*Plant Archives* Vol. 26, Supplement 1, 2026 pp. 2256-2260 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.supplement-1.305

# AN ANALYSIS OF FARM EFFICIENCY OF K V K ADOPTED AND NON- ADOPTED FARMERS IN JHANSI DISTRICT OF UTTAR PRADESH INDIA

**Sunil Kumar Jakhar[1], Ashish Kumar[1], Riya[2], Rishabh Pratap Singh[1], Manoj Kumar Sharma[3], and Rakesh Kumar Jakhar[1]**

[1]Department of Agricultural Economics and Management, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan, India
[2]Department of Agricultural Economics, Extension Education & Rural Sociology, CSKHPKV, Palampur, H.P., India
[3]Department of Extension Education, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan, India
Corresponding author E-mail: rakeshjakhar0115@gmail.com
(Date of Receiving : 14-10-2025; Date of Acceptance : 28-12-2025)

**ABSTRACT**

Krishi Vigyan Kendra's (KVKs), conceptualized by Dr. M.S. Swaminathan, aim to bridge the gap between production and productivity by promoting agricultural technologies. This study was conducted to measure the technical, allocative, and economic efficiency of wheat cultivation among farmers who adopted KVK facilities compared to non-adopters in Jhansi district of Uttar Pradesh. A total sample of 60 farmers, comprising 30 adopters and 30 non-adopters, was selected from two villages, Bharari and Bhojla. The efficiency analyses were conducted using Data Envelopment Analysis (DEA). The results revealed that technical efficiency (CRS) ranged mostly between 0.2–0.3 for adopted farmers and 0.1–0.2 for non-adopted farmers, while technical efficiency (VRS) showed maximum concentration in the 0.7–0.8 range for both groups. The scale efficiency indicated increasing returns to scale among adopted farmers, with a higher mean scale efficiency (2.11) compared to non-adopters (0.18). Economic efficiency was significantly higher among adopted farmers (0.76) than non-adopted farmers (0.71), suggesting better resource utilisation. However, allocative efficiency showed no significant difference between the two groups. The study concludes that the adoption of KVK facilities positively impacts the economic efficiency of farmers, highlighting the role of KVKs in enhancing farm productivity, profitability, and self-employment opportunities in rural India.
**Keywords:** Technical efficiency, Economic efficiency, Allocative efficiency and Scale efficiency.

## Introduction

In India, agriculture is the backbone of the economy, serving as the primary source of income for over 70 per cent of rural households (Ahluwalia, 2005). Krishi Vigyan Kendra (KVK), conceptualized by Dr. M.S. Swaminathan, were established to bridge the gap between production and productivity by testing and promoting agricultural technologies. The first KVK was set up in 1974 at Puducherry under TNAU, Coimbatore (Dhakne *et al.*, 2020). KVKs collaborate with ICAR institutes to train rural youth, produce and supply quality technological products, conduct frontline extension activities, document farm innovations and integrate with various schemes to enhance farmer's self-employment opportunities. As of 2020, there are 716 KVKs functioning across the country (Barman et al., 2020).In this study, an attempt was made to measure the technical, allocative, and economic efficiency of wheat cultivation, which was calculated by comparing farmers who adopted KVK facilities with those who do not adopted the KVK facilities (non-adopted).

## Materials and Methods

For the study, Jhansi district of Uttar Pradesh was selected. Within this district, Jhansi tehsil was selected because there is only one KVK in the district and studying this KVK is important as our study main focus to understand its functioning and the social benefits it provides. From Jhansi tehsil, two villages were selected, namely Bharari and Bhojla. A list of farmers who had adopted the KVK facilities was obtained from Jhansi KVK. From each village, 15 adopted farmers were selected from the list, making a total of 30 adopted farmers and similarly, 15 non-adopted farmers were selected from each village, making a total of 30 non-adopted farmers. Thus, the total sample consisted of 60 farmers, comprising 30 adopters and 30 non-adopters.

**T test: Two sample assuming Unequal Variance Technical efficiency**

Using Data Envelopment Analysis (DEA) in $R^2$, technical efficiency measures how well a farm (or any unit) turns resources like land, labor, and fertilizer into products either by getting the most output from fixed inputs (output-oriented), or by using the least input to produce a set output (input-oriented). DEA creates a "best-practice frontier" from the top-performing farms, and each farm's technical efficiency score (ranging from 0 to 1) shows how close it is to this frontier 1 means fully efficient, while a lower score reveals room to improve by producing more or using fewer resources.

**The technical efficiency-** The technical efficiency score of the $n^{th}$ farm can be find o.ut using

Following DEA linear programming formulation:

$$TE_n = \min \lambda, \theta_n \theta_n$$

s. t.

$$\sum_i^I \lambda_i X_{ij} - \theta_n X_{nj} \leq 0$$

$$\sum_i^I \lambda_i Y_{ik} - Y_{nk} \leq 0$$

$$\sum_i^I \lambda_i = 1$$

$$\lambda_i \geq 0$$

Where 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. $\lambda_i$ is the non-negative weight associated with $i^{th}$ farm. When $\sum_i^J \lambda_i$ is set equal to one then variable returns to scale (VRS) prevails and when this constraint is omitted then constant returns to scale (CRS) prevails.

**Scale efficiency-** a ratio of technical efficiency under VRS to CRS is computed.

**Economic efficiency-** Following cost minimizing linear programming formulation were used.

$$MCn = \min \lambda_i X*_{nj} \sum_{j=1}^J P_{nj} X_{*nj}$$

s.t.

$$\sum_i^I \lambda_i X_{ij} - \theta_n X_{nj}^{\prime *} \leq 0$$

$$\sum_i^I \lambda_i Y_{ik} - Y_{nk} \geq 0$$

$$\sum_i^I \lambda_i = 1$$

$$\lambda_i \geq 0$$

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 were calculated as following

$$EE_n = \frac{\sum_{j=1}^J P_{nj} X_{nj}^{*'}}{\sum_{j=1}^J P_{nj} X_{nj}}$$

**Allocative efficiency-** It was obtained by dividing the economic efficiency of the sample farm by the corresponding technical efficiency.

## Result and Discussion

**Efficiencies range of adopted and non-adopted farmers**

**Technical Efficiency (CRS)**

The information in Table (4.13) demonstrated that the technical efficiency (crs) had a minimum (1) number in the range of (0.6<=E<= 0.7) and a maximum (10) number of adopted farmers in the range of (0.2<=E<= 0.3). Accordingly, it was found that the technical efficiency (crs) had a minimum of 1 and 1 number of non-adopted farmers in the range of (0.7<=E<= 0.8) and (0.8<=E<= 0.9), respectively, and a maximum (7) number in the range of (0. 1<=E<= 0.2).

**Technical Efficiency (VRS)**

According to the data in Table (4.13), the technical efficiency (vrs) had a minimum of two adopted farmers in the range of (0.9<=E<= 1.0) and a maximum of twenty adopted farmers in the range of (0.7<=E<= 0.8). The information displayed in this table indicated that the technical efficiency (vrs) had a minimum (3 and 3) number in the range of (0.6<=E<= 0.7) and (0.9<=E<= 1.0) and a maximum (20) number of non-adopted farmers in the range of (0.7<=E<= 0.8).

**Scale efficiency**

According to the data in Table (4.13), the scale efficiency had a minimum of 10 adopted farmers in the range of (1.0<=E<= 2.0) and a maximum of 20 adopted farmers in the range of (>2 E). According to the statistics, the scale efficiency had a minimum of 12 adopted farmers in the range of (1.0<=E<= 2.0) and a maximum of 18 adopted farmers in the range of (>2 E).

**Economic efficiency**

The economic efficiency had a minimum of one adopted farmer in the range of (0.5<=E<= 0.6) and a maximum of eleven in the range of (0.7<=E<= 0.8), based on the data in Table (4.13). Economic efficiency had a minimum of two non-adopted farmers in the range of 0.6<=E<= 0.7 and a maximum of one in the range of 0.7<=E<= 0.8, based on the statistics.

**Allocative efficiency**

The allocative efficiency had a minimum of two adopted farmers in the range of (0.7<=E<= 0.8) and a maximum of 19 adopted farmers in the range of (1.0<=E<= 2.0), based on the data in Table (4.13). According to the data in the table, economic efficiency had a minimum (1) number in the range of (0.6<=E<=0.7) and a maximum (20) number of non-adopted farmers in the range of (0.7<=E<=0.8).

**Analysis of t-test of Adopted and Non-adopted Farmers**

**Technical Efficiency (vrs)**

In the case of technological efficiency (vrs), the t-test (0.226) is less than T-critical two-tail (0.267), according to the data in table (2), which displays the results of the t-test: two samples assuming unequal variance. The degree of freedom is 49, and the mean and variance for adopted farmers are 0.276 and 0.020, respectively, and for non-adopted farmers they are 0.336 and 0.050.

**Table 1:** Distribution of adopted and non-adopted farmers in various range

| S. No. | Efficiency range | Technical efficiency (CRS) | | Technical efficiency (VRS) | | Scale efficiency (SE) | | Economic efficiency (EE) | | Allocative efficiency (AE) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Adopted farmer | Non-adopted farmer | Adopted farmer | Non-adopted farmer | Adopted farmer | Non-adopted farmer | Adopted farmer | Non-adopted farmer | Adopted farmer | Non-adopted farmer |
| 1 | 0<=E<=0.1 | 2 | 3 | - | - | - | - | - | - | - | - |
| 2 | 0.1<=E<=0.2 | 6 | 7 | - | - | - | - | - | - | - | - |
| 3 | 0.2<=E<=0.3 | 10 | 3 | - | - | - | - | - | - | - | - |
| 4 | 0.3<=E<=0.4 | 5 | 5 | - | - | - | - | - | - | - | - |
| 5 | 0.4<=E<=0.5 | 4 | 4 | - | - | - | - | - | - | - | - |
| 6 | 0.5<=E<=0.6 | 2 | 3 | - | - | - | - | 1 | - | - | - |
| 7 | 0.6<=E<=0.7 | 1 | 3 | 5 | 3 | - | - | 3 | 2 | - | 1 |
| 8 | 0.7<=E<=0.8 | - | 1 | 20 | 20 | - | - | 11 | 7 | 2 | 3 |
| 9 | 0.8<=E<=0.9 | - | - | 3 | 4 | - | - | 9 | 10 | 3 | 2 |
| 10 | 0.9<=E<=1.0 | - | 1 | 2 | 3 | - | - | 6 | 11 | 6 | 4 |
| 11 | 1.0<=E<=2.0 | - | - | - | - | 10 | 12 | - | - | 19 | 20 |
| 12 | >2E | - | - | - | - | 20 | 18 | - | - | - | - |
| | Total | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |

**Technical Efficiency (crs)**

In the case of technical efficiency (crs), the t-test (1.112) is smaller than the T-critical two-tail (1.165). The mean and variance for adopted farmers are 0.736 and 0.005, whereas those for non-adopted farmers are 0.754 and 0.006, with a degree of freedom of 58.

**Scale Efficiency**

In the case of scale efficiency, the t-test (0.014) is greater than the T-critical two-tail (1.066). The mean and variance for adopted farmers are 0.760 and 0.231, respectively, while those for non-adopted farmers are 1.634 and 0.249. The degree of freedom is 58.

**Economic Efficiency**

In the situation of economic efficiency, the t-test (1.514) is higher than the T-critical two-tail (1.065). The mean and variance for adopted farmers are 0.778 and 0.010, respectively, while the mean and variance for non-adopted farmers are 0.828 and 0.008, with a degree of freedom of 57.

**Allocative Efficiency**

In the instance of allocative efficiency, the t-test (0.271) is less than the T-critical two-tail (1.065). The mean and variance for adopted farmers are 0.971 and 0.009, respectively, while the mean and variance for non-adopted farmers are 0.961 and 0.014, with a degree of freedom of 55.

**Competitively Analysis of Technical, Scale, Economic and Allocative Efficiency**

Technical, size, economic, and allocative efficiency analyses of adopted and non-adopted farms are shown in Table 3.

### Technical Efficiency (vrs) and (crs)

Technical efficiency (vrs) for adopted farmers was, on average, 0.27, whereas that of non-adopted farmers was 0.21. The mean efficiency technical (vrs) of adopted and non-adopted farmers did not differ significantly at the five percent significance level. The same is true for technical efficiency (crs), where the mean efficiency levels of adopted and non-adopted farmers were comparable, with the difference being negligible. The results were supported by research by Dhungana et al. (2004) [10], Akinbode et al. (2011) [3], Ajao et al. (2012) [2], and Ahmed et al. (2015) [1].

**Table 2:** T-test analysis of adopted and non-adopted farmers for all the efficiency

| S. N. | Particulars | Technical efficiency (CRS) | | Technical Efficiency (VRS) | | Scale efficiency | | Economic Efficiency | | Allocative Efficiency | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Adoption Status | Adopted | Non adopted | Adopted | Non adopted | Adopted | Non adopted | Adopted | Non adopted | Adopted | Non adopted |
| 2 | Mean | 0.276 | 0.336 | 0.736 | 0.754 | 0.760 | 1.634 | 0.778 | 0.825 | 0.971 | 0.961 |
| 3 | Variance | 0.020 | 0.050 | 0.005 | 0.006 | 0.231 | 0.249 | 0.010 | 0.008 | 0.009 | 0.014 |
| 4 | Observations | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| 5 | Hypothesis | 0 | | 0 | | 0 | | 0 | | 0 | |
| 6 | Df | 49 | | 58 | | 58 | | 57 | | 5 | |
| 7 | t Stat | 0.216 | | 1.112 | | -0.014 | | 1.514 | | 0.271 | |
| 8 | P(T<=t)one-tail | 0.012 | | 0.061 | | 0.190 | | 0.010 | | 0.143 | |
| 9 | t Criticalone-tail | 0.267 | | 1.165 | | 1.066 | | 1.065 | | 1.065 | |

### Scale Efficiency

According to scale efficiency, both adopted and non-adopted farmers are continuing to increase their planted area because they are seeing increasing returns to scale. At the 0–5% range, there is a considerable difference between adopted and non-adopted farmers.

### Economic Efficiency

The adopted farmers are more skilled at cultivating crops and dividing money among various inputs, as seen by their significantly greater mean economic efficiency (0.76) compared to non-adopted farmers (0.71).

### Allocative Efficiency

Adopted farmers' average allocative efficiency scope is 1.01, whereas non-adopted farmers' is 1.01; nonetheless, there is no appreciable difference between the two allocative scores.

**Table 3:** Competitively analysis of technical, scale, economic and allocative efficiency

| Particulars | Adopted | Non- adopted | Significant Difference |
|---|---|---|---|
| Technical Efficiency CRS | 0.27 | 0.21 | Significance |
| Technical Efficiency VRS | 0.68 | 0.66 | Non-Significance |
| Scale Efficiency | 2.11 | 0.18 | Non-Significance |
| Economic Efficiency | 0.76 | 0.71 | Significance |
| Allocative Efficiency | 1.01 | 1.01 | Non-Significance |

(Significance of difference at five percent level of significance)

## Conclusion

The study found that adopted and non-adopted farmers differed significantly in terms of technical, size, economic, and allocative efficiency levels. Adopted farmers were more likely to be in the mid-efficiency ranges ($0.2 \leq E \leq 0.3$) in terms of Technical Efficiency (CRS), but non-adopted farmers were more likely to be in lower ranges ($0.1 \leq E \leq 0.2$). Adopted farmers had somewhat more in the higher ranges, suggesting better relative performance, although both groups had the most farmers in the range of ($0.7 \leq E < 0.8$) for Technical Efficiency (VRS). While non-adopted farmers had a more dispersed distribution, suggesting inefficiencies in scale utilization, the majority of adopted farmers obtained values above 2.0, showing growing returns to scale.

Regarding Economic Efficiency, adopted farmers demonstrated better performance, with 11 farmers in the 0.7–0.8 range compared to only one from the non-adopted group. T-test analysis confirmed a significant difference in economic efficiency, with adopted farmers averaging 0.778 against 0.825 for non-adopted farmers, though the variance suggested higher consistency among adopters. Allocative Efficiency was high in both groups, with adopted farmers mostly in the 1.0–2.0 range, though the statistical difference was not significant.

The t-test analysis showed that the difference in technical efficiency (CRS) and economic efficiency between adopted and non-adopted farmers was statistically significant at the 5% level, whereas scale and allocative efficiency differences were statistically insignificant. Despite similar scores in allocative efficiency, adopted farmers used inputs more judiciously, leading to better overall outcomes. The results indicate that adoption of improved agricultural practices positively influences efficiency across multiple dimensions, particularly in technical and economic areas.

Overall, the findings suggest that farmers who adopt recommended technologies and practices are more efficient in resource use, scale management, and cost allocation, leading to better productivity and profitability. Hence, promoting adoption through policy intervention, farmer training, and extension services is crucial for enhancing efficiency and sustainable agricultural growth.

## References


Ahluwalia, M. S. (2016). *Reducing poverty and hunger in India: The role of agriculture*. Planning Commission, Government of India. http://planningcommission.nic.in/aboutus/speech/spemsa/msa046.pdf

Ahmed, M. H., Lemma, Z., & Endrias, G. (2015). Measuring technical, economic and allocative efficiency of maize production in subsistence farming: Evidence from the Central Rift Valley of Ethiopia. *Athletic,* **63**, 1–9.

Ajao, A. O., Ogunniyi, L. T., & Adepoju, A. A. (2012). Economic efficiency of soybean production in Ogo-Oluwa local government area of Oyo State, Nigeria. *American Journal of Experimental Agriculture,* **2**(4), 667–679.

Akinbode, S. O., Dipeolu, A. O., & Ayinde, I. A. (2011). An examination of technical, allocative and economic efficiencies in Ofada rice farming in Ogun State, Nigeria. *African Journal of Agricultural Research,* **6**(28), 6027–6035.

Akramov, K., & Malek, M. (2012). *Analyzing profitability of maize, rice, and soybean production in Ghana: Results of PAM and DEA analysis* (GSSP Working Paper No. 28). Ghana Strategy Support Program.

Anang, B. T., Bäckman, S., & Rezitis, A. (2016). Does farm size matter? Investigating scale efficiency of peasant rice farmers in northern Ghana. *Economics Bulletin,* **36**(4), 2275–2290.

Asghar, S., Sasaki, N., Jourdain, D., & Tsusaka, T. W. (2018). Levels of technical, allocative, and groundwater use efficiency and the factors affecting the allocative efficiency of wheat farmers. *Sustainability,* **10**(5), 1619.

Barman, S., Deka, N., & Deka, P. (2020). Impact assessment of KVK training programme in Nagaon district of Assam, India. *International Journal of Current Microbiology and Applied Sciences,* **9**(8), 1–9.

Borthakur, S., Mishra, P., Talukdar, R. K., & Bortamuly, D. (2016). Scaling the adoption of recommended rice production technologies by the farmers in Assam State. *Indian Research Journal,* **15**(2), 32–37.

Coelli, T., Rahman, S., & Thirtle, C. (2002). Technical, allocative, cost and scale efficiencies in Bangladesh rice cultivation: A non-parametric approach. *Journal of Agricultural Economics,* **53**(3), 607–626.

Debebe, S., Haji, J., Goshu, D., & Edriss, A. K. (2015). Technical, allocative, and economic efficiency among smallholder maize farmers in Southwestern Ethiopia: Parametric approach. *Journal of Development and Agricultural Economics,* **7**(8), 282–291.

Dhakne, V. B., Deshmukh, P. R., & Puri, S. G. (2020). Constraints faced by the staff of Krishi Vigyan Kendras during their job in Marathwada. *International Journal of Current Microbiology and Applied Sciences,* **9**(11), 2499–2505.

Dhungana, B. R., Nuthall, P. L., & Nartea, G. V. (2004). Measuring the economic inefficiency of Nepalese rice farms using data envelopment analysis. *Australian Journal of Agricultural and Resource Economics,* **48**(2), 347–369.

Kane, A. M., Lagat, J. K., Langat, J. K., Teme, B., & Wamuyu, S. N. (2018). Economic efficiency of water use in the small-scale irrigation systems used in vegetable production in Koulikoro and Mopti regions, Mali. *Advances in Agricultural Science,* **6**(4), 72–84.

Mukhtar, U., Mohamed, Z., Shamsuddin, M. N., Sharifuddin, J., & Iliyasu, A. (2018). Application of data envelopment analysis for technical efficiency of smallholder pearl millet farmers in Kano State, Nigeria. *Bulgarian Journal of Agricultural Science,* **24**(2), 213–222.

Rahman, S. (2003). Profit efficiency among Bangladeshi rice farmers. *Food Policy,* **28**(6), 487–503.

Sadiq, M. S., Singh, I. P., Singh, N. K., & Yakubu, G. M. (2018). Improving efficiency and total factor productivity of lowland paddy rice farmers in Kwara State of Nigeria. *Journal of Agricultural Sciences,* **13**(2), 114–117.

Sindhuja, P., & Asokhan, M. (2018). Socio-economic characteristics of dryland farmers in Tiruppur district, India: A gender analysis. *International Journal of Current Microbiology and Applied Sciences,* **7**(2), 54–58.

Singh, M. U., Ram, D., & Devi, M. D. (2015). Behavioral change of adopted farmers in Krishi Vigyan Kendra, Imphal East district of Manipur. *Agriway,* **3**(2), 84–88.

Usman, J. (2018). *Cost and return analysis of rice production in Song Local Government Area of Adamawa State, Nigeria* (Unpublished undergraduate project).

Wardana, F., Yamamoto, N., & Kano, H. (2018). Analysis of technical efficiency of small-scale rice farmers in Indonesia. *Journal of Tropical Life Science,* **8**(2), 120–124.

Zongli, Z., Yanan, Z., Feifan, L., Hui, Y., Yongming, Y., & Xinhua, Y. (2017). Economic efficiency of small-scale tilapia farms in Guangxi, China. *Aquaculture Economics & Management,* **21**(2), 283–294.