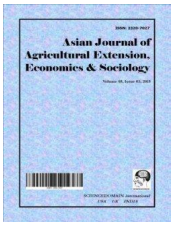

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Scale to Measure Attitude of Farmers towards Recommended Water Management Technologies and Practices

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Authors' contributions

This work was carried out in collaboration between all authors. The lead author KQJ designed the study, wrote the first draft of the manuscript and interoperated the results. Author PPM fine-tuned the methodology in reference to various literatures while author KM supervised data collection and the analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

Recommended water management technologies and practices are a number of measures developed for the specific crop of varied farming systems as a resolution for conserving water in agriculture. These technologies are developed after meticulous research and recommended to farmers by research institutes of Indian Council of Agriculture Research (ICAR), State Agricultural University or other organisation. In This Paper, a scale is developed that can be used to assess the attitude of farmers towards recommended water management technologies and practices to frame various developmental programs. Attitude is a developed feeling or emotion about some psychological object which helps an individual to give a verdict on that psychological object. The scale is developed to measure the attitude of farmers towards recommended water management technologies and practices for which 'Likert method of summated ratings' is followed.
A total of 57 statements results after edition of 85 statements as per the criteria suggested by

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Edwards [1], and sent to 100 extension specialists working in various research and extension wings of ICAR, State Agricultural Universities throughout the country for critical evaluation of statements on a 5 point continuum. The responses received from 46 judges out of 100, an aggregate of 29 statements are selected based on the relevancy test i.e., relevancy weight, percentage and mean relevancy scores. Further, the statements are subjected to item analysis by administering them to 100 farmers from a non-sample area. Finally a total of 12 statements are selected based on the 't' values (> 2.75) resulted from the item analysis and included in the final scale. Thus, the instrument developed to measure the attitude of farmers towards recommended water management technologies, and practices consist of 6 positive and 6 negative attitude statements.

Keywords: Attitude scale; relevancy test; water management technologies; t-value; split-half reliability; content validity; Likert's summated rating.

1. INTRODUCTION

Attitudes are imbibed through experiences and have a strong impact on the behaviour exerted by an individual. Further, it also assists the individual in exercising their decision-making skills efficiently [1]. To measure the attitude of farmers towards recommended water management technologies and practices a scale is developed by using summated attitude scale construction given by Edwards A.L. [2]. Edwards defines attitude as the degree of positive or negative affect associated with some psychological object [3]. The attitude in this study is operationally defined as the degree of favourable or unfavourable feeling of farmers towards recommended water management technologies and practices.

2. METHODOLOGY

Summated rating method is used to construct the attitude scale [4], and the procedure of this method followed in the study is adopted from Abdullah Faiz [5] to construct a distinct attitude scale towards recommended water management technologies and practices. The details of the procedure followed and standardisation of the scale to measure the attitude of farmers towards recommended water management technologies and practices is as follows:

2.1 Collection and Editing of Items

About 85 statements representing the attitude of farmers towards recommended water management technologies and practices are collected initially from various sources viz., literatures, journals, thesis of post-graduation and interaction with experts of different Institutes viz., Water Technology Centre, Tamil Nadu Agricultural University, Irrigation Management and Training Institute, MANAGE (National Institute of Agricultural Extension Management). They are then edited on the basis of criteria suggested by Edward [2] and about 57 statements are selected based on their appropriateness.

2.2 Relevancy Test

All the statements collected may not be relevant equally in measuring the attitude of farmers towards recommended water management technologies and practices. Hence, these statements are subjected to scrutiny by an expert panel to determine the relevancy and screening for inclusion in the final scale. For this, the list of scrutinised 57 statements are sent to a panel of 100 experts with request to critically evaluate each statement for its relevancy to measure attitude of farmers towards water management technologies and practices.

The experts comprised Scientists of ICAR Research Stations and Institutions, Subject matter specialists in KVKs and experts from State Agricultural Universities throughout the country for critical evaluation. The experts are requested to give their response on a five point continuum viz, highly relevant, Relevant, Neural, irrelevant, Highly Irrelevant with scores 5,4,3,2 and 1 respectively.

Out of 100 experts only 46 responded in a time span of two months. The relevancy score of each item is ascertained by adding the scores on rating scale for all the 46 experts' responses. From this data, relevancy percentage, relevancy weightage and mean relevancy scores are worked out for all the statements by using the following formulae [6,7].

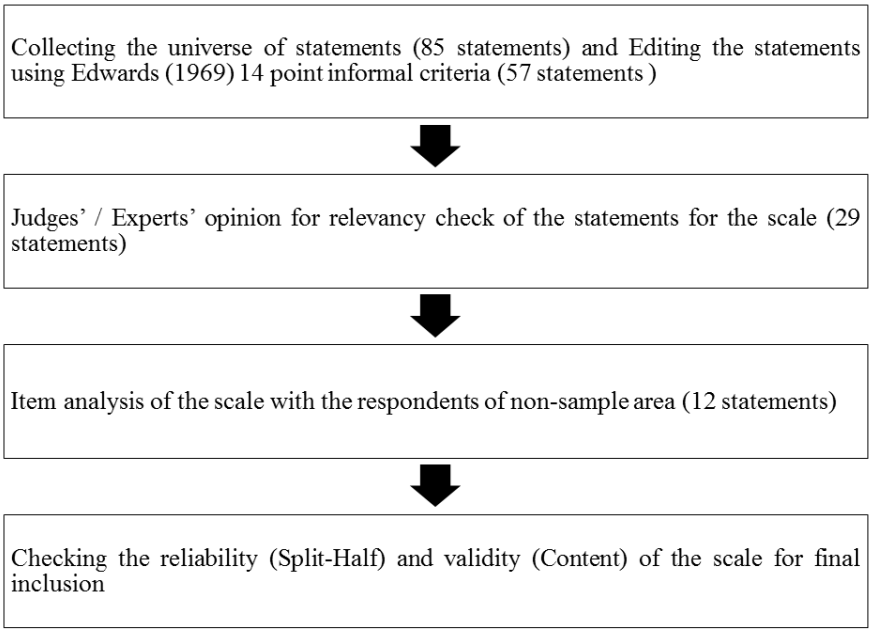

Fig. 1. Representation of the methodology used for the construction of the scale

2.2.1 Relevancy percentage (RP)

Relevancy percentage is worked out by summing up the frequency score of highly relevant, relevant, and neutral categories i.e. number of respondents who rated the statements highly relevant, relevant, and neutral, which are converted into percentage.

$$\mathrm{RP} = \left(\frac{\mathrm{FS}}{\mathrm{MPS}}\right) \times 100 \quad (1)$$

2.2.2 Relevancy weightage (RW)

Relevancy weightage is obtained by the Formula

$$\mathrm{RW} = \frac{\mathrm{HRR} + \mathrm{RR} + \mathrm{NR} + \mathrm{IR} + \mathrm{HR}}{\mathrm{MPS}} \quad (2)$$

2.2.3 Mean relevancy score (MRS)

This is obtained by the following formula

$$MRS = \frac{HRR+RR+NR+IR+HR}{N} \quad (3)$$

Where,

FS = Frequency score
HRR = High Relevant Response (X5)
RR = Relevant Response (X4)
NR = Neutral Response (X3)
IR = Irrelevant Response (X2)
HR = Highly Irrelevant (X1)
MPS = Maximum Possible Score (46 x 5 = 230)
N = Number of Experts (46)

Using these three criteria the statements are screened for their relevancy. Accordingly, statements having relevancy percentage >70, relevancy weightage >0.70 and mean relevancy score >3.5 are considered for final selection of statements. By this process, out of 59 statements, 29 statements have relevancy percentage >70, relevancy weightage >0.70 and mean relevancy score >3.5 and are isolated in the first stage of screening, suitably modified and rewritten as per the comments of experts. Thus finally about 29 statements are selected after the relevancy test.

2.3 Item Analysis and Calculation of "t" Value

The selected 29 statements are subjected to item analysis to demarcate the items based on the extent to which they can differentiate the respondents with high attitude and low attitude towards recommended water management technologies and practices. Thus scrutinized statements representing the attitude of farmers towards recommended water management technologies and practices are administered to 100 respondents from non-sampling area. The respondents are asked to

indicate their degree of agreement or disagreement with each statement on a five-point continuum ranging from "strongly agree" to "strongly disagree", the scoring given is 5 weightage to strongly agree responses, 4 to agree, 3 to undecided, 2 to disagree and 1 to strongly disagree responses for favourable statements.

For un-favourable attitude statements the scoring pattern is reversed viz. strongly agree response with 1 weightage, agree with 2, undecided with 3, disagree with 4 and strongly disagree with 5 weightage in that order. The respondents' responses are recorded and the summated score for the total statements of each respondent is obtained. For each respondent the maximum possible score for 29 statements is 145 and the minimum is 29. The scores of the respondents are then arranged in a descending order. The 25 per cent from highest scores (high group) and 25 per cent from lowest scores (low group) are taken for the item analysis. These responses are subjected to item analysis for selection of the items that constitute the final attitude scale.

The critical ratio i.e., t-value which is a measure of the extent to which a given statement differentiates between the high and low groups of respondents for each statement is calculated by using the formula proposed by [3].

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\left(\frac{S_H^2}{n_H}\right) + \left(\frac{S_L^2}{n_L}\right)}} \quad (4)$$

Where,

$\bar{X}_H$ = The mean score on a given statement for the high group.
$\bar{X}_L$ = The mean score on a given statement for the low group.
S^2_H = The variance of the distribution of the responses of the high group to the statement
S^2_L = The variance of the distribution of the responses of the low group to the statement
n_H = The number of respondents in the high group.
n_L = The number of respondents in the low group.

As n_H is equal to n_L (25 each) the modified formula for calculating the t- values of the statements is used. The formula is:

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\left((X_H - \bar{X}_H)^2 + (X_L - \bar{X}_L)^2\right)}{n(n-1)}}} \quad (5)$$

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

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

Where,

$\bar{X}_H$ = The mean score on a given statement for the high group.
$\bar{X}_L$ = The mean score on a given statement for the low group.
X_H = The sum of scores of all subjects on a given statement for the high group.
X_L = The sum of scores of all subjects on a given statement for the low group
X_H^2 = Sum of squares of the individual score on a given statement for high group
X_L^2 = Sum of squares of the individual score on a given statement for low group

After calculating the t- values for all the items (Table 1) of the attitude scale using the formula (4), the values of the statements are arranged in descending order from the highest to the lowest and 12 statements are selected from the scale whose values are highest i.e., with t- values more than 2.75, for both positive and negative statements.

2.4 Selection of Attitude Statements for Final Scale

After computing "t" value for all the items, 29 statements with highest "t" value equal to or greater than 1.75 were selected. The thumb rule of rejecting items with 't' value less than 1.75 was followed [3]. As per the thumb rule selection of items to be retained in the scale, includes the scales with highest discriminating values excluding the scales with poor discriminating ability and questionable validity. Thus, 24 statements were retained for consideration in the final scale based on the following norms:

i. The 't' value should be more than 1.75
ii. The statement should present a new idea i.e., the idea not overlapping with that expressed other
iii. The statement should be simply worded and brief.

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

Sl. no.	Question number	Attitude statements	t-value
1*	2*	Without the adequate support and monitoring of extension personnel farmers cannot follow water management recommendations.	2.274
2*	4*	Only progressive rich farmers get the benefit of improved water management technologies.	2.896
3	6	Water conservative measures has helped the farmers to cover the irrigation water crisis.	1.433
4*	9*	Water conservation recommendations cannot ensure sustainability in agriculture.	0.793
5	11	Water management measures are quite effective to solve the water problems of the farming community.	7.567
6*	12*	Improved water management measures will completely eradicate indigenous Technology knowledge of water management.	4.617
7	13	Adoption of water management recommendations develops self-Reliance among farmers.	6.878
8	15	Water management recommendations are not only useful for agriculture but also to the environment.	5.648
9	16	Water management technologies are not only helpful for agriculture but to the entire society.	0.925
10	17	Soul cause for Environmental Degradation is due to enhance to water usage.	2.562
11*	18*	Rich become richer poor become poorer because of the adoption of water management practices.	2.270
12	20	Creation of life happens due to water and to protect the life one has to use the water judiciously.	2.460
13	22	The potential yield can be obtained only through the adoption of effective water management practices.	5.106
14*	24*	Flood method of irrigation is the best method of irrigation for every crop.	1.638
15	26	I cannot manage the farm without the adoption of water management recommendations.	2.115
16	28	Social harmony is possible when there is judicious use of water by every sector of the community.	5.711
17*	29*	I believe that water conservative measures are the Kinder to the environment.	2.453
18	30	Soil fertility is not a matter when compare to water management practices in crop production.	1.904
19	31	The soul factor for the fragmentation of land holdings is because of ignorance of water conservative measures.	2.212
20	33	Migration of labour can be curtailed if we have already practiced the irrigation management methods.	2.319
21*	34*	Water management practices may promote intensive input oriented agriculture which in turn result in environmental Degradation.	3.245
22*	36*	What is being promoted as water management Technologies is nothing but old wine in new bottle.	2.250
23*	37*	Attending training on water management practices is a waste of time as there is nothing new to learn.	1.114
24*	38*	Water management recommendations are highly technical in nature that the farmer cannot understand.	0.786

Sl. no.	Question number	Attitude statements	t-value
25*	41*	Water management practices is a humbug that can give results were only in demonstration but not in full adoption.	6.258
26	42	Only when the existing water management technologies are modified to the local condition there is a possibility for wider adoption.	2.682
27*	45*	By calculating the investments and returns there is no significant profit with adoption of improved water management Technologies.	4.395
28*	46*	The toil that I put in farming remains same even after the adoption of water management recommendations	3.705
29	55	Water management recommendations are helping the farmers to improve their economic condition with available resources.	4.711

**Negative statements*

2.5 Reliability and validity of Attitude Scale

The scale developed was further standardized by establishing its reliability and validity. "Reliability is the accuracy or precision of measuring instrument" [8]. To know the reliability of the attitude scale Split-Half method is followed. As Validity literally means truthfulness, which refers to "the degree to which a test measures, what it claims to measure" [9], content validity is used to measure the validity of the scale.

2.5.1 Split-half methodology

The reliability of the scale is determined by 'split-half' method. The split-half method is regarded by many as the best of the methods for measuring reliability [10]. The twelve selected attitude items are divided into two halves by odd-even method [11]. The two halves are administered separately to 50 farmers in a non-sample area. The scores are subjected to product moment correlation test in order to find out the reliability of the half-test. The half-test reliability coefficient (r) is 0.628, which is significant at five per cent level of probability. Further, the reliability coefficient of the whole test is computed using the Spearman-Brown prophecy formula given below [11].

$$\text{Reliability Co} - \text{efficient of Whole test} = \frac{2 \text{ X Reliability co} - \text{efficient of half test}}{1 + \text{Reliability co} - \text{efficient of half test}} \quad (6)$$

The whole test reliability (r_{tt}) is 0.771. According to Singh [11], when the mean scores of the two groups are of narrow range, a reliability coefficient of 0.50 or 0.60 will suffice. Hence, the constructed scale is reliable as the r_{tt} is greater than 0.60.

2.5.2 Content validity of the attitude scale

The validity of the scale is established through content validity i.e., the representativeness or sampling adequacy of the content of a measuring instrument. The scale satisfies both these criteria as the clause of universe of statements that could be made about recommended water management technologies and practices is formulated from the standards and also in consultation with experts who has knowledge about the psychological object. This ensures high content validity of attitude scale. The scale is constructed in accordance with the steps enunciated in the summated rating scale given by Edward [3]. Therefore, it is assumed that the scores obtained by administering this scale measured nothing other than the attitude of farmers towards recommended water management technologies and practices. While selecting attitude statements, due care is taken for obtaining a fair degree of content validity. The calculated "t" value being significant for all the finalized statements of the score indicated that the attitude statements of the scale have discriminating values. Hence, it seems reasonable to accept the scale as a valid measure of the attitude.

3. RESULTS AND DISCUSSION

The calculated 't' values are found to be distributed between zero and 7.566. The statements with 't' values of 2.75 and above are considered for final inclusion to the scale. Thus, 6 positive and 6 negative statements with highest 't' values are arrived for the final scale (table 2) as they differentiate between highest and lowest groups.

The reliability of the scale is determined by 'split-half' method. The half-test reliability coefficient (r)

Table 2. Statements selected for inclusion in the final scale

Sl. no.	Question number	Attitude statements	SD	A	UD	DA	SDA
1*	4	Only progressive rich farmers get the benefit of improved water management technologies.					
2	11	Water management measures are quite effective to solve the water problems of the farming community.					
3*	12	Improved water management measures will completely eradicate indigenous Technology knowledge of water management.					
4	13	Adoption of water management recommendations develops self-Reliance among farmers.					
5	15	Water management recommendations are not only useful for agriculture but also to the environment.					
6	22	The potential yield can be obtained only through the adoption of effective water management practices.					
7	28	Social harmony is possible when there is judicious use of water by every sector of the community.					
8*	34	Water management practices may promote intensive input oriented agriculture which in turn result in Environmental Degradation.					
9*	41	Water management practices is a humbug that can give results were only in demonstration but not in full adoption.					
10*	45	By calculating the investments and returns there is no significant profit with adoption of improved water management Technologies.					
11*	46	The toil that I put in farming remains same even after the adoption of water management recommendations					
12	55	Water management recommendations are helping the farmers to improve their economic condition with available resources.					

** Negative statements*

SA: Strongly agree; A: Agree; UD: Undecided; DA: Disagree; SDA: strongly disagree

is 0.628, which is significant at five per cent level of probability. The reliability coefficient for the whole test is computed using the Spearman-Brown prophecy formula and it is found that the whole test reliability (rtt) is 0.771

The final items to be included in interview schedule are selected based on 't' value. The instrument developed to measure the attitude of farmers towards recommended water management technologies and practices consisted of 6 positive and 6 negative attitude statements (table 2) representing the various areas viz. relative advantage, understandability or complexity, sustainability, environment, welfare, social respect, ecological aspects. The attitude score on this scale ranges from 12 to 60. The higher score indicates that respondent has a more favourable attitude towards recommended water management technologies and practices & vice-versa.

4. CONCLUSION

The recommended water management technologies and practices are yet not fully grasped by many farmers in the rural areas. Farmers residing interior in many villages are still not much concerned about the judicious use of irrigation water which could affect the availability of water and environment adversely in the near future. The scale developed will be of use to assess the attitude of farmers towards recommended water management technologies and practices to frame various developmental programmes. Further, it could also be used to sketch new methodologies to impart the farmers about water saving in agriculture.

Researchers can use the scale in future for measuring the attitude of farmers in similar studies.

CONSENT

As per international standard or university standard written participants' consent has been collected and preserved by the authors.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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