

## Original Research Article

### **A STUDY ON ADOPTION PATTERN OF MECHANIZATION OF PADDY FARMS IN WEST GODAVARI DISTRICT OF ANDHRA PRADESH**

#### **ABSTRACT**

Farm mechanisation is a crucial component of contemporary agriculture. Along with lowering labour costs and human drudgery, it increases productivity. Mechanization also 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 No's sample paddy farmers of West Godavari district. 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 mechanisation was found in plant protection operation, tillage operations have average adoption index of 77.19. There was no mechanisation observed in inter cultural operations and mechanisation 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 fertilisers. 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 over 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 Western countries where farm mechanisation has exceeded 90 per cent, India is just in the early phases of farm mechanisation, with a mechanisation 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 mechanisation, 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 mechanised solutions for long-term and sustainable growth.

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

By attaining timeliness in farm operations, improving input usage efficiency, lowering unit cost of production, and raising competitiveness, farm mechanisation 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 mechanisation 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 mechanised farming methods during the past four years and are shown below.

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

<b>Year</b>	<b>Tractor sales (no.)</b>	<b>Power tiller (no.)</b>
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 mechanisation in the farm sector. The use of farm machinery is significantly impacted by the size of land holdings, particularly small land holdings, 80per cent of farm holdings were less than 2 hectares in size, with 62 percent 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, animal populations are declining on farms. (Shrivastava *et al.*, 2021).

Mechanization of rice production and post-harvest processing is a technology package that guarantees the efficiency of each farm operation, maximises 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.

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

**Table 02. Farm implements/machines used for rice production**

<b>S.No.</b>	<b>OPERATION</b>	<b>IMPLEMENTS/MACHINERY USED</b>
01.	Tillage	MB Plough, Reversible plough, Cultivator, Disc harrow, Puddler, Laser guided land leveller, Rotavator
02.	Sowing/planting	Self-propelled riding type transplanter, walk behind transplanter
03.	Interculture 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**

West Godavari district and Eluru division were purposively selected as they have 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 selected at random making the sample size 120. 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 adoption intensity index was used. The extent of adoption of mechanization in paddy was worked out for individual respondent for all practices. The level of adoption will be measured by computing adoption score. Score one is assigned for adoption and score zero is assigned for non-adoption.

Chart 1 : Adoption pattern and score

ADOPTION PATTERN	SCORE
Not adopted	0
Adopted	1

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

The respondents are then categorised into low, medium and high based on average and standard deviation. The adoption index for each respondent is 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. Independent variables selected were age of the farmer, educational status, family size, farm size, income, labour, inputs. The algebraic expression is given as,

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + e$$

Where;

$$Y = \text{Adoption Index}$$

$X_1$  = 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 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
<b>A.</b>	<b>Age</b>		
	Upto 30 years	10	8.33
	31 - 40 years	31	25.83
	41 - 50 years	36	30.00
	More than 50 years	43	35.83
	Average age ( in yrs.)	46.99	
<b>B.</b>	<b>Family type</b>		
	Nuclear	46	38.40
	Joint	74	61.70
<b>C.</b>	<b>Family size</b>		
	upto 2	4	3.33
	3 – 5	26	21.67
	More than 5	90	75.00
	Average family size	4.6	
<b>D.</b>	<b>Educational status</b>		
	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
<b>E.</b>	<b>Farm size</b>		
	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 high extent of adoption. For sowing only 5 per cent of respondents were partially adopted while 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)	0	0
		Medium(34 to 66)	9	7.5
		High(67 to 100)	111	92.5
02.	Sowing/planting equipment	Low (upto 33)	114	95
		Medium(34 to 66)	6	5
		High(67 to 100)	0	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	Co-efficient	t-value
Constant	3.103	8.205
Age of the farmer (X <sub>1</sub> )	-0.007***	-0.93
Educational status (X <sub>2</sub> )	0.030**	0.67
Family size (X <sub>3</sub> )	-0.006***	-0.32
Farm size (X <sub>4</sub> )	0.848	2.79
Income (X <sub>5</sub> )	0.001***	0.07
Labour (X <sub>6</sub> )	-0.299	-0.26
Inputs (X <sub>7</sub> )	0.062	0.81

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

The regression equation for the study is given as follows

$$Y=3.103-b_10.007***+b_20.030**-b_30.006***+b_40.848+b_50.001***-b_60.299+b_70.062$$

Age of the farmer and family size showed negative contribution towards the extent of adoption of machinery at one per cent level of significance and income showed positive relation towards extent of adoption of machinery at one per cent level of significance.

Educational status showed positive contribution towards extent of adoption of machinery at five per cent level of significance.

The coefficient of determination ( $R^2$  value) was 0.64, which indicates that there is 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 for paddy farmers in the study area. High extent of adoption was found in operations for tillage, plant protection . Whereas low adoption was observed in sowing and harvesting operations and no adoption of machinery in 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 status, income, farm size and inputs were positive and for age of the farmer, family size and labour were negative. 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 thereby increasing its profitability.

## **REFERENCES**

- Department of Agriculture & Farmers Welfare Ministry of Agriculture & Farmers Welfare, Annual report 2021-22
- Department of Economic Affairs , Economic Survey 2022.
- Farm mechanisation: Ensuring a sustainable rise in farm productivity and income FICCI,2019
- Mehta, C. R., N. S. Chandel, T. Senthilkumar, K. K. Singh. 2014a. Trends of Agricultural Mechanization in India. CSAM Policy Brief, 2: 1-13.
- Shrivastava, A.K., Khandelwal, N. K., Dubey. R. K. and P. K. Guru. 2021. Long term study of declining animal usage in Indian agriculture. Agricultural Engineering International: CIGR Journal, 23(1): 109-114
- World Bank Open Data 2019, FederUnacoma, PwC analysis