices and the type of farmer in the paddy cultivation.

Ho: There is no significant difference in the mean usage of mechanisation for farm practices on the type of farmers.

Table 4. ANOVA – Mean Usage of Mechanisation for Farm Practices vs Type of Farmers

Type of Farmers	Usage of Mechanization for Farm Practices				
	N	Mean	SD	F-value	p-value
Small	200	2.08	0.11	1.229	0.293
Medium	200	2.07	0.10		
Large	200	2.09	0.09		
Total	600	2.08	0.10		

Significance tested at 5% level

The above table depicts the analysis of variance between the mean usage of mechanisation for farm practices and the type of farmer. The mean and standard deviation values of the farmers are as follows; small farmer 2.08±0.11, medium farmer 2.07±0.10 and large farmer 2.09±0.09. The analysis is tested at 5 per cent level of significance. It is observed from the resultant table 4.67 that the F-value is 1.229, and its p-value is 0.293, which is greater than the level of significance 0.05. Hence, the result denied the significant difference exists among the type of farmers on the mean preference of mechanisation for farm practices in paddy cultivation. The subsequent Figure 1 illustrates the mean plot of the result predicted for the usage of mechanisation for farm practices.

The key finding states that the type of farmer has not found a significant difference in the mean usage of mechanisation for farm practices in paddy cultivation. The large farmers use slightly more mechanisation for farm practices than other farmers in paddy cultivation.

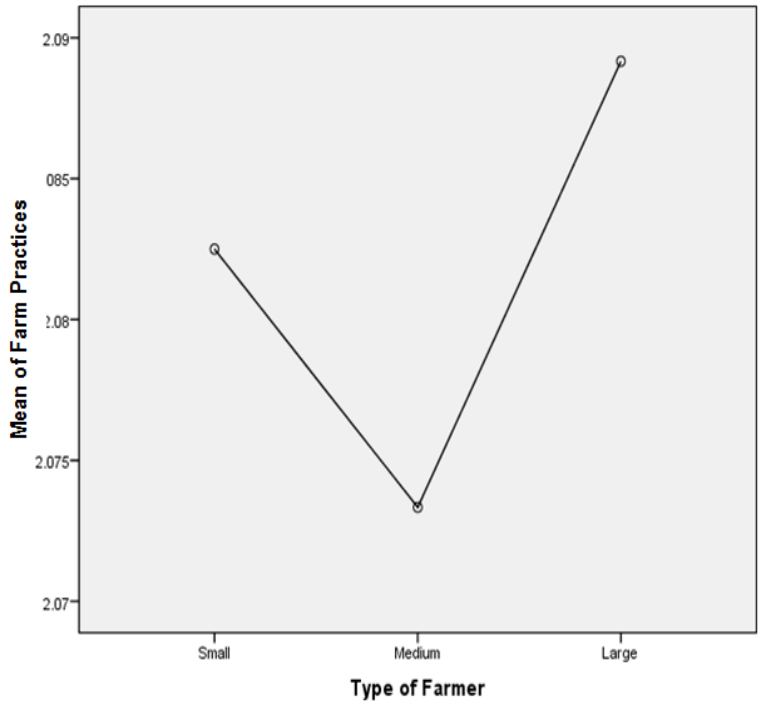


Fig. 1. Usage of Mechanisation for Farm Practices versus Type of Farmer

Mechanisation-Average Rank Analysis

Due to the latest advancement and innovations, human activities are mainly performed using mechanisation. It helps the human to reduce their current workload and completes the given task as earlier as possible. This mechanisation is mainly used to simplify human works in an effective manner. The following table shows the weighted average rank analysis to predict the factor influences to select the mechanisation in the paddy cultivation.

Table 5. Average Rank – Factor Influences to Select Mechanisation

Factor influences to Select Mechanisation	Avg. Rank	Final Rank
Replacement of labour	1.92	2
Quality of work	3.34	5
Minimising the wastage	2.77	4
Quicken the processing time	1.85	1
Better price of goods	2.62	3
Better yield	3.42	6

It is observed from the above table 5 that six factors are considered to measure the influence on mechanisation in paddy cultivation. The weighted average rank analysis method is used to predict the preference order of the factors considered for evaluation. The preference order of automation respectively, quicken the processing time (1.85) as rank-1, replacement of human labour (1.92) as rank-2, better price of goods (2.62) as rank-3, minimising the wastage (2.77) as rank-4, quality of work (3.34) as rank-5 and better yield (3.42) as rank-6.

The key finding states that among the list of factors considered for the influence of mechanisation in the paddy field is quicken the process time. Further, it can be used for the replacement of human labour and better price of goods.

The extent of Mechanisation in Ploughing in Selected Blocks

Ploughing is a vital farm practice in Paddy cultivation. Now a day's ploughing is generally a mechanised activity done by a tractor. In order to understand the extent of mechanisation in ploughing in different blocks, Kruskal Wallis H test is performed. The following table shows the hypothesis test summary of the study.

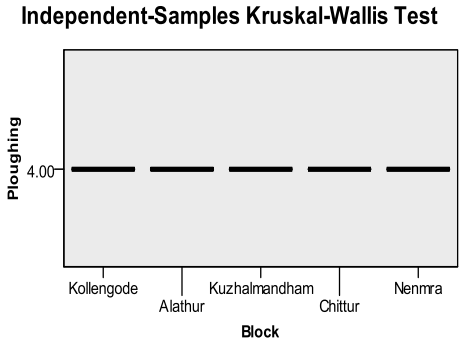
Ho: There is no significant difference in the distribution of ploughing in the selected blocks.

Following hypotheses, test summary depicts the usage of Ploughing in selected blocks.

Table 6: Test results

Test	Sig.
Independent- Samples Kruskal -Wallis Test	1.000

Hence the test results are insignificant at 5% the set hypothesis is accepted



Total N	600
Test Statistic	.000
Degrees of Freedom	4
Asymptotic Sig. (2-sided test)	1.000

1. The test statistic is adjusted for ties.
2. Multiple comparisons are not performed because the overall test does not show significant differences across samples.

Fig.2. The extent of Ploughing in Selected Blocks

Table 6 illustrates the Kruskal-Wallis H analysis regarding the extent of mechanisation in ploughing in paddy cultivation. The main intention of this analysis is to assess the differences between blocks such as Kollegode, Alathur, Kuzhalmannam, Chittur and Nemmara in the study area. It is observed from the result that the p-value (sig.) is equal to the level of significance 0.1. Hence, hypothesis retains the usage of ploughing is same in selected blocks. The pair-wise comparison is not performed due to any difference between the selected blocks. Fig 2 depicts the selected blocks have found no significant difference in ploughing.

The key finding states that no significant difference found in the usage of ploughing in selected blocks.

The extent of Mechanisation in Harvesting in Selected Blocks

Harvesting is a crucial mechanised activity in the paddy fields. Combine harvester is widely used in this district for harvesting operations. Mechanisation in paddy fields is mainly on ploughing and harvesting operations.

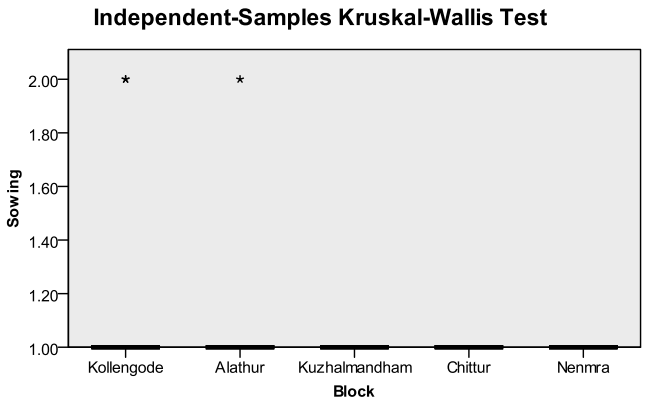
Ho: There is no significant difference in the distribution of harvesting operations in selected blocks.

The following table depicts the Kruskal-Wallis H test for the distribution of harvesting operations in selected blocks of the study area.

Table 7. Test results

Test	Sig.
Independent- samples Kruskal -Wallis Test	.196

Hence the test results are insignificant at 5% the set hypothesis is accepted



Total N	600
Test Statistic	5.351
Degrees of Freedom	4
Asymptotic Sig. (2-sided test)	.253

1. The test statistic is adjusted for ties.
2. Multiple comparisons are not performed because the overall test does not show significant differences across samples.

Fig. 3. The extent of Mechanisation in Harvesting in Selected Blocks

Table 7 and fig 3 illustrates the Kruskal-Wallis H analysis regarding the extent of mechanisation in harvesting. The main intention of this analysis is to assess the differences between blocks such as Kollegode, Alathur, Kuzhalmannam, Chittur and Nemmara in the study area. It is observed from the result that the p-value (sig.) is more significant than the level of significance 0.05. Hence, hypothesis retains the usage of harvesting is same in selected blocks. The pair-wise comparison is not performed due to any difference between the designated blocks. The blocks have found no significant difference in harvesting.

The key finding states that no significant difference found in the usage of harvesting in selected blocks.

Analysis of Variance (ANOVA)

The following table shows the analysis of variance of mean machine labour by human labour ratio on the type of farmer.

H_0: The mean ML/HL ratio has no significant difference in the type of farmer

Table 8. ANOVA – ML/HL Ratio vs Type of Farmer

Crop	Type of Farmer	Machine Labour / Human Labour Ratio				
		N	Mean	SD	F-Value	P-Value
First Crop	Small	200	0.47	0.11	2.033	0.132
	Medium	200	0.50	0.12		
	Large	200	0.50	0.24		
	Total	600	0.49	0.17		
Second Crop	Small	200	0.43	0.10	5.984	0.003
	Medium	200	0.47	0.14		
	Large	200	0.45	0.11		
	Total	600	0.45	0.12		

Significance tested at 5% level

Table 8. depicts the analysis of variance between the mean machine labour cost by human labour cost ratio and type of farmers involved in the paddy cultivation in the study area. The mean and standard deviation values of the first crop are as follows; small farmer 0.47±0.11, medium farmer 0.50±0.12, large farmer 0.50±0.24. Similarly, the mean and standard deviation values of the second crop are as follows; small farmer 0.43±0.10, medium farmer 0.47±0.14, large farmer 0.45±0.11. The analysis is tested at Five per cent level of significance. The first crop's F-value = 2.033, p-value = 0.132 and second crop's F-value = 5.984, p-value = 0.003. It is observed from the resultant table that second crop's p-value is less than the level of significance 0.05. Therefore, the result confirms the significant difference exists among the type of farmers on the mean machine labour cost by human labour cost during the second crop.

The key finding states that the type of farmer has found a significant difference in the mean ML/HL cost ratio during the second crop of paddy cultivation.

sIV. Descriptive Analysis

The following table shows the descriptive analysis of cost incurred during the first crop.

Table 9. Descriptive – Mean Cost Incurred in First Crop

First Crop	Mean Cost	Per cent
Human Labour	12156.38	48.03
Machine Labour	6127.36	24.21
Other	7027.46	27.76
Total	25311.20	100.00

Table 9. depicts the mean cost incurred during the first crop, such as human labour Rs.12156.38 per acre, machine labour Rs.6127.36 per acre and other input cost Rs.7027.46 per acre. Among the overall costs incurred during the first crop, 48.03 per cent of the amount is for human labour, 24.21 per cent of the amount is for machine labour and remaining 27.76 per cent of the amount is for other input items.

The key finding states that among the overall cost incurred during the first crop major part (48.03 per cent) is for human labour.

The following table shows the descriptive analysis of the cost incurred during the second crop.

Table 10. Descriptive – Mean Cost Incurred in Second Crop

Second Crop	Mean Cost	Per cent
Human Labour	12406.75	49.45
Machine Labour	5971.60	23.80
Other	6709.68	26.74
Total	25088.02	100.00

Table 10 depicts the mean cost incurred during the second crop such as human labour Rs.12406.75 per acre, machine labour Rs.5971.60

per acre and other input cost Rs.6709.68 per acre. Among the overall costs incurred during the second crop, 49.45 per cent of the amount is for human labour, 23.80 per cent of the amount is for machine labour and remaining 26.74 per cent of the amount is for other input items.

The key finding states that among the overall costs incurred during the second crop major part (49.45 per cent) of the amount is for human labour cost.

The following table shows the descriptive analysis of paddy cultivation summary.

Table 11. Descriptive – Summary of Paddy Cultivation

Paddy Cultivation	ML/HL Ratio	Mean Cost	Mean Yield
First Crop	0.49	Rs.22,708	1762
Second Crop	0.45	Rs.21,454	1883

Table 11 depicts the summary of paddy cultivation during the first and second crop. The result states that machine labour by human labour ratio of the first crop is 0.49, and the second crop is 0.45. It means that less machine labour is required for the second crop. Similarly, the farmer's cots are Rs.22708 per acre for the first crop and Rs.21454 per acre for the second crop. This context also exhibits as the second crop is more cost-effective than the first crop in paddy cultivation. Finally, the mean yield is considered for evaluation; the result states that the mean product of the first crop is 1762 kg per acre, whereas the second crop yield is 1883 kg per acre. It means that high yield is received during the second crop with less cost.

V. CONCLUSION

The key finding states that the second crop of paddy cultivation is significant in terms of high yield (1883 kg per acre) with less cost (Rs.21454 per acre) compared to the first crop. An important point to be noticed is that machine labour cost in the first crop is high compared to the second crop is because of the wet nature of the field in the autumn season. Intensive use of machinery like a tractor and combine harvester for the first crop leads to more cost. The mechanisation is gradually increasing in every field; as such, it also influences in the agriculture field. The result reveals that mechanisation in the paddy field is primarily quickened the processing time, reduces the dependency of human labour and helps to optimise the price of goods. The benefit of mechanisation differs based on the type of farmers such as average earnings, average spending ratio between machine labour and human labour. In

general, the second crop of paddy cultivation is significant in terms of high yield (1883 kg per acre) with less expenditure (Rs.21454 per acre) compared to the first crop. The share of human labour cost is around 48 per cent, Machine labour cost is 24 per cent, and other input item costs constitute 28 per cent. In the context of labour shortage, there is further scope for increasing selected mechanisation in the study area. Therefore, in both situations, it is identified that human labour, machine labour, other input items are majorly contributing to the monetary benefits extracted from the paddy fields.

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