

## Determinants and effect of KVK Adoption on Various Efficiency Measures of Farms in Khargone District of Madhya Pradesh

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**Abstract:** The study examined the technical, allocative, and economic and scale efficiency of the adopted and non-adopted farmers estimated using data envelopment analysis in Khargone District of Madhya Pradesh. In addition, the factors affecting technical, allocative, scale and economic efficiency of sample farmers in Kharif and Rabi seasons were examined by the OLS regression analysis. No significant difference was found in the mean efficiency score of adopted non-adopted famers except for scale efficiency in rabi season. The factors affecting economic efficiency were fertilizer(kg/ha) and small farm in kharif season and area under crop, adoption status and labour to machine in rabi season. The factors affecting scale efficiency in kharif season were fertilizer (kg/ha), small farm and labour to machine. and in rabi season were area under crop, adoption status, Non-farm income. The major policy implication includes increasing farm mechanisation to sustain scale efficiency and increasing fertilizer application in kharif season.

### Introduction

Farmers are assumed to be rational decision makers. A farmer makes operational decision on what to produce, how to produce and how much to produce. The quality of decision differs from person to person and organization to organization. The characteristics of decision makers influence the quality of decision. At later stage, the quality of decision is reflected in efficiency of the farm unit. Therefore, it is essential that factors affecting different kind of efficiencies are considered so that a constructive approach can be devised to improve the quality of decision. In the past, Paul, Nehring, Banker & Somwaru (2004), Anang, Bäckman & Reztis (2016), and Debebe, Haji, Goshu & Edriss (2015) among several other

researchers attempted to answer this question. On similar lines, this study is focused on finding the determinants of efficiency of farms and suggest pathways for future action.

## **Methodology**

### ***Study area/Data collection***

The Khargone district of Madhya Pradesh was selected purposely selected on account of investigator being well acquainted with the area and time & resources being the major limitations. The Khargone district comprises of nine blocks namely the Bhikangoan, Jhirnya, Gogawan, Kasrawad, Segaoan, Bhagwanpura, Khargone, Mandaleshwar, Maheshwar. Out of these blocks, the Gogawan block was purposively selected from among the blocks adopted by the Krishi Vigyan Kendra of the Khargone District. After selection of block, a list of those villages was prepared where KVK has implemented its programme. From the list of adopted villages, three villages namely Gowadi, Ghughariyakhedi, Devalgaon were selected on purposively.

The study was based on collection of primary data from at least 45 adopted farmers by the KVK and 45 non-adopted farmers present in the study area during 2018 Kharif and 2019 rabi season. A list of all the farmers adopted in different villages by the KVK had been prepare with their size of holding and categorized them into three major strata i.e small (<2 hectare), medium (2-4 hectare) and large (>4 hectares) farms. 15 farmers were selected randomly from each category for the study. On the same lines, non-adopted were selected. The non-adopted farmers were selected from vicinity of adopted farmers so as to minimize the difference in various characteristics of farm & farmers & the environment faced by them thereof .Thus, a total number of 90 farmers were selected for the study.

Data was collected through a pre-tested well designed interview schedule through personal face to face interview from sample farmer. The primary data was collected on all physical inputs applied by farmer in the production process for various enterprises on the farm. The data on prices of inputs purchased from markets and prices of output realized by farmers from the market were collected.

### ***Method of Analysis***

For each farmer, technical, economic, allocative and scale efficiencies were calculated using DEA method. Details on DEA estimation and results of DEA analysis are available from Yadav, S. & Vani, G. K. (2022).

### ***OLS Regression***

The OLS regression was used to find out factors affecting technical and economic efficiency of adopted and non-adopted farmers in the district. List of independent variables to be considered for running regression analysis is as following

1. Area under cultivation and irrigation(acre)
2. Farm size (Dummy)
3. Adoption status (Dummy)
4. Education status (Dummy)
5. Fertilizer (Kg/acre)
6. Land holding (acre)
7. Age (years)
8. Value of Machine total inventory ratio
9. Labour to machine expense ratio
10. Non- farm income range (Dummy)

Best fit was obtained based on lowest value of Akaike information criteria (AIC).

### **Results and Discussion**

The factors affecting technical, allocative, scale and economic efficiency of adopted and non-adopted farmers in Kharif crop are presented in Table 1. From the table it is evident that for every one kilogram of additional fertilizer applied per acre, economic efficiency, allocative and scale efficiency, respectively increases by 0.003, 0.01 and 0.047 units on an average while other things held constant. For every one kilogram of addition fertilizers applied per acre, technical efficiency (crs) decreases by -0.04 units on an average while other constant. Compared to large farmer, the economic efficiency, scale efficiency and technical efficiency (vrs) of small farm units was higher by 0.363, 7.139, 0.188 units on an average while other things held constant, respectively. Compared to large farm units, technical efficiency (crs & vrs) of medium farm unit was higher by 0.134 and 0.149 unit on an average while other held constant, respectively. For every one unit increase in labour to machine ratio of farm, scale efficiency and technical efficiency (vrs) decreases by -0.268 and -0.002 units on an average while other things held constant, respectively. Adoption status and non-farm income had no significant effect on various efficiencies estimated for kharif season in the study. Coefficient of determination (R square adjusted) for most of the regressions presented in table 1 is quite low except for regression involving allocative efficiency as dependent variable. In that case, it is 0.99 which means that 99 percent of the variation present in the allocative efficiency of the farmers is accounted by the independent variables used in the regression model. For scale efficiency, coefficient of determination was 0.3718 which means that 37.18 percent of the variation present in scale efficiency was accounted by all the independent variables used in the regression analysis. In all of the regression analyses performed and presented in table 1, the F statistic is greater than F critical meaning that all the estimated coefficients are jointly significantly different from zero at five percent level of significance.

**Table 1: Factors affecting technical, allocative, scale and economic efficiency of farmers in Kharif season**

<i>Particular</i>	<i>Economic efficiency</i>	<i>Allocative efficiency</i>	<i>Scale efficiency</i>	<i>Technical Efficiency (crs)</i>	<i>Technical Efficiency (vrs)</i>
<b>(intercept)</b>	0.5248** (3.138)	1.358** (2.725)	-0.564 (-0.429)	0.621*** (9.601)	0.512*** (9.60)
<b>Family size (numbers)</b>	-0.028 (-1.458)	-0.091 (-1.628)	-0.076 (0.376)	-	-
<b>Fertilizer (kg/acre)</b>	0.003* (2.618)	0.01* (2.133)	0.047*** (5.581)	-0.004*** (-5.186)	-
<b>Medium farm(Dummy)</b>	0.203 (1.860)	-0.102 (-0.314)	-0.482 (-0.803)	0.134** (2.272)	0.149* (2.433)
<b>Small farm(Dummy)</b>	0.363** (2.951)	-0.185 (-0.505)	7.139** (3.120)	0.112 (1.731)	0.188** (2.965)
<b>Labour to machine expense ratio</b>	-	0.01 (1.589)	-0.2681* (-2.397)	-	-0.002* (0.045)
<b>Adoption status (Dummy)</b>	-	-	-	0.0029 (0.052)	0.069 (1.247)
<b>Non-farm income Rs. 1000 to 10000 (Dummy)</b>	-	-	-	0.112 (1.337)	0.1320 (1.447)
<b>Non-farm income 2(Rs 10000 to 50000) (Dummy)</b>	-	-	-	-0.093 (-1.515)	-0.113 (-1.844)
<b>Non-farm income 3 (Rs 50000 to 100000) (Dummy)</b>	-	-	-	-0.059 (-0.685)	-0.155 (-1.810)
<b>Non-farm income 4 (Rs 1 lakh to 10 lakh) (Dummy)</b>	-	-	-	0.409 (1.712)	0.198 (0.831)
<b>F-statistic (F critical)</b>	6.048 (2.323)	18.28 (0.563)	8.524 (0.54)	5.321 (0.519)	2.014 (0.49)
<b>R-squared adjusted</b>	0.2209	0.99	0.3718	0.282	0.085
<b>AIC</b>	121.56	314.95	418.50	10.34	12.054
<b>No. of observation</b>	90	90	90	90	90

The figures within parenthesis are t-statistic for the respective estimated coefficient.

Table 2 presents the factors affecting technical, allocative, scale and economic efficiency of adopted and non-adopted farmers in the rabi season. Adoption status had positive significant effect on economic and scale efficiency but negative impact on technical efficiency. Non-farm income had positive and significant effect on allocative and technical efficiency. For every one acre additional land cultivation under cultivation, economic efficiency decreases and technical efficiency increases by 0.007 and 0.04 units, on an average while other things held constant, respectively. For every one unit increase in labour to machine expense ratio, economic efficiency decrease by 0.535 units on an average while other held constant. Compared to large farmer, the allocative efficiency of small farm units and medium farm units were higher by 0.716 and 0.423 units an average while other things held constant, respectively. Age of the farmers had positive and significant effect on allocative efficiency but negative impact on technical efficiency. Coefficient of determination

(R square adjusted) for most of the regressions presented in table 8 is quite low except for regression involving scale efficiency as dependent variable. In that case, it is 0. 871 which mean that 87.1 percent of the variation present in the scale efficiency of the farmers is accounted by the independent variables used in the regression model. For economic efficiency, coefficient of determination was 0.415 which means that 41.5 percent of the variation present in economic efficiency was accounted by all the independent variables used in the regression analysis. In all of the regression analyses performed and presented in table 2, the F statistic is greater than F critical meaning that all the estimated coefficients are jointly significantly different from zero at five percent level of significance.

**Table 2: The factors affecting technical, allocative, scale an economic efficiency of farmers in Rabi season**

<i>Particular</i>	<i>Economic efficiency</i>	<i>Allocative efficiency</i>	<i>Scale efficiency</i>	<i>Technical Efficiency (CRS)</i>	<i>Technical Efficiency (VRS)</i>
<b>(intercept)</b>	1.322*** (9.00)	-0.95 (-1.447)	-6.25** (3.651)	1.641*** (4.741)	1.478*** (4.578)
<b>Area under crop acre (acres)</b>	-0.007* (-2.132)	-	0.610*** (14.937)	-	0.04*** (-6.126)
<b>Adoption status (Dummy)</b>	0.09** (3.151)	-	1.092** (3.210)	-0.03 (0.466)	-0.214** (-3.358)
<b>Family size (numbers)</b>	-0.008 (-1.553)	-	-	-	-
<b>Fertilizer (Kg/acre)</b>	-0.003 (-1.917)	-	0.038 (2.224)	-0.004 (-1.502)	-0.0062 (-1.912)
<b>Medium Farm(Dummy)</b>	0.06 (-1.553)	0.423* (2.282)	0.228 (0.601)	-	-
<b>Small Farm (Dummy)</b>	-0.002 (-0.033)	0.716** (2.736)	1.89 (3.510)	-	-
<b>Labour to machine expense ratio</b>	-0.535** (-3.145)	1.67 (1.57)	-	-0.452 (-1.502)	-
<b>Non-farm income (Rs 1000 to 10000) (Dummy)</b>	-	0.41 (1.540)	-0.070 (-0.142)	-0.156* (-1.926)	-
<b>Non-farm income (Rs 10000 to 50000) (Dummy)</b>	-	0.409* (2.108)	0.320 (0.874)	-0.144* (-2.344)	-
<b>Non-farm income (Rs 50000 to 100000) (Dummy)</b>	-	0.670* (2.449)	-1.142* (-2.201)	-0.167* (-1.964)	-
<b>Age (years)</b>	-	0.02* (2.566)	-	-0.006* (-2.375)	-
<b>Machine to Inventory ratio</b>	-	0.338 (1.630)	-	-	-
<b>F-statistic (F critical)</b>	6.77 (0.551)	2.822 (0.544)	49.07 (0.545)	8.319 (0.518)	2.145 (0.36)
<b>R-squared</b>	0.415	0.204	0.871	0.1039	0.2867
<b>AIC</b>	-93.55	126.56	198.44	-13.90	9.44
<b>No. of observation</b>	58	58	58	58	58

The figures within parenthesis are t-statistic for the respective estimated coefficient.

### Summary and Conclusions

Fertilizer quantity and small farm size were the two factors significantly affecting the economic, scale and technical (crs) efficiency of the farmer in kharif season. In addition, labour to machine expense ratio had significant but negative influence on scale efficiency of the farm in kharif season. Adoption status of the farmer and non-farm income had no significant influence on any efficiency level in kharif season.

Contrary to factors found affecting efficiencies in kharif season, during rabi season, fertilizer quantity and small farm size had no significant influence on economic, scale and technical (crs) efficiency of the farmer. However, small and medium farm size significantly and positively influences the allocative efficiency of the farmer in rabi season. Similarly, adoption status of the farmer had significant and positive influence on economic and scale efficiency of the farmer but negative effect on technical efficiency of the farmer in rabi season. Area under crop had significant but negative effect on economic efficiency while positive effect on scale and technical efficiency in rabi season.

Low level of non-farm income had significant and negative influence on technical efficiency of the farmer in rabi season. Age of the farmer had significant and negative influence on technical efficiency of the farmer. Labour to machine expense ratio had negative and significant influence on economic efficiency of the farmer in rabi season.

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