Original Research Article

ADOPTION PATTERN OF MECHANIZATION OF PADDY FARMS IN WEST GODAVARI DISTRICT OF ANDHRA PRADESH

ABSTRACT

Farm mechanization is a crucial component of contemporary agriculture. Along with lowering labour costs and human drudgery, it increases productivity. Mechanization enhances the safety and comfort of agricultural workers, the efficiency with which other inputs are used, and the quality and added value of the produce. The present study assesses the adoption pattern of farm mechanization at farm level among 120 sample paddy farmers of West Godavari district of Andhra Pradesh. Adoption index was applied for selected sample respondents to study their adoption of machinery at different operations performed during paddy production. The overall adoption index score was 45.78. Complete adoption of mechanization was found in plant protection operation, tillage operations have average adoption index of 77.19. There was no mechanization observed in inter cultural operations and mechanization in sowing, transplanting and harvesting was observed mainly in large farms.

Key words : *Adoption Pattern , Adoption Index ,Farm mechanization , Paddy farmers*

INTRODUCTION

In India, the agriculture sector's contribution to the economy is crucial. In addition to fulfilling the ever-increasing population's food and nutritional needs, it has fostered the service and industrial sectors and contributed to macroeconomic stability. During the Green Revolution, the sector reached self-sufficiency by using better inputs such high-yielding varieties (HYVs) and inorganic fertilizers. Since then, the agriculture sector had amazing expansion and now it has reached a substantial worldwide footprint in terms of the production of important staple foods like rice, wheat, milk, sugarcane, fruits and vegetables. More than half of the workforce (54.60%) is employed by the nation's agricultural and allied industry, which makes for around 3.9 % of the GDP. (Department of Economic Affairs 2022).

In contrast to the western countries where farm mechanization has exceeded 90 per cent, India is just in the early phases of farm mechanization, with a mechanization level of 40–45per cent (World Bank Open Data 2019).

Farm mechanization is a crucial component of contemporary agriculture since it helps to boost production and make wise use of other inputs like seeds, fertilizers, chemicals & pesticides and natural resources like water, soil nutrients, etc., while also lowering labor costs and human toil.

In addition to the agricultural, social and economic growth drivers of mechanization, macroeconomic and fundamental variables like the expanding population and demand, urbanisation, spike in agricultural exports like tractors, better flow of agricultural financing, labour migration and shortages are also pressing India's agriculture toward the adoption of mechanized solutions for long-term and sustainable growth. In view of the efforts being made to modernize Indian agriculture, mechanization in an important element (Vatsa, 2013)

Farm mechanization in India has substantial drivers and potential, but the sector also confronts difficulties due to fragmented landholdings, supply-demand mismatches heavily reliant on market subsidies, inadequate implementation of support programmes by the government, inefficiencies in the distribution of subsidies, and a lack of skilled workers.

The difficulties of timely farm operations, uniform technology adoption, and the availability of location-specific farm equipment and machinery are increased by the varied soil, climatic conditions, geography, flora, and fauna throughout the country (Mehta et al., 2014a). Higher level of mechanization increases the overall technical efficiency of the farms (Pooja *et.al,*.2021).

By attaining timeliness in farm operations, improving input usage efficiency, lowering unit cost of production, and raising competitiveness, farm mechanization serves a complementary role to address the aforementioned issues and to contribute to boosting output, productivity, and profitability in agriculture. It improves agriculture operations' timeliness while simultaneously lowering labour costs and eliminating human drudgery. Therefore, balancing the labour requirements for agriculture and Agro-based sectors.

Farm mechanization has been rising significantly over the years as a result of various programmes that the Indian government has launched and fair involvement from the private sector. This is seen by the sales of tractors and power tillers, which are used as a measure of the adoption of mechanized farming methods during the past four years and are shown below.

Table 01. Year wise sale of tractors and power tillers in the country

Year	Tractor sales (no.)	Power tiller (No.)
2017-18	796873	51680
2018-19	897548	51523
2019-20	785059	46476
2020-21	988028	54175

SOURCE : Department of Agriculture & Farmers Welfare– Annual report 2021-22

In India, there are various obstacles to farm mechanization in the farm sector. The use of farm machinery is significantly impacted by the size of land holdings, particularly small land holdings, 80 per cent of farm holdings were less than 2 hectares in size, with 62 per cent average less than half a hectare (Mehta *et al.,* 2014). In order to cultivate rice, farmers mostly employ three types of power: tractors, power tillers, and animals. Due to rising maintenance costs and limited capacity, declining animal populations. Farm mechanization is an imperatively needed at this juncture (Shrivastava *et al.,* 2021).

Different researches showed and experimented that the farm size and the machineries are the important factors deciding the rice production (Chidambaram 2013). Mechanization in rice production and post-harvest processing is a technology package that guarantees the efficiency of each farm operation, maximizes the use of available land, improves the effectiveness of other inputs, lowers farming costs, lowers losses, raises the quality of the produce and adds value to it. In Indian agricultural system there is a direct relationship between the farm power availability on farms and farm productivity (Guru et al, 2018; Din et al, 2014). Making research and extension more farmer-focused is the biggest issue for the future of rice cultivation (Guru *et.al.,* 2022).

The machinery available and used in rice production practices is shown in table 02.

Table 02. Farm implements and machines used in rice production

S.No.	OPERATION	IMPLEMENTS/MACHINERY USED
01.	Tillage	MB Plough, Reversible plough, Cultivator, Disc harrow, Puddler, Laser guided land leveler, Rotavator
02.	Sowing/planting	Self-propelled riding type transplanter, walk behind transplanter
03.	Intercultural operations	Power weeder, Sprayer, Cono-weeder, Hand hoe, Rotary weeder, Fertilizer applicators, Deep placement urea applicators
04.	Harvesting	Self-propelled vertical conveyor reaper, Reaper cum binder, Combine harvester

DATA SOURCES AND METHODOLOGY

The West Godavari district was purposively selected as it has the highest paddy production. A multi stage random sampling procedure was used with West Godavari district as universe at the first stage, Eluru division as second stage, Tadepalligudem and Ungutur mandals as third stage, villages (Krishnayapalem, Madhavaram, Tadepalle, Garapadu, Atkuru, Ungutur) as fourth stage and the ultimate sampling units were the paddy farmers. 20 farmers from each village were randomly selected to the tune of total sample size of120. A very well structured and pre- tested interview schedule was prepared and used in collection of primary data.

TOOLS OF ANALYSIS

i) Adoption Index :

To study the extent of mechanization in paddy production, the adoption intensity index was used. The extent of adoption of mechanization in paddy was worked out for individual respondents for all practices. The level of adoption was measured by computing the adoption score. The score one is assigned for adoption and zero is assigned for non-adoption.

The total score for a respondent was obtained by summing up the score obtained on adoption of farm machinery in different operations of paddy production.

The respondents were then categorized into low, medium and high based on average and standard deviation. The adoption index for each respondent was calculated by using following formula:

$$\text{Adoption index} = \frac{\text{Respondents total score}}{\text{Total possible score}} \times 100$$

Depending upon the extent of adoption of machinery the respondents were categorized as follows:

1) Low adopters (up to 33per cent)

2) Medium adopters (34-66per cent)

3) High adopters (67-100per cent)

ii)Multiple Regression Analysis:

It was employed to find out the effect and extent of influence of each independent variable contributing significantly towards the dependent variable i.e., adoption index. The

selected independent variables selected were age of the farmer, educational status, family size, farm size, income, labour and inputs. The algebraic expression is given as below -

$Y=b_0+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X5+b_6X_6+b_7X_7+e$

Where;

Y =Adoption Index (%)

X_1 = Age of the farmer (in years)

X_2 = Educational status (in school years)

X_3 = Family size (in no.)

X_4 = Farm size (in ha)

X_5 = Income (in Rs.)

X_6 = Labour (in Rs.)

X_7 = Inputs (in Rs.)

RESULTS AND DISCUSSION

a)General characteristics of farmers

It was observed that more than one-third (35.83%) of respondents belonged to the age group between 51-74. Around 61.7 per cent belonged to a joint type of family, 36.67 per cent were small land holding farmers and around 40.83 per cent of them have degree education. The primary occupation of respondents was agriculture. (Table 03)

Table 03. Distribution of respondents according to general characteristics (N=120)

S.no	Characteristics	Frequency	Percentage
A.	**Age**		
	30 years and below	10	8.33
	31 - 40 years	31	25.83
	41 - 50 years	36	30.00
	More than 50 years	43	35.83
B.	**Family type**		
	Nuclear	46	38.40
	Joint	74	61.70
C.	**Family size**		
	upto 2	4	3.33
	3 – 5	26	21.67
	More than 5	90	75.00

	Average family size	4.6	
D.	**Educational status**		
	Illiterate (0)	0	0.00
	Primary (class 1 to class 5)	29	24.17
	Secondary (class 6 to class 10)	42	35.00
	College	49	40.83
E.	**Farm size**		
	Upto 1ha	18	15.00
	1.1 to 2.0 ha	44	36.67
	2.1 to 4.0 ha	37	30.83
	More than 4 ha	21	17.50
	Average farm size (in ha.)	6.79	

Source : Field survey, 2022

b)Adoption of machinery during different operations in paddy production

The overall adoption index was 45.78. Around 94.16 per cent were medium adopters and 5.83 per cent were low adopters. For tillage operations, around 92.5 per cent of respondents showed a high extent of adoption. In sowing only 5 per cent of respondents were partially adopted while the remaining were non-adopters. All the respondents adopted machinery for plant protection operations while there was zero adoption for intercultural operations. For harvesting 18.3 per cent of respondents adopted machinery.(Table 04)

Table 04. Adoption Index of machinery during different operations of paddy production

(N=120)

S.No.	Operation	Category for level of Adoption	Frequency	Percentage
01.	Tillage	Low (upto 33) Medium(34 to 66) High(67 to 100)	0 9 111	0 7.5 92.5
02.	Sowing/planting equipment	Low (upto 33) Medium(34 to 66) High(67 to 100)	114 6 0	95 5 0
03.	Intercultural operations	Low (upto 33)	120	100

		Medium(34 to 66)	0	0
		High(67 to 100)	0	0
04.	Plant protection	Low (upto 33)	0	0
		Medium(34 to 66)	0	0
		High(67 to 100)	120	100
05.	Harvesting	Low (upto 33)	120	100
		Medium(34 to 66)	0	0
		High(67 to 100)	0	0
06.	Overall	Low (upto 33)	7	5.83
		Medium(34 to 66)	113	94.16
		High(67 to 100)	0	0

Source : Field survey 2022

c)The regression analysis (multiple regression)

The multiple regression analysis was carried out to find out the effect and extent of influence of independent variables to levels of adoption of mechanization in paddy production. The results of analysis are presented in Table 05.

Table 05. Multiple Regression Analysis of Adoption Index with selected independent variables

Independent variable	**Coefficient**	**t-value**
Constant	3.103	8.205
Age of the farmer (X_1)	-0.007***	-0.93
Educational status (X_2)	0.030**	0.67
Family size (X_3)	-0.006***	-0.32
Farm size (X_4)	0.848	2.79
Income (X_5)	0.001***	0.07
Labour (X_6)	-0.299	-0.26
Inputs (X_7)	0.062	0.81

*** significant at the 0.01 level of probability; ** significant at the 0.05 level of probability

$R^2 = 0.64$

The age of the farmer and family size had a negative contribution towards the extent of adoption of machinery at one per cent level of significance and income had a positive relationship with the extent of adoption of machinery at one per cent level of significance.

Educational status had positively influenced the extent of adoption of machinery at five per cent level of significance.

The coefficient of determination (R^2 value) was 0.64, which could indicate that there was 64 per cent variation in the adoption gain levels of mechanization in paddy production was explained by independent variables selected for the study.

CONCLUSION

The overall adoption of machinery for paddy production was medium level in the study area. High extent of adoption was in operations for tillage, plant protection . Whereas low adoption was observed in sowing and harvesting operations and no adoption of machinery was intercultural operations. The major factors for adoption of machinery as perceived by farmers were timely unavailability of labour and high labour charges .While few small implements like ploughs and sprayers were owned by farmers but most of the large farm machinery have hired from custom hiring centres or from other large farmers. Combine harvesters and rice transplanter were mostly used by large farmers. The regression analysis showed the coefficients of educational and income were positively significant and age of the farmer and family size were negatively influenced. The community-based organisations on cooperative basis need to be developed for custom hiring operating system in the clusters of villages which would go a long way in further reducing the cost of production in paddy and increasing profitability in paddy farming.

Consent

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

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