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DEVELOPMENT AND STANDARDIZATION OF A SCALE TO ASSESS ATTITUDE OF PADDY FARMERS TOWARDS NATURAL DISASTER MANAGEMENT

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ABSTRACT

A standardized scale was developed to measure farmers' attitudes towards the Natural Disaster Management of Paddy farmers of Andhra Pradesh state. A total of 64 items including both positive and negative were subjected to expert's judgement and 34 items were selected for item analysis and were presented to 60 respondents from non-sample area. The item analysis score was performed using Likert's rating technique of measurement and t values were calculated for each item. Finally, 18 items were selected under four components prevention and mitigation, preparedness, response and recovery of Natural Disaster Management and were standardized by establishing their reliability with Cronbach's alpha value 0.74 and content validity attained through experts' judgement. The. Thus, the reliability and validity of the current scale indicate its consistency and precision of the results. The developed scale will help the researchers in assessing the attitude of Paddy farmers towards the Natural Disaster Management within a defined target population. Additionally, it will facilitate the development of evidence-based extension strategies and programs designed to enhance disaster management.

Key words: Attitude, Natural Disaster Management, Likert Scale, Cronbach Alpha, Reliability and Validity

Introduction

India is one of the most disaster-prone countries in the world, with approximately 85 per cent of its land exposed to one or more natural hazards. On average, every year around 75 lakh hectares of land is affected by floods, more than 1,600 lives are lost, and damage to crops, houses, and public utilities amounts to approximately Rs. 1,805 crores (NDMA Floods, n.d.). Rice (*Oryza sativa* L.) is the main staple food in India and provides the income to millions of small-scale farmer growers and occupies a central place in the agricultural economy of states like Andhra Pradesh, Odisha, West Bengal and Punjab. It is, however, highly sensitive to climatic shifts throughout the crop cycle, especially in the transplanting,

tillering and grain-filling phases when the crop is most vulnerable to flooding, cyclones and heavy rains because water-logging, submergence, strong winds and lodging that can cause partial to total crop failure as monsoonal variability and cyclonic activity coming from the Bay of Bengal, particularly the low lying coastal and deltaic areas of the country. At the aggregate level, India loses roughly 0.46 percent of its GDP annually to floods, with crop damage alone accounting for about 0.18 percent of GDP and nearly 6 percent of the rural population affected each year. (Parida *et al.*, 2022)

In Andhra Pradesh specifically, crop areas damaged due to hydro-meteorological hazards including cyclonic storms, heavy rains, flash floods, and river floods have

been recorded consistently from the 1970s onwards, with extensive damage documented for the years 1977, 1990, 2000, 2009, 2010, 2019, 2023, and 2024 (Indiastat,; NDMA AP Flood Hazard Atlas). Heavy and unseasonal rains independent of cyclonic activity have also been reported to have affected 52,551.99 hectares of agricultural land in Andhra Pradesh in a single season, damaging crops including paddy, horticulture produce, and vegetables (Outlook India, 2020). The impact of disasters on farmers' decision-making extends beyond the actual loss of standing crops, as disaster exposure alters farmers' decision-making in more enduring ways. Farmers' attitudes toward natural disaster management are a perceptual and dispositional dimension determines how well prevention and mitigation measures are taken up and influences preparedness behaviour in the run-up to forecast events and the speed and suitability of response and recovery actions when a disaster occurs. In view of this aspect, the researcher has decided to develop the scale to measure attitude of farmers towards Natural Disaster Management of Paddy farmers.

Materials and Methods

Attitude is an organized predisposition to think, feel, perceive and behave towards a cognitive object. The attitude in the present study as "The degree of positive or negative effect associated with some psychological object" (Thurstone, 1946). By psychological object we mean the feeling about Natural Disaster Management, which people could differ with respect to positive or negative effect. Among the techniques available for construct of attitude scale, Likert's technique of summated rating scale is quite well known. Likert scale is a commonly used method for measuring attitudes, opinions, perceptions or beliefs, where respondents are asked to rate their level of agreement or disagreement with a series of statements. The study utilized the well-established Likert summated rating method (Likert, 1932), which is appropriate for assessing psychological constructs like attitude (Thurstone, 1946). The steps for Likert's summated rating scale construction are as under:

Item Collection

The items making up an attitude scale are known as statement. A statement may be defined as anything that is said about an object. A total of 78 statements were listed tentatively by thorough assessment of literature and expert opinions that are relevant to the study.

Editing the statements

By adopting the 14 informal criteria suggested by Edwards (1969) the statements were edited, revised and refined carefully. These statements were framed in such

a way that they expressed the both positive and negative attitude. The following criteria were used to edit the drafted statements.

1. Avoided statements that refer to the past rather than to the present.
2. Avoided factual statements.
3. Avoided statements that may be interpreted in more than one way.
4. Avoided statements that are unrelated to the psychological item being examined.
5. Avoided statements that are likely to be endorsed by almost everyone or by almost no one.
6. Selected the statements that are believed to cover the entire range of the affective scale of interest.
7. Maintained the language of the statements simple, clear, and direct.
8. Statements were made as short as possible, rarely exceeding 20 words.
9. Each statement contained only one complete thought.
10. Statements containing universals such as all, always, none and never often introduce ambiguity were avoided.
11. Words such as only, just, merely and others of a similar nature were used with care and moderation was also carried out in writing statements.
12. Almost all the, statements were framed in the form of simple sentences rather than in the form of compound or complex sentences.
13. Avoided the use of words that may not be understood by those who are to be given the completed scale.
14. Avoided the use of double negatives

After editing, the 78 statements 12 statements were deleted and 66 statements were retained for the Judges evaluation of which 43 statements were positive and 23 statements were negative.

Experts' response to raw statements

It is possible that not all of the initially collected statements were equally relevant for assessing farmers' attitudes toward natural disaster management. Therefore, the statements were subjected to expert review to evaluate their relevance and to determine their suitability for inclusion in the final scale. For this purpose, 66 statements were administered to a panel of experts for review to assess their relevance, comprehensiveness, and

Table 1: Statements of item analysis by farmers of non-sample area.

S. No	Statements	t Values
I Prevention & Mitigation		
1	I am aware that my area is disaster prone	1.36
2	I am aware of the different natural disasters that affect paddy cultivation in my area	2.03
3	Disaster management increases my farms profitability	2.48
4	I am willing to use new technologies to minimize crop losses	1.98
5	I regularly maintain drainage channels to prevent water logging	0.51
6	Real time information via mobile helps to respond quickly to disasters	1.99
7	I regularly discuss possible disaster scenarios and coping strategies with my family	1.38
8*	Preventive measures for natural disasters are not effective for paddy farming	2.06
9*	Frequent occurrence of disasters affects the long-term sustainability of paddy farming	2.11
10*	I have inadequate insurances to tackle uncertainties	1.49
II Preparedness		
11	Agricultural contingency plans of government are the best source of preparedness of disaster management	2.13
12	I believe contingency plans should include livestock protection	1.48
13	I feel that government should provide regular updates on contingency crop planning	1.13
14	Government should provide more trainings and demonstrations on managing paddy fields during disasters	1.89
15	I am open to adopt new technologies like weather apps and SMS alerts	0.82
16	I regularly monitor weather forecasts during the paddy growing season	1.95
17*	I feel disaster related issues should be assessed from farmer's point of view	0.98
18*	Lack of timely and accurate early warning information is barrier to disaster preparedness	1.90
III Response		
19	I believe that the success of disaster management depends largely on community cooperation and collective efforts rather than individual actions	1.50
20	Multiple buyers contacts ensure purchase of produce after disaster	1.84
21	Organized farmer groups can improve marketing options after a disaster damages paddy quality	1.76
22	Government intervention in paddy procurement ensures support for affected farmers	2.07
23*	Disaster management is the responsibility of government but not the community	1.32
24*	Natural disasters affect the timeliness of agricultural operations	1.94
25*	I often rely on my own experience than scientific advice	1.49
IV Recovery		
26	Repeated occurrence of disaster will affect the farmers living standards	1.62
27	Crop insurance minimizes crop losses due by disasters	2.15
28	I believe that social networks help in quick recovery after disasters	2.00
29	Access to low interest credit is vital for farmer's quick recovery after disasters	1.91
30	The combined effect of crop insurance and government market support during disasters increases my motivation to continue paddy farming	1.59
31*	Government support is temporary after a major disaster but lacks long term support	2.48
32*	Delay in receiving insurance claims disrupts my farm budget and sometimes leads me to borrow money at high interest after crop failures	1.62
33*	I believe migration is sometimes the only option after repeated disasters	1.57
34	Government compensation is sufficient to recover from the crop losses	1.18
<i>* Negative statements</i>		

clarity. The expert panel comprised subject matter specialists, faculty members, scientists affiliated with various ICAR institutes, ANGRAU and researchers or professionals with substantial experience in the domain of natural disaster management and agricultural extension. A questionnaire comprising 66 attitude statements, under four components of Natural Disaster Management i.e., 1. Prevention and Mitigation, 2.

Preparedness, 3. Response and 4. Recovery. Each item was rated on a five point relevance scale (ranging from most relevant, relevant, somewhat relevant, less relevant and not relevant with corresponding scores of 5, 4, 3, 2, and 1, respectively), was circulated to 80 judges via emails, google forms and in some cases distributed in person. Detailed instructions were provided for the rating process for each item. In addition, judges were invited to suggest

any modifications, additions, or deletions to the statements based on their professional judgment and insights. Of the 80 judges approached, 50 returned their completed responses.

The responses received from the judges were subjected to a Standard Normal Deviate test (z test). After assigning scores to the statements, the 'z' values were computed for each statement using the formula:

$$z = (X - \mu) / \sigma$$

$\bar{z}$ = average of the score obtained for each statement

μ = mean score for that statement

σ = standard deviation of the scores for that statement.

The grand 'z' values for all 66 statements were then derived and ' $\bar{z}$ ' was determined. Statements with 'z' values above ' $\bar{z}$ ' (0.02) were retained as the scalable items reflecting farmers' attitudes towards natural disaster management, whereas those with 'z' values below ' $\bar{z}$ ' were discarded. As a result, 34 out of the original 66 statements were retained through the relevancy testing procedure.

Item analysis (Computation of t-value)

Analysis of the statements is a significant step in construction of scale that is both valid and reliable. So, the selected 34 statements were subjected to item analysis to differentiate items according to their ability to distinguish respondents with a favourable attitude from those with an unfavourable attitude toward natural disaster management. For computation of t value, the selected statements were administered to 60 non-sample respondents and their responses were collected. Respondents indicated their responses on a five point Likert scale, ranging from Strongly Agree (SA; score = 5) to Strongly Disagree (SDA; score = 1). For positive statements, the scale was coded as SA = 5, Agree (A) = 4, Undecided (UD) = 3, Disagree (DA) = 2 and Strongly Disagree (SDA) = 1 and for negative statements, the scoring was reversed accordingly. Following the computation of overall attitude scores for each farmer, respondents were ranked in descending order. The top 25% (15 farmers) and the bottom 25% (15 farmers) were selected as criterion groups for item analysis, while the middle 50% were excluded, in accordance with Edwards' (1957) procedure. The critical ratio (t value) for each statement was subsequently calculated using Edwards' (1969) method to evaluate its discriminative power.

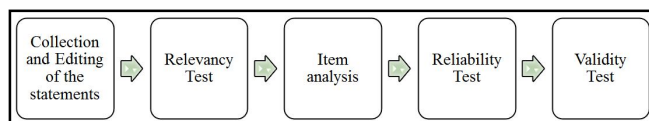


Fig. 1: Steps followed in development of an attitude scale.

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

$\bar{X}_H$ = Mean score on a given statement for high group

$\bar{X}_L$ = Mean score on a given statement for low group

$\sum \bar{X}_H^2$ = Sum of squares of individual score on a given statement for high group

$\sum \bar{X}_L^2$ = Sum of squares of individual score on a given statement for low group

$\sum \bar{X}_H$ = Summation of scores on a given statement for high group

$\sum \bar{X}_L$ = Summation of scores on a given statement for low group

n = Number of respondents in each group

Σ = Summation

Selection of attitude statements for the final scale

Using Bird's (1940) criterion, items with t-values below 1.75 were discarded for insufficient discrimination. Items with t-values exceeding 1.75 were retained for the final attitude scale, as they effectively distinguished between favourable and unfavourable respondents and were therefore considered valid measures of farmers' attitudes toward natural disaster management. The resulting standardized attitude scale comprised 18 highly discriminating items, of which 13 were positive and 5 negative measured on a five-point continuum viz., strongly agree (SA), agree (A), undecided (UD), disagree (DA) and strongly disagree (SDA) with 5,4,3,2 and 1 for positive statements and vice-versa for negative statements.

Standardization of the scale

For the purpose of standardization, validity and reliability of the scale was ascertained as following.

Reliability of the scale

Reliability refers to the precision or accuracy of measurement or score (Ray and Mondal, 1999). A good instrument should evoke responses that are valid and yield nearly same results if administered twice to the

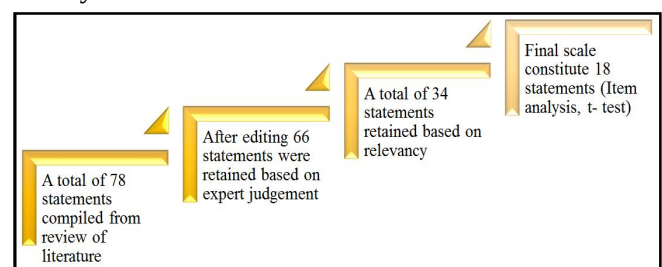


Fig. 2: Procedure for selection of statements for attitude scale construction.

Table 2: Statements selected for inclusion in the final scale.

S.No.	Statements	t values
I Prevention & Mitigation		
1	I am aware of the different natural disasters that affect paddy cultivation in my area	2.03
2	Disaster management increases my farms profitability	2.48
3	I am willing to use new technologies to minimize crop losses	1.98
4	Real time information via mobile helps to respond quickly to disasters	1.99
5*	Preventive measures for natural disasters are not effective for paddy farming	2.06
6*	Frequent occurrence of disasters affects the long-term sustainability of paddy farming	2.11
II Preparedness		
7	Agricultural contingency plans of government are the best source of preparedness of disaster management	2.13
8	Government should provide more trainings and demonstrations on managing paddy fields during disasters	1.89
9	I regularly monitor weather forecasts during the paddy growing season	1.95
10*	Lack of timely and accurate early warning information is barrier to disaster preparedness	1.90
III Response		
11	Multiple buyers contacts ensure purchase of produce after disaster	1.84
12	Organized farmer groups can improve marketing options after a disaster damages paddy quality	1.76
13	Government intervention in paddy procurement ensures support for affected farmers	2.07
14*	Natural disasters affect the timeliness of agricultural operations	1.94
IV Recovery		
15	Crop insurance minimizes crop losses due by disasters	2.15
16	I believe that social networks help in quick recovery after disasters	2.00
17	Access to low interest credit is vital for farmer's quick recovery after disasters	1.91
18*	Government support is temporary after a major disaster but lacks long term support	2.48
* Negative statements; SA: Strongly Agree; A: Agree; UD: Undecided; DA: Disagree; SDA: Strongly Disagree		

respondents (Goode and Hatt, 1952). To ensure the reliability of the final attitude scale measuring farmer's attitude towards natural disaster management, its reliability was tested using Cronbach's Alpha. The resulting value is 0.74 signifies the excellent internal consistency, indicating that the items were measuring the targeted construct but in some cases a Cronbach Alfa coefficient of 0.6 or higher is also regarded and adequate to establish the accuracy of the measuring instrument. (Nunnally and Bernstein, 1994)

Validity of the scale

The validity of the scale was established through content validity. Content validity refers to the representativeness or sampling adequacy of the content, substance, subject matter and topics covered by a measurement instrument. Content validity of the attitude scale is obtained through the judge's opinion. The statements selected for the scale were evaluated individually and as a whole by the judges. These were again checked by experts in Acharya N.G. Ranga Agricultural University for their relevance and coverage. As the content of the scale was borne out by the method of collecting statements within the universe of attitude of farmers towards natural disaster management, it may reasonably be assumed that the attitude of farmers towards natural disaster management scale has content validity.

Results and Discussion

A total of 34 statements were retained based on the opinion of experts and administered to 60 farmers from a non-sampling area and responses were recorded on a five- point scale i.e., Strongly agree (SA), Agree (A), Undecided (UD), Disagree(D) and strongly disagree (SDA) with scores 5,4,3,2 and 1 respectively for positive statements and vice-versa for the negative statements.

The summed scores of respondents for all the statements with values ranging from 34 to 170 and the respondents were arranged in descending order. The top 25 per cent and bottom 25 per cent were chosen as the criterion groups for the t- value computation. Each statement t value is calculated and the statements having t value more than 1.75 is selected as they could distinguish between favourable and unfavourable attitudes.

As a result, the final scale to assess farmers attitude towards natural disaster management contains 4 components with a total of 18 statements of which 13 were positive and 5 were negative as shown in the Table 2.

Conclusion

Development of a standardized scale to measure the attitude of farmers towards natural disaster management represents the significant step forward in disaster management in practice. The scale's robustness in

capturing various dimensions of farmer attitude ensures its utility in effective interventions for farmers. Further studies could build upon this work by further refining the scale, exploring how attitude correlates with socioeconomic factors. It can serve as a useful tool for researchers, policymakers, and development agencies to identify the risks and uncertainties perceived by farmers, to prioritize suitable interventions, and to design data-driven and context-specific strategies for strengthening resilience of farmers towards natural disasters.

Declarations

Ethical approval and consent to participate: The informed consent was sought from the respondents.

Availability of supporting data: Supporting data are available upon request.

Competing interests: No competing interests were declared.

Conflict of interest: No conflicts of interest among the authors.

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