P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating (2025): 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 10; October 2025; Page No. 618-621

Received: 19-07-2025
Accepted: 23-08-2025

Indexed Journal
Peer Reviewed Journal

From lab to land: Assessing the success of KVK demonstrated technologies

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DOI: https://www.doi.org/10.33545/26180723.2025.v8.i10i.2593

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Abstract

Indian Council of Agricultural Research (ICAR) has established Krishi Vigyan Kendras (KVKs) all over the country to identify and solve the problems of farmers and to transfer the new agricultural technologies and skills. KVKs act as a link between the research wing and farmers. It is engaged in resolving problems faced by the farmers and in implementing various technologies developed by different research institutions. They are an integral part of agricultural extension services, facilitating the smooth and effective transfer of knowledge and technology from research institutions to the farming community. The present study was conducted to develop a scale to measure the effectiveness of KVK demonstrated technologies. We collected 82 statements, out of these 40 statements were selected through relevancy test. Out of 40 statements, 21 statements were retained on the final scale. Reliability and validity of the scale indicates its consistency and precision of the results.

Keywords: Krishi Vigyan Kendras, agricultural extension, transfer of knowledge, effectiveness

Introduction

Agricultural development in India has always relied on the effective transfer of scientific innovations from research institutions to farmers' fields. The Krishi Vigyan Kendras (KVKs), established under the Indian Council of Agricultural Research (ICAR), play a crucial role in bridging this "lab-to-land" gap (Sahoo *et al*., 2021) [12]. The concept of Krishi Vigyan Kendras (KVKs) was introduced by the Indian Council of Agricultural Research (ICAR) in 1974, following the recommendations of the Education Commission (1964-66) led by Dr. D.S. Kothari (Pranesh, 2016) [9]. The main objective was to create a network of district-level farm science centers that could serve as the link between research institutions and the farming community. Unlike traditional extension agencies, KVKs focus not only on transferring technologies but also on assessing, refining, and validating them under diverse agro-climatic conditions (Joshi *et al*, 2018) [5]. Each KVK operates as a frontline extension system that conducts activities such as On-Farm Testing (OFTs), Frontline Demonstrations (FLDs), training programs, and extension campaigns to enhance farmers' knowledge and skills.

Over the years, KVKs have emerged as vital institutions for technology dissemination and capacity building, covering all major aspects of agriculture, horticulture, animal husbandry, fisheries, and allied sectors (Nagaraj *et al*,.2017) [8]. Their approach of "learning by doing" encourages farmers to directly experience the benefits of scientific innovations in their own fields. By demonstrating technologies that address local problems—such as improved crop varieties, integrated pest management, resource conservation practices, and climate-resilient farming—KVKs have contributed significantly to agricultural modernization and rural empowerment (Acharya and Roy, 2025) [1]. Through their mandate of technology assessment, refinement, and dissemination, KVKs ensure that proven agricultural technologies reach farmers in a practical, adaptable, and result-oriented manner. One of the most important mechanisms employed by KVKs is the Frontline Demonstration (FLD), which allows farmers to observe the performance of improved technologies under real field conditions. At present there are 731 KVKs across the country under different host organizations" (Rana *et al*., 2023) [10].

Assessing the success of these demonstrated technologies is crucial for understanding their effectiveness in improving productivity, profitability, and sustainability of farming systems. Such evaluations not only measure yield gains and economic benefits but also capture farmers' perceptions, adoption behavior, and the long-term impact on livelihood enhancement. In this context, analyzing the effectiveness of KVK demonstrations helps identify success stories, constraints, and future directions for strengthening technology dissemination strategies. The present article explores how KVKs have translated scientific innovations into field-level success, highlighting their role in empowering farmers and advancing rural development.

Methodology

The effectiveness of KVK demonstrated technologies refers to the extent to which the technologies showcased by Krishi Vigyan Kendras (KVKs) achieve their intended objectives in real farming conditions. Effectiveness can be assessed through parameters such as efficiency, productivity, quality, profit and sustainability. Efficiency indicates how effectively available resources—such as labor, capital, and technology—are utilized to achieve the desired outcomes. Productivity indicates the increase in yield resulting from the adoption of improved technologies compared to traditional practices. Quality denotes the standard or grade of the agricultural produce, determined by its physical, chemical, or nutritional characteristics like size, color and shape. Profit is the financial gain obtained after deducting the cost of cultivation or production from the total returns. It serves as a key indicator of the economic viability of KVK-demonstrated technologies. In KVK demonstrations, sustainability implies that the technologies promoted are environment-friendly, economically viable, and socially acceptable.

The Likert's technique was used for constructing the tool to study the effectiveness of KVK demonstrated technologies. The details of the procedure followed in the construction of the likert type scale to study the effectiveness of KVK demonstrated technologies have been discussed as below.

Based on the review of literature, 82 statements reflecting the parameters of effectiveness *viz*, efficiency, productivity, quality, profit and sustainability were collected and revised based on criteria suggested by Edward (1983) [3]. After review 60 items were retained for scale construction. The 60 items under five sub-dimensions were sent to 65 experts in the field of agricultural extension to determine its relevancy and screening for inclusion in the final scale. "The experts were requested to give their responses on a five-point continuum i.e., highly relevant, relevant, undecided, less relevant and not relevant with scores 5,4,3,2 and 1 respectively. These experts were from the field of agricultural extension education and social science. They were requested to indicate their response by putting a tick mark in suitable continuum for each item. The experts were also requested to make necessary modifications and additions or deletions, if they desired so. Out of 65 experts, only 54 experts responded in a period of two months and their relevancy score was ascertained by adding the scores and a relevancy test was worked out using the formula" (Ravikishore and Seema, 2017) [11].

$$\text{Relevancy score} = \frac{\text{Total score obtained on each item}}{\text{Maximum Possible score}} \times 100$$

Those items, which secured a relevancy score of 80 and above, were selected and were suitably modified and rewritten as per the comments of experts. From the 60 statements, final 40 were selected under the five sub dimensions.

Calculation of 't' Value

The respondents were asked to indicate how much they agreed or disagreed with each statement on a five-point continuum ranging from "strongly agree" to "strongly disagree". The scoring pattern adopted was 5 to 1 where, 5 corresponds to strongly agree, 4 corresponds to agree, 3 corresponds to undecided, 2 corresponds to disagree and 1 corresponds to strongly disagree.

"The perception score of the respondent was obtained by adding up the scores of all statements in the scale. Based on the total summated scores, respondents were arranged in descending order. Respondents with highest total scores (top 25%) and lowest total scores (bottom 25%) were made into two groups. The two groups provided the criterion groups in terms of which item analysis was carried out as suggested by Edward (1957) [3]. Thus, out of 40 respondents, 10 respondents with high scores were considered as high group and 10 respondents with low scores were considered as low group to calculate the critical ratio i.e., 't' value for each of the selected statement. The critical ratio was calculated by t-test. The 't' values were calculated by using the formula" suggested by Edward (1957) [3].

"The t value is calculated as a measure of the extent to which the statement differentiates between the respondents of high group and low group" (Kumar & Ratnakar, 2016) [6].

$$t = \frac{\bar{X}_H - \bar{X}_L}{\dfrac{\sqrt{\Sigma\left[X_H - \bar{X}_H\right]^2 + \Sigma\left[X_L - \bar{X}_L\right]^2}}{\sqrt{n(n-1)}}}$$

Where,

t = the extent to witch a given statement differentiates between the high and low groups,

XH = the mean score on a given statement for the high group,

XL = the mean score on the same statement for the low group,

(XH−XH)2 = the variance of the distribution of responses of the high group to the statement,

(XL−XL)2 = The variance of the distribution of responses of the low group to the statement

n(n−1) = number of subjects in low or high group;

Selection of Statements for Final Scale

"A scale should measure what it seeks to accomplish to measure and it should be consistent in its measurement. A scale thus has to be standardized before it is administered. The scale developed was standardized by testing its reliability and validity. A scale is reliable when it will consistently produce the same results for the same individuals on different occasions or with different sets of equivalents. For testing the reliability, split half method was employed" (Garrett &Woodworth, 1973) [4]. "After getting back the responses, the scale was divided into two halves, all odd statements into one half and all even statements into another. One half (one set) contains the odd numbered items (1, 3, 5, 7 etc.) and the other half (other set) the even-numbered items (2, 4, 6, 8 etc.). Reliability coefficient (R.C) was computed using the Spearman-Brown formula" (Chandra *et al*., 2024) [2].

$$\text{RC of test} = \frac{2 * \text{R.C of the half test, found experimentally}}{1 + \text{R.C of the half test, found experimentally}}$$

Results and Discussion

From the 60 statements, total of 40 statements were selected through relevancy score, based on judges rating. After computing 't' values for all 40 statements, the statements with 't' values more than 2.55 were selected for the final scale. Thus, out of 40 statements, 21 statements with 't' value more than 2.55 were selected in the scale.

Testing the Reliability of the Scale

"A scale is reliable when it will consistently produce the same results when applied on the same sample" (Kumaret *et al*., 2018) [7]. The coefficient of reliability was calculated between the two halves. The correlation of the reliability coefficient for both sets was worked out. The correlation of reliability coefficient (r = 0.706) was significant at 0.05 level of significance indicating the scale was highly suitable for administration to beneficiary farmers of the demonstrated technologies as the scale was stable and dependable in its measurement.

Table 1: Scale developed to measure the effectiveness of KVK demonstrated technologies

Efficiency	t-value
The demonstrated technologies have led to a reduction in resource consumption, such as water, and other inputs.	3.61
The time required to implement and adopt the demonstrated technologies have decreased, leading to improved efficiency in the overall process.	3.04
The utilization of the demonstrated technologies has streamlined operations, minimizing waste and optimizing resource allocation	2.67
Productivity	
The demonstrated technologies have increased the overall output or yield per unit of resources utilized.	3.42
The adoption of the demonstrated technologies has reduced production downtime.	3.89
The demonstrated technologies have enhanced the efficiency and effectiveness of labor utilization.	4.21
The demonstrated technologies have reduced time-to-market.	3.18
The implementation of the demonstrated technologies has improved the scalability and capacity of the production system.	3.57
Quality	
The demonstrated technologies have led to a higher level of product standardization.	3.78
The adoption of the demonstrated technologies has reduced defects and errors.	3.89
The demonstrated technologies have improved the precision and accuracy of measurements.	3.35
The demonstrated technologies have enabled better control over critical process parameters, leading to improved product quality.	4.32
The implementation of the demonstrated technologies has improved product reliability, durability, or longevity, resulting in enhanced quality.	2.98
Profit	
The demonstrated technologies have increased sales volume.	3.09
The adoption of the demonstrated technologies has reduced production costs.	4.16
The demonstrated technologies have improved the utilization of resources.	2.61
The implementation of the demonstrated technologies has enhanced pricing strategies or market positioning, resulting in improved profitability.	2.57
The demonstrated technologies have facilitated the development of new business opportunities,	3.42
Sustainability	
The demonstrated technologies have reduced environmental impacts, such as greenhouse gas emissions and waste generation.	3.13
The adoption of the demonstrated technologies has promoted the use of renewable or eco-friendly resources.	4.18
The demonstrated technologies have improved resource efficiency.	2.78

Testing the Validity of the Scale

Content validity: The content validity is the representative or sampling adequacy of the content, the substance, the matter and the topics of a measuring instrument (Yibrah *et al*., 2017) [13]. This method was used in the study to determine the content validity of the scale. The validity of the scale was obtained through content validity by taking the judge's opinion. The statements selected for the scale were evaluated individually and as a whole by the experts. As the content of the scale was borne out by the method of collecting statements within the universe it may reasonably be assumed that the scale to measure the effectiveness of KVK demonstrated technologies, has content validity.

Administration of the Scale

The final scale to measure the effectiveness of KVK demonstrated technologies comprised of 21 statements under five dimensions *viz*. efficiency, productivity, quality, profit and sustainability measured on a five-point continuum, *viz*., Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (DA) and Strongly Disagree (SDA) with scores of 5, 4, 3, 2 and 1. Obtained score on this scale ranges from 25-125.

Conclusion

The final scale developed and standardized to measure the effectiveness of KVK demonstrated technologies, was again checked by subject matter specialists in the extension department of KAU and KVKs for their relevance and coverage. The scale can be used in any geographical area with suitable modification. Other parallel scales can also be derived and standardized from the results of the study.

Acknowledgements

With a deep sense of gratitude, I sincerely thank the Indian Council of Agricultural Research (ICAR) and Kerala Agricultural University (KAU), Thrissur for their continuous guidance and financial support provided for the period of this research work.

Competing Interests

Authors have declared that no competing interests exist.

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