



A Scale to Measure Farmers' Perception of Capacity Needs under NICRA

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HIGHLIGHTS

- A standardized scale with 31 statements was constructed to measure farmers' perceptions of capacity needs under NICRA.
- The reliability coefficient of the scale was 0.955.
- The scale helps assess farmers' needs, aiding policymakers in designing effective climate-resilient training programs.

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ABSTRACT

A study conducted in 2024 developed and standardized a summated-rating scale to measure farmers' perceptions of capacity needs under the National Innovations in Climate Resilient Agriculture (NICRA) program. An initial pool of 155 statements was generated from literature and expert consultation, then screened by 100 judges (41 responses) and reduced to 80 items using a relevancy index threshold of ≥ 80 . The 80 items were pilot-tested with 32 farmers in a non-sampled area; item analysis followed Edwards' top/bottom 25 per cent t-test procedure, and 31 items with $t > 2.145$ were retained. The final instrument's reliability was assessed using the split-half method with 40 respondents (odd-even split), yielding a coefficient of 0.955. Criterion validity was examined by correlating perception scores with operational landholding; the correlation was moderate ($r = 0.531$), supporting the scale's validity. The resulting scale provides a consistent and interpretable measure of farmers' capacity-need perceptions under NICRA and can inform targeting of training, advisory, and monitoring interventions. The tool is adaptable to other locations and projects with minor contextual changes.

INTRODUCTION

Climate change causes major challenges to agriculture, particularly in regions dependent on consistent weather patterns (Ashoka et al., 2022; Kotir, 2011; Khan et al., 2025). In India the National Initiative on Climate Resilient Agriculture (NICRA) plays a good role in helping farmers adapt to climate variability by fostering practices that improve their resilience (Prasad et al., 2014; Hayat et al., 2025). NICRA, launched in 2011 by the Indian Council of Agricultural Research (ICAR), aims to make Indian agriculture more resilient to climate variability (Gupta, 2021). It promotes climate-resilient technologies in crops, livestock, fisheries, and natural resource management through activities such as technology

demonstrations, capacity building, custom hiring of machinery, weather-based advisories, and contingency planning. Implemented via KVKs, ICAR institutes, and State Agricultural Universities, NICRA covers four modules - Natural Resource Management, Crop Production, Livestock and Fisheries, and Institutional Interventions and provides a national platform for research, demonstration, and policy support. NICRA provides training, demonstrations, and on-farm trials that link research with real-world applications, thus considerably enhancing sustainable agricultural development and farmers' livelihoods (Prem et al., 2024). To make sure that the program successfully satisfies these requirements, it is crucial to comprehend how farmers view their needs for capacity building under NICRA (Nguyen et al., 2016). This involves assessing the

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extent to which NICRA's initiatives, such as information exchanges, trainings, and adaptive trials, assist farmers in implementing climate-resilient farming methods (Saini et al., 2020).

In the study, perception was defined as the meaningful recognition of the gap between the current availability and the required level of knowledge, skills, resources, and institutional support needed by farmers to effectively adapt to and mitigate the effects of climate change on agriculture. This recognition reflects the comprehension of what is necessary to achieve resilience and sustainability in agricultural practices amid changing climate conditions.

This research seeks to answer the question: "How can a reliable and valid scale be developed to measure farmers' perceptions of their capacity needs under NICRA?" The specific objective is to develop and standardize a perception scale that captures farmers' beliefs, feelings, and tendencies towards NICRA services. The tool, though not a needs assessment itself, is intended for future use in assessing such needs and generating data that can guide policymakers and practitioners in designing targeted and effective capacity-building programs. By providing a valid and reliable measure, the scale can support improvements in NICRA's effectiveness, ultimately strengthening farmers' resilience to climate change and promoting growth in the farming sector.

METHODOLOGY

The approach of summated rating was adopted for constructing the scale. A summated rating scale is a set of statements, each carrying distinct scores based on the degree of agreement or disagreement from subjects (Jaisridhar et al., 2013). This method was adopted for the present study because it avoids using a single statement to represent a concept (Harpe, 2015). Instead, multiple statements are used as indicators, each representing different facets of the concept, providing a more well-rounded perspective (Thakur et al., 2017).

A set of items and statements that elicit the perception of farmers' capacity needs under NICRA was compiled in consultation with experts in Agricultural Extension Education and officials of KVK. A preliminary list of 155 statements, consisting of 85 positive and 70 negative statements, was drafted, ensuring their relevance to the study area. These items were then meticulously revised according to the criteria proposed by Likert, and Edwards (1957), leading to the elimination of 21 statements. The remaining 134 statements were included for judges rating.

The relevancy of the items was determined by distributing the statements to 100 judges along with clear instructions. These judges were experts from agricultural universities and KVKs. They were asked to rate the relevance of each item in assessing farmers' perceptions of capacity needs under NICRA on a five-point scale: Most Relevant (MR), Relevant (R), Somewhat Relevant (SWR), Less Relevant (LR), and Not Relevant (NR), with corresponding scores of 5, 4, 3, 2, and 1, respectively and reverse scoring for negative statements. Of the 100 judges, 41 responded within two months. The scores for each item were aggregated across all respondents, and a relevancy index was calculated using the following formula:

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

Items that achieved a relevancy index of 80 or above were selected, resulting in the retention of 80 items. Item analysis was then conducted on the selected statements, with the scale standardized by testing its reliability and validity. Item analysis is a set of procedures applied to determine the indices for truthfulness (or validity) of the items within a scale (Rezigalla, 2022). The t-test, as suggested by Edwards (1957) was used for item selection. This method was employed to evaluate the ability of each item to discriminate between high and low effectiveness groups of respondents.

The 80 items, based on the relevancy ratings provided by the judges, were administered to 32 farmer respondents in a non-sampled area, with responses collected using a five-point scale: 'Strongly Agree,' 'Agree,' 'Somewhat Agree,' 'Disagree,' and 'Strongly Disagree.' For the item analysis, two types of scores were utilized: the item score, referring to an individual's score on a specific item, and the total score, which is the sum of an individual's scores across all items. These scores were used to calculate the t-test.

The t-test reflects an item's ability to distinguish between respondents in the high-effectiveness and low-effectiveness categories. As suggested by Edwards (1957), the top 25 per cent of respondents with the highest total scores and the bottom 25 per cent with the lowest total scores were selected for analysis. The critical ratio (t-value) for each item was then calculated 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, $\bar{X}_H$ = Mean of the score of an item for the high group, $\bar{X}_L$ = Mean of the score of an item for the low group, N = Number of subjects in a group

The developed scale was standardized by assessing its reliability and validity. In this study, the split-half method was utilized to test reliability. The scale was split into two halves based on the odd and even-numbered statements and administered to 40 respondents. The two sets of scores were then obtained, and Karl Pearson's product-moment correlation coefficient was calculated between them to determine the reliability of the scale. In this investigation, criterion validity was evaluated using the operational landholding of the farmers as the criterion.

RESULTS

The t-values for the 80 items were analysed to determine the most relevant statements for the final scale. As shown in Table 1, 31 items had t-values above 2.145 and were selected for inclusion in the final scale. To ensure the scale accurately measures the intended construct and maintains consistency in measurements, it was standardized by evaluating its reliability and validity. The reliability coefficient of the test was 0.955, indicating a high level of reliability. This suggests that the scale provides consistent results and is suitable for assessing farmers' perceptions of capacity needs under NICRA.

The scale was developed through a systematic examination of its content to ensure it represented a comprehensive sample of the

Table 1. Final Items included in the perception scale

S.No.	Items	t value
1.	Familiarity with integrated crop management approaches through training is highly advantageous for me.	2.16
2.	Training on pest and disease management methods is highly beneficial for me.	2.72
3.	Familiarity with human nutrition and childcare practices through training is not beneficial for me. (-)	5.49
4.	Training on climate change did not enable me to actively engage in NICRA project tasks. (-)	2.81
5.	Less emphasis should be placed on the horticultural sector. (-)	2.55
6.	Training on fodder and feed management practices is not beneficial for me. (-)	2.17
7.	Learning about natural resource conservation methods through training is not advantageous for me. (-)	2.30
8.	Learning livestock and fishery management techniques through training is not beneficial for me. (-)	2.41
9.	Understanding drudgery reduction methods for women in agriculture through training is not beneficial for me. (-)	3.05
10.	Proficiency in nursery raising practices through training is not beneficial for me. (-)	3.99
11.	Training on crop diversification strategies is highly beneficial for me.	2.35
12.	The training themes don't correspond well with my farming activities. (-)	6.14
13.	I believe using field days for showing technology related to climate change adaptation is necessary for effective climate change adaptation in the village.	2.64
14.	I think dissemination through electronic media is occasional.	2.30
15.	I support group discussions are the highly effective training method.	5.96
16.	I think fields of successful farmers are not suitable venues for effective training. (-)	2.25
17.	I believe using farmer field school extension approaches for developing farmers' problem-solving skills is necessary for effective climate change adaptation in the village.	4.12
18.	I feel scientists are not effective trainers. (-)	4.68
19.	I think video lessons are the highly effective training method.	2.25
20.	I feel training for more number of days at a stretch are not much effective.	2.91
21.	I believe agro-advisory services are helping less number of farmers. (-)	2.57
22.	I believe that in-person monitoring really helps the project.	2.35
23.	In my view, monitoring and evaluation play a crucial role.	3.47
24.	I perceive that the primary function of the monitoring committee is to evaluate and offer recommendations.	4.91
25.	I believe that additional training would enhance my understanding of the complexities of adaptation interventions.	2.39
26.	I think there ought to be a designated budget allocated specifically for exposure visits.	2.57
27.	I feel that capacity building should be organized in a more systematic manner.	4.53
28.	ICT plays a vital role in effectively reaching out to people.	4.85
29.	I feel that greater attention should be given to capacity building for farm women.	2.30
30.	There is a necessity to shift away from conventional methods of project activities.	2.29
31.	I find the distribution of soil health cards to be greatly beneficial.	2.43

(-) Negative statements

domain being measured. Essential items reflecting farmers' capacity needs were included, confirming content validity. The perception scores were compared with the operational landholding of 40 non-sampled respondents. Pearson's product-moment correlation coefficient ($r = 0.531$) confirmed the validity of the scale.

The final scale consisted of 31 statements arranged in random order. Respondents indicate their responses using a five-point Likert scale: Strongly Agree (5), Agree (4), Somewhat Agree (3), Disagree (2), and Strongly Disagree (1) for positive statements, with reverse scoring for negative statements. The total score for each respondent is computed and classified into high, medium, or low perception levels based on predefined score ranges.

DISCUSSION

The selection of 31 statements based on t-values above 2.145 ensures that the final scale retains only the most significant items, improving its precision in assessing farmers' perceptions. The high reliability score (0.955) indicates strong internal consistency, suggesting that the scale will yield stable results across different applications. The reliability of the present scale is higher than that reported by Salam et al., (2025) in their scale for assessing farmers'

attitude towards indigenous cattle conservation and Kour et al., (2025) in their attitude towards the maize and wheat crops. The reported values were also less in case of Shitu et al., (2018) & Gupta et al., (2022). The content validity of the scale was established by carefully selecting statements that comprehensively represent farmers' capacity needs under NICRA. The criterion validity, supported by a moderate correlation ($r = 0.531$) with operational landholding, further confirms that the scale effectively captures the intended perception construct.

The administration procedure ensures a structured and quantifiable assessment of perceptions. The five-point Likert scale allows for nuanced responses, while the categorization into high, medium, and low perception levels enhances interpretability. This standardized approach ensures that the scale can be effectively used in future research and policy assessments related to capacity-building interventions under NICRA.

CONCLUSION

A scale was developed and standardized to measure farmers' perceptions of their capacity needs under NICRA. The scale was identified to be both reliable and valid. This tool will quantify

farmers' perceptions regarding their capacity needs, and the data obtained can be replicated in similar projects with minimal modifications. Ultimately, this will aid in formulating strategies to effectively mitigate the consequences of climate change on agriculture and support farmers.

DECLARATIONS

Ethics approval and informed consent: The experts to judge the items were well informed regarding the purpose and only the responses of the judges who consented have been included for analysis purposes.

Conflict of interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The authors declare that during the preparation of this work, they thoroughly reviewed, revised, and edited the content as needed. The authors take full responsibility for the final content of this publication.

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