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

NAAS Rating: 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 7; July 2025; Page No. 327-333

Received: 20-04-2025
Accepted: 24-05-2025

Indexed Journal
Peer Reviewed Journal

Development and validation of a managerial efficiency scale for senior scientist and heads of selected Krishi Vigyan Kendra's (KVKs)

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DOI: https://www.doi.org/10.33545/26180723.2025.v8.i7e.2148

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Abstract

The present study aimed to develop a standardized scale to assess the managerial efficiency of Senior Scientists and Heads of Krishi Vigyan Kendra's (KVKs). Initially, key dimensions were identified through an extensive review of literatures, including research papers, conference proceedings, and web-based resources, along with discussions with KVK professionals and stakeholders. This process led to the formulation of 62 items across ten conceptual dimensions. After critical review by an advisory committee, 44 items were retained. To ensure content validity, the 44 items were circulated among 120 subject matter experts from institutions such as ICAR, SAUs, NAARM, CRIDA, IIHR, MANAGE, IIMR, and KVKs. Experts rated each item on a three-point continuum—Most Relevant (3), Relevant (2), and Less Relevant (1). A total of 62 responses were received, and Relevancy Scores, Relevancy Weightages, and Mean Relevancy Scores were calculated for each item. For item analysis, responses were collected from a non-sample area. The summated scores for each respondent were arranged in descending order. The top 25% (high group) and bottom 25% (low group) were selected for statistical comparison. A 't'-test was conducted to determine each item's discriminating power. Following the standard rule, items with a 't'-value of 1.75 or higher were retained. Based on this analysis, 34 items were finalized for the scale. The resulting scale is a valid and reliable tool to measure managerial efficiency in agricultural extension settings, supporting better training, evaluation, and policy decisions.

Keywords: Managerial efficiency, Krishi Vigyan Kendra, senior scientist and heads, scale development

1. Introduction

Agriculture remains the backbone of the Indian economy, providing livelihoods to nearly 60 per cent of the population, with approximately 42.38% directly engaged in agricultural activities. During 2020-21, agriculture and allied sectors, including livestock, forestry, and fisheries, contributed 20.20% to the nation's Gross Domestic Product (GDP), underscoring their critical role in national development. In this context, Krishi Vigyan Kendra's (KVKs), established by the Indian Council of Agricultural Research (ICAR), have emerged as vital institutions for transferring agricultural technologies from research laboratories to farmers' fields.

KVKs serve as knowledge and resource hubs, offering region-specific training, demonstrations, and capacity-building programmes. Their mission is to foster science and technology-led agricultural growth through targeted interventions and farmer-centric extension approaches. Functioning under the supervision of 11 Agricultural Technology Application Research Institutes (ATARIs) and monitored by ICAR, KVKs operate across the country with strong institutional support. Each KVK is guided by a Scientific Advisory Committee (SAC) Which is Headed by Vice- Chancellors of respective SAU's and Director of ATARI respective, members from agriculture and other line Departments, along with representatives of SHG's FPO's and Progressive Farmers and led by a Senior Scientist and Head, who plays a central role in planning, implementation, coordination, and monitoring of all KVK activities.

These activities include on-farm testing (OFTs) frontline demonstrations (FLDs), capacity development programs, and advisory services through ICT tools and direct interaction with the Stakeholders, KVKs also organize awareness campaigns and special days such as Farmers' Day, World Soil Health Day, and Technology Week, further strengthening their grassroots engagement.

Despite their significance, KVKs face growing challenges: shrinking arable land, climate change, resource degradation,

rising costs, and declining farmer interest. As expectations from KVKs increase, the managerial efficiency of their leaders becomes pivotal to ensuring effective service delivery and institutional performance. However, no standardized tool exists to objectively measure this managerial efficiency.

This study, therefore, aims to develop a valid and reliable scale to assess the managerial efficiency of Senior Scientists and Heads of selected KVKs, enabling more structured evaluation, training, and capacity-building interventions to support India's agricultural transformation.

2. Methodology

The present study was conducted to develop a standardized and reliable scale to measure the managerial efficiency of Senior Scientist and Heads of selected KVKs. The scale development process followed a systematic and multi-stage approach, which included identification of dimensions, item generation, expert validation, item analysis, and finalization of the scale.

2.1 Identification of Dimensions

A comprehensive review of literature, including research articles, review papers, national and international conference proceedings, working documents, and online resources, was undertaken to identify the major dimensions of managerial efficiency relevant to the roles and responsibilities of KVK Heads. In addition, discussions and consultations were held with Senior Scientist, Heads of KVKs, extension professionals, and subject matter experts to ensure contextual relevance. Ten core dimensions were finalized for the study.

2.2 Item Generation

Based on the identified dimensions, a total of 62 items were initially drafted. These items represented the functional, administrative, communication, planning, monitoring, coordination, and leadership aspects of KVK management. The items were framed as statements reflecting observable managerial behaviours and actions.

2.3 Content Validation

The initial 62 items were critically reviewed by an advisory committee, and 44 items were retained after refining for clarity, relevance, and non-redundancy. These 44 items were then sent to 120 experts in the field of agricultural extension and management from institutions like ICAR, SAUs, NAARM, CRIDA, IIHR, MANAGE, IIMR, and various KVKs. The experts were asked to evaluate each item on a three-point relevancy continuum

- Most Relevant (MR) - 3
- Relevant (R) - 2
- Less Relevant (LR) - 1

A total of 62 responses were received. For each item, the Relevancy Score, Relevancy Weightage, and Mean Relevancy Score were calculated to assess the appropriateness of the item. Suggestions for modification, deletion, or addition of items were also considered.

2.4 Item Analysis

To further refine the scale, the edited items were subjected to item analysis. Responses were collected from a non-sample area. Each respondent's total score for the 44 items was computed, with the maximum possible score being 170 and the minimum 34 (based on a five-point Likert scale). Scores were arranged in descending order, and the top 25% (high group) and bottom 25% (low group) of respondents were selected for analysis.

A 't'-test was applied to determine the discriminatory power of each item, i.e., the ability of an item to differentiate between high and low performers. According to the accepted psychometric guideline, items with a 't'-value of 1.75 or above were retained. Based on this criterion, 34 items were finally selected for the managerial efficiency scale.

2.5 Final Scale

The final scale comprised 34 items under ten dimensions. Each item was designed to be measured on a five-point Likert-type scale ranging from "Strongly Disagree" (1) to "Strongly Agree" (5). This scale provides a quantifiable and objective tool for assessing the managerial efficiency of Senior Scientist and Heads of KVKs.

3. Operationalization and measurement of dependent variables

Operationalization of dependent variables is the process of defining the variable so as to make the clarification of the concept with distinguishable or measurable and better understanding in terms of empirical observations. The Operationalization of dependent variable i.e., managerial efficiency of the senior scientist and heads of selected KVKs, the procedures followed for the measurement of dependent variable in the present study mentioned as below:

3.1 Managerial efficiency of Senior Scientist and Heads of Selected KVKs

In the present study, managerial efficiency of senior scientist and heads of KVKs is operationally defined as "degree of performing the functions of management activities (Planning, Organizing, Directing, Communicating, Controlling, Human Relation, Leading, Supervising Co-ordinating and Decision making) effectively in the process of extension of KVK activities as per the guidelines".

For measuring the managerial efficiency of the senior scientist and heads of the KVKs, a scale was developed, after considering the set of guidelines designed through systematic procedure for developing a standardized scale, after review of literature and discussion with experts, extension professionals, other stakeholders in the transfer of technology.

3.2 Construction of managerial efficiency scale

A concept is a term that expresses an abstract idea generalizing from particulars and summarizing related observations. The term "construct" is a concept with additional meaning evolved for scientific purposes. In another words, a construct is a combination of concepts with items related to managerial efficiency.

To address the research problem, managerial efficiency of senior scientist and heads of KVKs was taken as the major construct.

4 Steps for constructing the Managerial efficiency scale of senior scientist and heads of KVKs

4.1 Identification of dimension of Managerial efficiency scale

Ten major dimensions related to managerial efficiency of senior scientist and heads of KVKs were identified based on review of literature and discussion with extension professionals in the field of agricultural extension education and other KVK scientists. The identified dimensions are Planning, Organizing, Directing, Communicating, Controlling, Human Relation, Leading, supervising, Co-ordinating and Decision making.

4.2 Selection of scale dimension

After rigorous exercises of review of literature, using the relevancy weightage formulae, the relevancy weightage of each dimension was calculated and all the dimensions had the relevancy weightage of more than 0.75. Hence, all the ten dimensions are found as valid to be considered in the composite scale and it is presented in Table 01.

Table 1: Relevancy weightage of the dimensions selected of managerial efficiency scale

Sl. No.	Dimensions	Relevancy Weightage
1	Planning	0.887 *
2	Organizing	0.870 *
3	Directing	0.817 *
4	Communicating	0.827 *
5	Controlling	0.876 *
6	Human relation	0.833 *
7	Leading	0.811 *
8	Supervision	0.812*
9	Co-ordinating	0.782*
10	Decision making	0.877*

5. Collection and structuring of scale items

After, identifying different concepts or dimensions relevant to the measuring construct, the next step is the collection and creation of number of items under each concept. The items were collected from various sources *viz.*, research articles, review articles, various national and international conference proceedings, working papers, and also from several websites. Discussion with KVK Senior scientist and heads and other stakeholders were also done for the structuring of items relevant to measure the managerial efficiency of Senior scientist and Heads of KVKs. A total of 62 items were collected and structured initially and after critical evaluation and discussion with the advisory committee, only 44 items were retained under ten dimensions stated earlier. These edited items were then sent to 120 extension specialists through post and Google forms into their inboxes working in various institutions like, Indian Council of Agriculture Research (ICAR), State Agriculture Universities (SAU's), NAARM, CRIDA, IIHR, KVKs, MANAGE, IIMR, Experts in various Research institutes, Agricultural Officers and experts in other national institutions throughout India for the critical evaluation of statements to determine their relevancy on a three-point continuum *viz.*, Most Relevant (MR), Relevant (R) and Less Relevant (LR) with the score of 3, 2 and 1, respectively. The judges were also requested to make necessary modifications or suggestions and addition or deletion of items. The responses received from 62 experts out of 120 experts in time. The relevancy score for each statement was found out by adding the scores based on the rating of all the judges. The relevancy weightage of each item was worked out to get the mean relevancy score using the following formulas.

$$\text{Relevancy Percentage (RP)} = \frac{(MR\times3 + R\times2 + LR\times1)}{\text{Maximum possible score (i.e., } 62\times3=186)} \times 100$$

$$\text{Relevancy Weightage (RW)} = \frac{(MR\times3 + R\times2 + LR\times1)}{\text{Maximum possible score (i.e., } 62\times3=186)}$$

$$\text{Mean Relevancy Score (MRS)} = \frac{(MR\times3 + R\times2 + LR\times1)}{\text{Number of Judges responded (i.e., } 62)}$$

Using the mean relevancy score formulae, the mean relevancy score was calculated for verifying of each item for the managerial efficiency of Senior scientist and Heads of KVKs. The values of relevancy score of each item were given in Table.2.

Table 2: Relevancy Weightage, Mean Relevancy Score and Relevancy Percentage for selection of items for Managerial efficiency of Senior scientist and heads of KVKs

Sl. No.	Statements	RW	MRS	RP
	Planning			
1	Senior Scientist and Heads of KVK demonstrate excellent determination of objectives	0.88	2.66 *	88.70 *
2	They effectively plan for the transfer of technology, ensuring successful outreach.	0.87	2.61 *	87.09 *
3	Their ability to plan for utilization of funds/budget ensures financial efficiency.	0.79	2.38	79.56
4	The preparation of the annual action plan reflects their structured approach to research.	0.82	2.46 *	82.25 *
5	They are proactive in forecasting pest and diseases, showing foresight in agricultural planning.	0.81	2.45 *	81.72 *
6	Senior Scientist and Heads of KVKs efficiently plan for forecasting pest and diseases**,** ensuring timely interventions	0.76	2.30	76.88
7	Regularly attending to visitors from time to time highlights their commitment to engagement.	0.77	2.32	77.41
	Organizing			
8	Senior Scientist and Heads of KVK provide work opportunities to their staff, fostering productivity.	0.88	2.66 *	88.70 *
9	They conduct regular staff meetings, ensuring good communication and coordination within the team.	0.88	2.66 *	88.70 *
10	Their approach to division of work ensures tasks are efficiently distributed.	0.83	2.50 *	83.33 *
11	They successfully organize field days, promoting hands-on learning for staff and farmers.	0.87	2.61 *	87.09 *
12	Their efforts in providing work opportunities contribute to a positive and productive work environment.	0.79	2.38	79.56
	Directing			
13	Senior Scientist and Heads of KVK excel in giving clear and complete instructions to their subordinates.	0.81	2.45 *	81.72 *
14	They ensure technical guidance is provided to staff, enhancing their knowledge and skills.	0.80	2.41 *	80.64 *
15	Their appreciation of good work motivates staff and encourages high performance.	0.82	2.48 *	82.79 *

16	Providing proper direct instructions ensures clarity in task execution and results.	0.74	2.24	74.73
Communicating				
17	They provide instructions in time, keeping the work environment organized and timely.	0.82	2.48 *	82.79 *
18	Senior Scientist and Heads of KVK are adept at selecting the appropriate medium of communication, whether written or oral.	0.87	2.62 *	87.63 *
19	They set up an effective feedback mechanism to ensure continuous improvement.	0.88	2.64 *	88.17 *
20	They maintain regular work reports, demonstrating effective control over work processes.	0.74	2.22	74.19
Controlling				
21	They regularly track work progress through detailed reports from subordinates.	0.87	2.62 *	87.63 *
22	Senior Scientist and Heads of KVK are diligent in submitting timely reports to higher authorities, maintaining transparency and accountability.	0.89	2.67 *	89.24 *
23	They take personal observation of work processes to ensure everything is on track.	0.76	2.30	76.88
24	Maintaining self-discipline is a key part of their effective leadership and organizational culture.	0.67	2.30	67.74
Human Relation				
25	Senior Scientists and Heads of KVK consistently cooperate with staff to create a positive work environment.	0.89	2.67 *	89.24 *
26	They are impartial in their behavior towards colleagues, fostering a fair and just work environment.	0.95	2.85 *	95.16 *
27	They actively take interest in the development of juniors, contributing to the growth of future leaders.	0.76	2.29	76.34
Leading				
28	Senior Scientist and Heads of KVK promote teamwork and cultivate a collaborative environment for effective achievement of goals.	0.88	2.64 *	88.17 *
29	They work towards developing high group morale**,** ensuring a motivated and productive team.	0.87	2.62 *	87.63 *
30	Their inspiration to subordinates enhances the work spirit and encourages high performance.	0.89	2.67 *	89.24 *
31	They ensure the right person is chosen for each job**,** aligning skills with tasks.	0.95	2.85 *	95.16 *
32	Senior Scientist and Heads of KVK excel in maintaining discipline, fostering a respectful and productive work environment.	0.81	2.43 *	81.18 *
Supervising				
33	They consistently give suggestions properly to ensure the staff improves and delivers quality results.	0.82	2.48 *	82.79 *
34	They emphasize focus on quality of work, ensuring all tasks meet the highest standards.	0.81	2.45 *	81.72 *
35	Senior Scientist and Heads of KVK ensure timely completion of tasks, preventing delays in organizational goals.	0.81	2.43 *	81.18 *
36	They consistently supervise and evaluate the work of subordinates, ensuring efficiency and accountability.	0.76	2.29	76.34
Co- ordinating				
37	Senior Scientist and Heads of KVK excel at coordinating with line departments to ensure smooth inter-departmental operations.	0.82	2.48 *	82.79 *
38	They maintain strong coordination with reporting institutions, ensuring smooth communication for reporting purposes.	0.81	2.45 *	81.72 *
39	Coordination with subordinates is maintained to ensure all tasks are aligned with goals.	0.81	2.43 *	81.18 *
40	They work effectively in coordination with sister institutions, ensuring a collaborative and unified approach.	0.87	2.61 *	87.09 *
DECISION MAKING				
41	They make the right decision at the right time, contributing to effective decision-making.	0.82	2.48 *	82.79 *
42	Senior Scientist and Heads of KVK excel at finding facts for decision making, ensuring informed choices are made.	0.81	2.45 *	81.72 *
43	They implement decisions effectively, ensuring that all decisions lead to successful outcomes.	0.81	2.43 *	81.18 *
44	Decisions are made at the best level where information is accurate and adequate, ensuring quality outcomes.	0.79	2.37	79.03

Accordingly, statements having relevancy percentage of equal and more than 80.80 per cent, relevancy weight age of equal and more than 0.80 and mean relevancy score of equal and more than 2.42 were considered for the inclusion in item analysis. Thus, 34 statements were retained out of 44 statements and these statements were considered for further processing and suitably modified as per the comments of extension professionals wherever applicable.

6. Item analysis

The purpose of items analysis was to consider such items, which can very well discriminate between two criteria. The 34 items chosen through the judge's opinion were administered to the respondents in non-sampling area. The respondents were asked to indicate their degree of agreement or disagreement with each item on a five-point continuum, *viz*., Very Greater Extent (VGE), To a Great Extent (GE), To a Moderate Extent (ME), To a Least Extent (LE) and To a Very Least Extent (VLE), with scores of 5, 4, 3, 2 and 1, respectively, for positive statements and vice versa for negative statements. The selected 34 items were then subjected to item analysis to demarcate the items based on the extent to which they can differentiate the respondents into high and low score groups based on the level of managerial efficiency of senior scientist and Heads of KVKs.

7. Final selection of items for the managerial efficiency scale

The responses of the respondents in the non-sample area in ATARI Zone- XI were recorded and the summated score for the total items of each item of each respondent was obtained. For each respondent, the maximum possible score for 34 items was 170 and the minimum was 34. The scores of the respondents were arranged in descending order. The 25.00 per cent from the highest scores (high group) and the 25.00 per cent from the lowest scores (low group) were taken for the item analysis. These responses were subjected to item analysis for the selection of the items that constitute the final scale. The critical ratio, i.e., the t-value, which is a measure of the extent to which a given item differentiates between the high and low groups of scientists for each item,

is calculated by using the following formula:

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\sum(X_H - \bar{X}_H)^2 + \sum(X_L - \bar{X}_L)^2}{n(n-1)}}}$$

Where

$$\sum(X_H - \bar{X}_H)^2 = \sum X_H{}^2 - \frac{(\sum X_H)^2}{n}$$

$$\sum(X_L - \bar{X}_L)^2 = \sum X_L{}^2 - \frac{(\sum X_L)^2}{n}$$

Where,
XH=Individual scores in the high group
$\bar{X}$L=Individual scores in the low group
$\sum x^2$H=Sum of squares of the individual score on a given statement for high group
$\sum x^2$L=Sum of squares of the individual's core on a given statement for low group
n =Number of respondents in each group

8. Selection of items for inclusion in final scale

After computing the 't' value for all the items under study, 34 items with the highest 't' vale equal to or greater than 1.75 were chosen for the final study. The thumb rule of rejecting items with a 't' value less than 1.75 was followed. Thus, 34 items were retained with 't' values equal to or greater than 1.75, which is presented in Table 3.

Table 3: t-value for analysis of items in Managerial Efficiency of Senior scientist and heads of KVKs

Sl. No.	Statements	t-value
	Planning	
1	Senior Scientist and Heads of KVK demonstrate excellent determination of objectives	3.55
2	They effectively plan for the transfer of technology, ensuring successful outreach.	2.85
3	Their ability to plan for utilization of funds/budget ensures financial efficiency.	3.24
4	The preparation of the annual action plan reflects their structured approach to research.	2.79
5	They are proactive in forecasting pest and diseases, showing foresight in agricultural planning.	4.16
	Organizing	
6	Senior Scientist and Heads of KVK provide work opportunities to their staff, fostering productivity.	3.67
7	They conduct regular staff meetings, ensuring good communication and coordination within the team.	3.91
8	Their approach to division of work ensures tasks are efficiently distributed.	2.97
9	They successfully organize field days, promoting hands-on learning for staff and farmers.	2.33
	Directing	
10	Senior Scientist and Heads of KVK excel in giving clear and complete instructions to their subordinates.	3.58
11	They ensure technical guidance is provided to staff, enhancing their knowledge and skills.	3.92
12	Their appreciation of good work motivates staff and encourages high performance.	4.06
	Communicating	
13	They provide instructions in time, keeping the work environment organized and timely.	4.13
14	Senior Scientist and Heads of KVK are adept at selecting the appropriate medium of communication, whether written or oral.	3.68
15	They set up an effective feedback mechanism to ensure continuous improvement.	3.98
	Controlling	
16	They regularly track work progress through detailed reports from subordinates.	4.01
17	Senior Scientist and Heads of KVK are diligent in submitting timely reports to higher authorities, maintaining transparency and accountability.	4.14
	Human relation	
18	Senior Scientist and Heads of KVK consistently cooperate with staff to create a positive work environment.	4.12
19	They are impartial in their behavior towards colleagues, fostering a fair and just work environment.	4.08
	Leading	
20	Senior Scientist and Heads of KVK promote teamwork and cultivate a collaborative environment for effective achievement of goals.	3.88
21	They work towards developing high group morale**,** ensuring a motivated and productive team.	2.78
22	Their inspiration to subordinates enhances the work spirit and encourages high performance.	3.89
23	They ensure the right person is chosen for each job**,** aligning skills with tasks.	2.30
24	Senior Scientist and Heads of KVK excel in maintaining discipline, fostering a respectful and productive work environment.	4.09
	Supervising	
25	They consistently give suggestions properly to ensure the staff improves and delivers quality results.	3.12
26	They emphasize focus on quality of work, ensuring all tasks meet the highest standards.	2.99
27	Senior Scientist and Heads of KVK ensure timely completion of tasks, preventing delays in organizational goals.	3.96
	Co- ordinating	
28	Senior Scientist and Heads of KVK excel at coordinating with line departments to ensure smooth inter-departmental operations.	4.14
29	They maintain strong coordination with reporting institutions, ensuring smooth communication for reporting purposes.	3.89
30	Coordination with subordinates is maintained to ensure all tasks are aligned with goals.	3.78
31	They work effectively in coordination with sister institutions, ensuring a collaborative and unified approach.	4.19
	Decision making	
32	They make the right decision at the right time, contributing to effective decision-making.	3.62
33	Senior Scientist and Heads of KVK excel at finding facts for decision making, ensuring informed choices are made.	3.86
34	They implement decisions effectively, ensuring that all decisions lead to successful outcomes.	3.28

Standardization of Managerial Efficiency Scale for senior scientist and heads of KVKs

The reliability and validity are the concepts gives to evaluate the quality of scale how well a method measure something. The details of its procedures employed in the process of scale development elaborated as shown below:

9. Reliability and Validity of the scale

9.1 Reliability of the Scale

Reliability refers to the precision or accuracy of the measurement instrument. It is the degree of consistency between multiple measurements of a variable. Used when you have multiple questions in a survey/questionnaire that form a scale and you wish to determine if the scale is reliable or not. Cronbach alpha (Internal consistency reliability) coefficient was used to determine the reliability of the measuring instrument. Cronbach alpha coefficient was calculated on SPSS 20.0 *viz*., Analyse > Scale > Reliability Analysis > Check Items: Item, Scale, Scale if Deleted, Correlations > Click Continue and Ok > Reliability Statistics > Cronbach Alpha value.

The formula for Cronbach's alpha is

$$\alpha = N.\hat{C} / \bar{v} + (N-1).\hat{C}$$

Where,

N = the number of items.

$\bar{c}$ = average covariance between item-pairs.

$\bar{v}$ = average variance.

Scale	Reliability Statistics		
	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
ME	0.761	0.761	34

In the present study, the structured items are employed to sizable number of respondents in the non-sample area in the ATARI Zone-XI. The resulting α co-efficient of reliability for the managerial efficiency of respondents is 0.761, which made evident that the internal consistency of managerial efficiency is 'Better'. Hence, it is clear from the above results that the constructed scale is reliable as the value of reliability coefficient (α coefficient) is greater than 0.60.

10. Validity of the index

Validity is the extent to which a scale accurately represents the concept or construct of interest. In simple, scale is valid, if and only if it measures what it is supposed to measure. The content validity is the representative or sampling adequacy of the content, the substance, the matter and the topics of a measuring instrument. This method was used in the present scale to determine the content validity of the scale. The content of the final scale was finalized through exhaustive literature survey, followed by interaction with experts of the relevant field, scientists and other researchers. In addition, the judgement survey conducted prior to its finalization and selection of indicators according to the relevancy weightages ensured the content validity of the instrument. The statements had at least 80 per cent judges' agreement were retained. This indicated the content validity of the managerial efficiency scale. As the scale value difference for almost all the statements included had discriminating values, it seemed reasonable to accept the scale as valid measure of the desired dimension.

11. Administering the scale

The final scale was administered to all the senior scientist and Heads working for the KVKs in Karnataka irrespective of monitoring either by SAUs, NGOs and ICAR institutes and they were asked to respond on a five-point continuum, *viz*., strongly agree, Agree, Undecided, Disagree and strongly disagree against 34 statements. The final managerial efficiency scale consists of ten dimensions *viz.*, Planning, Organizing, Directing, Communicating, Controlling, Human Relation, Leading, Supervising Co-ordinating and Decision making, comprising to 34 statements.

The details of positive and negative statements used in the final scale were given in the table below. The scoring order for the responses was 5, 4, 3, 2 and 1, respectively, for positive items and vice versa for negative items.

Magnitude	Positive items	Negative items
Item Number	1, 2, 3, 4, 6, 7, 9, 10, 11, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29,30,31,32,33 and 34	5, 8, 12 and 18
Total	30	04

Based on the total cumulated score obtained, the managerial efficiency of senior scientist and head was classified in to three categories *viz*.; less efficient, efficient and highly efficient based on the mean and standard deviation as measure of check.

Sl. No.	Categories of Managerial Efficiency	Criteria
1	Less Efficient	(Mean -0.425× SD)
2	Efficient	Between (Mean ± 0.425× SD)
3	Highly Efficient	(Mean + 0.425× SD)

12. Conclusion

The present study was a significant step toward developing a standardized, valid, and reliable scale to measure the managerial efficiency of Senior Scientists and Heads of Krishi Vigyan Kendras (KVKs). Given the pivotal role that KVKs play in agricultural transformation and rural development, assessing the effectiveness of their leadership is crucial for enhancing institutional performance and impact.

Through a rigorous and systematic methodology—comprising literature review, expert consultations, item generation, content validation, and item analysis—the study successfully identified ten critical dimensions of managerial efficiency. Out of the initially framed 62 items, a refined set of 34 high-quality items with strong discriminatory power (t-values ≥ 1.75) was finalized for inclusion in the scale.

This scale serves as a comprehensive tool to evaluate various managerial competencies such as planning, coordination, communication, supervision, decision-making, and stakeholder engagement—key functions essential for effective leadership in the agricultural extension domain. The development of this scale not only provides a means to assess current managerial performance but also offers a foundation for identifying training needs, professional

development opportunities, and policy interventions aimed at strengthening the KVK system.

In conclusion, the scale offers a scientifically sound instrument that can be used by researchers, administrators, and policymakers to improve the overall effectiveness of agricultural extension services in India. Its adoption will contribute to strengthening grassroots agricultural institutions, thereby supporting national goals of food security, rural development, and sustainable farming.

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