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An assessment of farm efficiency of adopted and non-adopted kvk farms of sant Kabir Nagar district of Uttar Pradesh

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ABSTRACT

In this study, an attempt was made to measure the farm profitability of adopted and non- adopted KVK farms of Sant Kabir Nagar district of Uttar Pradesh. A multistage stratified purposive cum random sampling technique was applied for the selection of district, block, villages and respondents. The primary data were collected through survey on schedule with the help of personal interviews. A list of all the villages falling under selected Pauli and Nath Nagar block were prepared and five villages were randomly selected. The farmers were stratified into two strata (Adopted & Non-adopted). Ultimately, 100 respondents were selected for conducting the detailed study. The data pertained to the agricultural year 2022-23. Both tabular and functional techniques were used for the analysis of data. Present study based on randomly selected 100 respondents of 50 adopted and 50 non- adopted categories with the average size of land holding as 1.35 and 1.15 hectare, respectively. The results pertaining to farm efficiencies that estimated mean of technical, economic, scale and allocative efficiency of KVK adopted respondents was more as compared to non-adopted respondents in kharif as well as in Rabi season. Again, it was found that there is a positive impact of KVK on adopted respondents over non-adopted respondents. The mean difference between adopted and non-adopted respondents for technical efficiency and economic efficiency was found to be significant but allocative efficiency was found to be non-significant in kharif as well as Rabi season.

Keywords: *Profitability, comparison, cost, return, KVK, Efficiency, DEA approach.*

INTRODUCTION

India is referred to as an agricultural nation because the majority of its citizens depend on agriculture for a living. Due to division and fragmentation, the operating holding has currently become small and unprofitable. Small holdings are a disadvantage to agriculture. However, only a small portion (42.39%) of the 328.72mha total reported area is suitable for cultivation. The net sown area (139.35 mha) and gross cropped area (197.32 mha) of this area are not economically viable due to a number of regional environmental, technological, and socioeconomic issues. Due to the prevalence of tiny holdings, there is only a limited possibility for mechanized and technologically advanced farming. Despite all of these challenges, marginal and small farmers consistently work to maximize agricultural potential to boost food production and to adopt other correlated agricultural activities alongside crop production in order to supplement revenue. According to the agricultural census of 2021, India has 139.35 million hectares of operational holdings, with an average size of 1.08 hectares. 85 percent of the assets are classified as marginal or small farms with less than 2 hectares.

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India has a cropping intensity of 141.6%, whereas Uttar Pradesh has a cropping intensity of 162.4%, creating significant land for cultivation.

Since Indian agriculture depends so heavily on the natural world, danger and uncertainty are the primary challenges to its success. In Uttar Pradesh, a high percentage of farmers (92%) have very small plots of land. Marginal holdings average 0.40 hectares, while small farmers typically have 1.43 hectares on an average and providing insufficient income and employment to the family.

Efficiency in business must coexist with the financial success of the farming enterprise. Due to resource limitations, Indian farms are known to run below the efficiency frontier. At this point, policymakers' main role is to assist farmers in overcoming these barriers so that they can move closer to the efficiency frontier. among the several government operatives. There are many stack holders in this sector of the economy, and they are crucial to its development. Krishi Vigyan Kendra (KVK), the light house for rural peoples, is an innovative science-based institution, which undertakes vocational training of farmers, farm women, and rural youths, conduct on-farm researches for technology refinement and organize frontline demonstration to promptly demonstrate the latest agriculture technologies to the farmers as well as the extension workers. The KVK functions on the principle of collaborative participation of scientist, subject-matter experts, extension workers and farmers.

The Indian Council for Agricultural Research (ICAR) and its affiliated institutions established Krishi Vigyan Kendra (KVK) agricultural extension centres at the district level to offer different kinds of farm support to the agricultural sector. On the recommendations of the Mehta committee, the first KVK was formed in Puducherry (Pondicherry) in 1974 as an experimental project. KVKs offer a range of farm support services, including education, training, and the distribution of technology to farmers. Farm Science Centre, also known as Krish Vigyan Kendra, offers solutions to agricultural and associated issues as they arise for local farmers in that area. In the adopted villages, KVKs carry out the following types of activities to achieve the objectives set: (1) Farm Advisory Service. (2) Training programmed for different categories of people. (3) Training programmed for the extension functionaries.

(4) Front Line Demonstration (FLD). (5) On Farm Testing (OFT).

One of Krishi Vigyan Kendra's most significant activities is training. Training is a planned, scientific attempt of improving a person's knowledge, skills, and attitude towards a certain subject. The first and most important thing to take into account before beginning any training plan is an evaluation of training needs. KVK mainly provides the following three forms of training, depending on the need and trainee categories:

1. Training to the practicing farmers and farm women.
2. Training to the Rural Youth.
3. Training programme for the extension functionaries.

The KVK used to provide training on a variety of topics and organize multiple activities at the local level for improving capacity and effective resource utilization, thereby improving the productivity and financial stability of the farming community. Efficiency is the term used to describe "how well" or "how effectively" a decision-making unit combines inputs to produce an output. Technical, economic, allocative, and return to scale efficiency are the primary components of farm efficiency. Technical efficiency focuses on the results obtained from a particular set of inputs and technological capabilities. Allocative efficiency focuses on an economic unit's capacity and desire to reduce production costs for a specific range of input prices through input substitution or reallocation. In order to serve each person or organization in the best possible manner while minimizing waste and inefficiency, economic efficiency requires an economical state.

Hypothesis

H0: The efficiencies (technical, allocative, economic, scale) are the same in case of adopters and non-adopters sample farms.

H1: The efficiencies of the adopted and non-adopted sample farms are not same.

Further, the Government of India has committed itself to rapidly doubling the income of farmers. The KVKs' adoption of the farmers may also enable them to increase their income by double. A KVK run by the Acharya Narendra Deva University of Agriculture & Technology, Kumarganj Ayodhya, is operating in the eastern Uttar Pradesh district of Sant Kabir Nagar, and many farmers have adopted it to increase the productivity and profitability of their farms. In a study titled "A Comparative Study on Farm Efficiency Measures between Adopted and Non-Adopted Farms of Sant Kabir Nagar District of Uttar Pradesh," this KVK, which works well for farmers, can be seen to have an effect on the farmers' ability to generate income in comparison to non-adopted farmers in the district of Sant Kabir Nagar. of eastern Uttar Pradesh.

Keeping the above facts under due consideration, this study seems to generate a specific impact in income and employment generation aspect in study area. The present investigation is carried out with following specific objective

To evaluate the technical, economic and allocative efficiency of adopted and non-adopted farms of the study area

MATERIALS AND METHODS

Study area and data collection

The study was mainly based on primary data to the Sant Kabir Nagar district, Uttar Pradesh which comes under the Eastern Plane Zone Region of Madhya Pradesh. A multistage sampling procedure was followed to select adopted and non-adopted farmers. The study was carried out purposively in Ten villages under two Blocks namely; Haiser and Pauli due to higher concentrated of growing area. After finalization of the list of adopted and non-adopted farmers from different categories was selected in such a way that the major components covered under the scheme get the due representation. And further categorized on the basis of Adoption as follows :(I) KVK adopted (II) Non adopted from each category 50 adopted farmers and 50 non-adopted farmers were selected randomly for fulfilling the objective of the study. To examine the technical efficiency Data Envelopment Analysis (DEA) would be performed using R software. The DEA method is a non-parametric approach to the measurement of efficiency. It does not assume a production function like Stochastic Frontier Analysis does. However, neither of the two can be said as better to the other (Watkins, 2013). DEA consists in preparing an efficient frontier with which to compare the inputs and outputs of the DMUs. In the terminology of DEA, a farm is a decision-making unit (DMU). Farrell (1957)[4 introduced the notion of relative efficiency in which the efficiency of a particular decision-making unit (DMU) may be compared with another DMU within a given group. Farrell identified three types of efficiency: technical efficiency, allocative efficiency (referred to by Farrell as “price efficiency”), and economic efficiency (referred to by Farrell as “overall efficiency”). Technical efficiency (TE) refers to the ability of a DMU to produce the maximum feasible output from a given bundle of inputs, or the minimum feasible amounts of inputs to produce a given level of output. The former definition is referred to as output-oriented TE, while the latter definition is referred to as input-oriented TE. Allocative efficiency (AE) refers to the ability of a technically efficient DMU to use inputs in proportions that minimize production costs given input prices. Allocative efficiency is calculated as the ratio of the minimum costs required by the DMU to produce a given level of outputs and the actual costs of the DMU adjusted for TE. Economic efficiency (EE) is the product of both TE and AE (Farrell, 1957). Thus, a DMU is economically efficient if it is both technically and allocatively efficient. Economic efficiency is calculated as the ratio of the minimum feasible costs and the actual observed costs for a DMU. The technical efficiency score of the nth farm can be find out using the following DEA linear programming formulation:

The technical efficiency score of the n^h farm can be find out using following DEA linear programming formulation:

$$TE_n = \min_{\theta_n, \lambda_i} \theta_n$$

$$\sum_{i=1}^{I} \lambda_i x_{ij} \leq \theta_n x_{nj}, \quad \forall j$$

$$\sum_{i=1}^{I} \lambda_i y_{ik} \geq y_{nk}, \quad \forall k$$

$$\sum_{i=1}^{I} \lambda_i = 1$$

$$\lambda_i \geq 0, \quad \forall i$$

Subscript i , j and k are used for i^{th} farm, j^{th} input and k^{th} output. The symbol X- denotes input while Y-denotes output.

To find economic efficiency, following cost minimizing linear programming formulation would be used:

$$MC_n = \min_{\lambda_i} \sum_{j=1}^{J} p_{nj} x^*_{nj}$$

$$\sum_{i=1}^{I} \lambda_i x_{ij} \leq x^*_{nj}, \quad \forall j$$

$$\sum_{i=1}^{I} \lambda_i y_{ik} \geq y_{nk}, \quad \forall k$$

$$\sum_{i=1}^{I} \lambda_i = 1$$

$$\lambda_i \geq 0, \quad \forall i$$

Where, Mc_n is the minimum cost for the n^{th} farm and P_{nj} is the price of j^{th} input for n^{th} farm.

Then economic efficiency would be calculated as following:

$$EE_n = \frac{\sum_{j=1}^{J} p_{nj} x^*_{nj}}{\sum_{j=1}^{J} p_{nj} x_{nj}}$$

Allocative efficiency would be obtained by dividing the economic efficiency of the sample farm by the corresponding technical efficiency.

Test: two sample assuming unequal variance

To test the technical efficiency, economic efficiency and allocative efficiency of adopted and non- adopted farms unit is statistically different or not we applied t-test, two sample assuming unequal variance.

$$t = \frac{x_1 - x_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where,

x_1 and x_2 are the sample mean, s_1^2 and s_2^2 are the sample variances and n_1 and n_2 arethe numbers of samples size of adopted and non-adopted farms, respectively.

RESULTS AND DISCUSSION

Estimation of Farm Efficiency

The season wise farm efficiency viz. technical, economic and allocative efficiency of KVK adopted and non-adopted respondents are presented in table 3.1

Table 3.1 Efficiencies of adopted and non-adopted respondents

Particulars	Kharif Season			Rabi Season		
	Adopted	Non-Adopted	Difference	Adopted	Non-Adopted	Difference
Technical efficiency	0.84*	0.65	Significant	0.77*	0.57	Significant
Economic efficiency	0.87*	0.7	Significant	0.81*	0.61	Significant
Allocative efficiency	1.04	1.08	Non - Significant	1.05	1.07	Non- Significant

Table 3.1(a) T test results (kharif season)

Particular	Technical Efficiency		Economic Efficiency		Allocative Efficiency	
	A	NA	A	NA	A	NA
Mean	0.84	0.65	0.87	0.7	1.04	1.08
Variance	0.006	0.008	0.003	0.003	0.01	0.06
DF	49		49		49	
T Stat	10.7		6.03		-1.79	
Observation	50	50	50	50	50	50
P(T≤ t) two tail	0		0		0.07	
t Critical two -tail	2.009		2.009		2.009	

(A denotes number of adopted respondents, NA denotes number of non-adopted respondents)

Table 3.1(b) T test results (Rabi season)

Particular	Technical Efficiency		Economic Efficiency		Allocative Efficiency	
	A	NA	A	NA	A	NA
Mean	0.77	0.57	0.81	0.61	1.05	1.07
Variance	0.13	0.13	0.17	0.02	0.12	0.008
DF	49		49		49	
T Stat	8.79		7.22		-0.94	
Observation	50	50	50	50	50	50
P(T≤ t) two tail	0		0		0.34	
t Critical two -tail	2.009		2.009		2.009	

(A denotes number of adopted respondents, NA denotes number of non-adopted respondents)

The table depicts that in the kharif season, the technical efficiency of adopted and non- adopted farm units was found to be 0.84 and 0.65 for adopted and non-adopted farm units, respectively. Thus, KVK adopted a farm unit achieve high technical efficiency for every unit of input applied in the kharif season. For rabi season, the mean technical efficiency score was found to be 0.77 and 0.57 for adopted and non-adopted farm units respectively. Thus, KVK adopted farm achieve more technical efficiency for every input applied in the kharif as well as rabi season. In kharif and rabi seasons significant difference was found between adopted and non- adopted farm unit under technical efficiency as p value < α i.e., 0 %< 5% for the kharif season and p value 0 %< 5% in rabi season.

The mean economic efficiency score across adopted and non-adopted farm units was calculated as 0.87 and 0.70 for the kharif season, which reveals that total cost of production could be reduced on an average by approx.13% and 30% respectively, to achieve same level of output. For rabi season, the mean economic efficiency score across adopted and non-adopted farm units was found to be 0.81 and 0.61 which revealed that the total cost of production could be reduced on an average by approx 19% and 39% respectively, to achieve the same level of output. There was a significant difference between adopted and non-adopted farm units under economic efficiency as the p value < α i.e., 0 %< 5% for the kharif season and 0 %< 5% in the Rabi season.

The mean allocative efficiency score across adopted and non-adopted farm units was calculated 1.04 and 1.08 for kharif season which indicates that on an average, non-adopted farm unit are using input in cost minimizing levels given the input prices efficiently than adopted farm units in kharif season. For the Rabi season, the mean allocative efficiency score was calculated 1.05 and 1.07 for adopted and non-adopted farm units, respectively which reveals that adopted farm units using inputs more efficiently than the non-adopted farm units.There was non-significant difference between adopted and non-adopted farm units under allocative efficiency as the pvalue7%>5% in the kharif season and 34%>5% in the Rabi season.

Table 3.2 Distribution of efficiencies of respondents (Kharif season)

Efficiency Range	Technical Efficiency		Economic Efficiency		Allocative Efficiency	
	A	NA	A	NA	A	NA
E<0.1	0	0	0	0	0	0
0.1≤E≤0.2	0	0	0	0	0	0
0.2≤E≤0.3	0	0	0	2	0	0
0.3≤E≤0.4	0	0	0	0	0	0
0.4≤E≤0.5	0	3	0	5	0	0
0.5≤E≤0.6	0	3	0	4	0	0
0.6≤E≤0.7	2	35	0	11	0	0
0.7≤E≤0.8	11	6	1	14	1	0
0.8≤E≤0.9	24	2	38	5	5	1
0.9≤E≤1.0	13	1	11	9	7	5
E>1	0	0	0	0	37	44
Total	**50**	**50**	**50**	**50**	**50**	**50**

Distribution of efficiencies of respondents (Kharif season) Technical Efficiency

The data presented in this Table (3.2) showed that the technical efficiency had maximum (24) number of adopted farmers in the range of (0.8≤E≤0.9) and a minimum (2) number in the range of (0.6≤E≤0.7). The data showed that the technical efficiency had a maximum (35) number of non- adopted farmers in the range of (0.6≤E≤0.7) and minimum (2 and 1) number in the range of (0.8≤E≤0.9) and (0.9≤E≤1.0) respectively.

Economic efficiency

The data presented in this Table (3.2) showed that the economic efficiency had a maximum (38) number of adopted farmers in the range of (0.8≤E≤0.9) and a minimum (1) number in the range of (0.7≤E≤0.8).It signified that the economic efficiency had maximum (14) number of non- adopted farmers in the range of (0.7≤E≤0.8) and minimum (2) number in the range of (0.2≤E≤0.3) respectively.

Allocative efficiency

The data presented in this Table (3.2) showed that the allocative efficiency had maximum (37) number of adopted farmers in the range of (E>1) and minimum (5 and 1) number in the range of (0.8≤E≤0.9) and (0.7≤E≤0.8) respectively. The data showed that the allocative efficiency had a maximum (44) number of nonadopted farmers in the range of (E>1) and minimum (5 and 1) number in the range of (0.9≤E≤1.0) and (0.8≤E≤0.9) respectively.

Table 3.3 Distribution of efficiencies of respondents (Rabi season)

Efficiency Range	Technical Efficiency		Economic Efficiency		Allocative Efficiency	
	A	NA	A	NA	A	NA
E<0.1	0	0	1	0	0	0
0.1≤E≤0.2	0	0	0	0	0	0
0.2≤E≤0.3	0	0	0	0	0	0
0.3≤E≤0.4	0	0	0	2	0	0
0.4≤E≤0.5	0	11	0	10	0	0
0.5≤E≤0.6	3	22	0	14	0	0
0.6≤E≤0.7	6	14	1	12	1	0
0.7≤E≤0.8	25	0	17	7	1	1
0.8≤E≤0.9	7	2	22	4	3	2
0.9≤E≤1.0	9	1	9	1	5	3
E>1	0	0	0	0	40	44
Total	**50**	**50**	**50**	**50**	**50**	**50**

Distribution of efficiencies of respondents (Rabi season)
Technical Efficiency

The data presented in this Table (3.3) showed that the technical efficiency had maximum (25) number of adopted farmers in the range of (0.7≤E≤0.8) and a minimum (3) number in the range of (0.5≤E≤0.6). The data showed that the technical efficiency had a maximum (22) number of non- adopted farmers in the range of (0.5≤E≤0.6) and minimum (1) number in the range of (0.9≤E≤1.0) respectively.

Economic efficiency

The data presented in this Table (3.3) showed that the economic efficiency had maximum (22) number of adopted farmers in the range of (0.8≤E≤0.9) and a minimum (1 and 1) number in the range of (0.6≤E≤0.7) and (E<0.1) respectively. .It signified that theeconomic efficiency had a maximum (14) number of non-adopted farmers in the range of (0.5≤E≤0.6) and minimum (1) number in the range of (0.9≤E≤1.0) respectively.

Allocative efficiency

The data presented in this Table (3.3) showed that the allocative efficiency had maximum (40) number of adopted farmers in the range of (E>1) and minimum (1 and 1) number in the range of (0.6≤E≤0.7) and (0.7≤E≤0.8) respectively. The data showed that the allocative efficiency had maximum (44) number of non-adopted farmers in the range of (E>1) and a minimum (1) number in the range of (0.7≤E≤0.8) respectively.

CONCLUSION

The results pertaining to farm efficiencies that estimated mean of technical, economic, scale and allocative efficiency of KVK adopted respondents was more as compared to non-adopted respondents in the kharif as well as in Rabi season. Again, it was found that there is a positive impact of KVK on adopted respondents over non-adopted respondents. The mean difference between adopted and non-adopted respondents for technical efficiency and economic efficiency was found to be significant but allocative efficiency was found to be non-significant in kharif as well as Rabi season.

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