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MULTIDIMENSIONAL SCALE TO MEASSURE STAKEHOLDERS' ATTITUDES ON COMMUNITY PARTICIPATION IN TANK MANAGEMENT

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ABSTRACT

Attitude is an important psychological determinant of the behavior of an individual. Measurement of such attitude of tank users towards community participation is essential for tank management. Many social researchers measure multidimensional variables, such as community participation, by aggregating the scores of individual dimensions / sub-dimensions. These dimensions / sub-dimensions are highly correlated and have inherent problems of multicollinearity which causes attenuation in measurement. Community participation is a multidimensional variable, whereas it is being measured as if it was a uni-dimensional variable. The data on community participation have been collected from randomly selected 40 experts related irrigation, rural development, extension, agriculture and panchayat raj departments. The collected data exposed to statistical tools like item total correlation, t-test followed by principal component analysis. The scale was standardized by testing its reliability (r = 0.83) and validity (validify coefficient= 0.91). The final scale consisting of 39 statements (29 positive and 10negative) categorized in to 7 dimensions i.e. Resource sharing behavior (6), Collective behavior (5), Capacity building (6), Responsibility (6), Involvement (6), Collectivism (4) and Self-perception (6) was presented to respondents with instructions to indicate their agreement on five-point continuumviz. strongly agree, agree, undecided, disagree, and strongly disagree with the weightages of 5, 4, 3, 2 and 1 for positive statements and vice versa for negative statements, The attitude score of each respondent is obtained by summing up the scores on all attitude statements.

Keywords: *multidimentsion scale, attitude, stakeholders, community participation, tank management*

INTRODUCTION

In India, irrigation systems are classified into major, medium, and minor categories for administrative purposes. Major works, typically situated along perennial rivers, cover extensive cultivable command areas. Medium works include large tanks supplied by runoff water, while minor schemes cater to smaller cultivable command areas, each identified based on water source, lift pattern, and ownership(Planning Commission, 2008).Tanks, small reservoirs constructed from earthen walls across rivers and streams, store water for irrigation and domestic use in villages. While primarily serving irrigation needs, they also provide drinking water and support various activities like livestock watering and fish culture. Despite their importance, tank irrigated areas in (Palanisami 1997). India have seen stagnation or decline in recent decades, leading to increased instability in agricultural production.

Water resources development and management is imperative for sustainable agriculture in water scarce areas (Ashraf et al., 2007). Moreover, the importance of collective action in many aspects of agriculture, natural resource management, and rural development programs in developing countries has been recognized (Meinzen-Dick et al., 2004). In recent years development strategies have undergone a dramatic shift, with the emphasis changing from the state being the central sector toward greater participation by government or non-governmental organizations (Yercan, 2003). Participation by farmers in system design and management helps to ensure the sustainability of the system, reduce the public expenditure burden, and improve efficiency, equity, and standards of service (World Bank, 2003). Attitude was operationally defined in this study as the degree of positive or negative affect of tank users towards community participation in tank management. Measuring attitudes is crucial as they profoundly influence the willingness and enthusiasm of key stakeholders (Sandeep *et al.,* 2023). A scale is developed on attitude of tank users towards community participation in tank management by using multi-dimensional scaling technique. It is common knowledge that most of the dimensions of a multidimensional variable are highly correlated and there is a high covariance among the dimensions / sub-dimensions of a multidimensional variable. While measuring the multidimensional variable many researchers do not eliminate the overlapping effect arising

due to covariance among dimensions / sub-dimensions and as a result get an inflated measurement of the variable in question. Subsequently, any further analysis using inflated measurement leads to inaccurate statistical results. In order to overcome this problem, a multi-dimensional scale was developed to measure the attitude of tank users towards community participation in tank management.

OBJECTIVE

To develop and standardize a multidimensional scale to measure stakeholders' attitude towards community participation in tank management.

METHODOLOGY

A method developed by Kumar et al. (2006) has been blended with Edwards used to eliminate the overlapping effect of covariance among dimensions/sub dimensions and calculate the scores more accurately. A total of 110 statements were collected reflecting the attitude of tank users towards community participation in tank management. The statements were edited using the criteria suggested by Edwards (1957), and the opinions of the experts on relevancy of statements were obtained on a three-point continuum (3=most relevant, 2=relevant, 1=not relevant) and finally seventy statements were selected based on higher relevance mean scores. The above 70 statements were administered to a group of 60 respondents other than final sample. The respondents were asked to indicate their degree of agreement or disagreement with each statement on five-point continuum i.e. Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (DA) and Strongly Disagree (SDA) with the weightages of 5,4,3,2 and 1 for positive statements and vice versa for negative statements. Then discriminate power of each item and criterion groups were calculated. The mean difference of high and low groups was tested by an independent t–test. The statements which had significant 't' values were retained. Then, after using factor analysis extraction of principal components, Assess communality (Commonness) of the variables and finally beta values calculated to regress the dimensions (variables) into factors (components).A reliable scale consistently yields consistent responses from the same sample (Goode and Hatt, 1952).The study assessed the reliability of an attitude scale on community participation in tank management using a test-retest method. Thirty non-sample tank users were surveyed at two tanks with a 30-day interval, correlating their responses to compute the reliability coefficient, ensuring consistency over time. Content validity andintrinsic validity of the attitude scale was determined using Guilford's formula, where it was defined as the square root of its reliability.

RESULTS AND DISCUSSION

The results were presented in sequence multidimensional scale construction.

(1) Selection of statements by criterion groups (t-test analysis): Respondents were grouped based on their total scores, with the top and bottom thirds forming high and low groups, respectively. An independent t-test was conducted to assess the extent to which statements differentiated between these groups. Statements with significant t-values (ranging from -8.89 to -0.057) at the 0.01 and 0.05 significance levels were retained. Thirty-six positive statements and all thirty negative statements were selected based on this criterion to gauge tank users' attitudes towards community participation in tank management.

(2) Selection of statements by item total correlation: Statements were selected based on their item total correlation coefficients, also known as discrimination indices (Nunnally and Bernstein, 1994). Statements with significant 't' values and item total correlation values exceeding 0.20 were retained for further analysis (Giles, 2002). Positive statements S1, S8, S10, S17, S18, S19, S23, S30, S31, S32, S34, and S36 demonstrated low discriminative power and were excluded from further analysis (Table 1).

Table 1 : Discrimination analysis of Positive statements on attitude of project and non-project tank users towards community participation in tank management

Sr. No.	Positive statements	Mean		Mean Difference	t value	Discriminative Power (Item -total correlation)
		Top 1/3rd	Bottom 1/3 rd			
S1	Irrigation management is carried in a better way through community participation	1.15	1.35	0.90	-0.24	**0.013 NS**
S2	Tank water users as a team can collect, contribute and use resources efficiently	1.35	2.35	-1	-4.24**	0.243
S3	Its hard to bring various farmers groups in a community on to a single platform	1.05	2.1	-1.05	-5.32**	0.513

Sr. No.	Positive statements	Mean		Mean Difference	t value	Discriminative Power (Item -total correlation)
		Top 1/3 rd	Bottom 1/3 rd			
S4	Community participation in tank management ensures collection of dues, makes prudent investment of their resources	1.12	2.2	-1.08	-4.81**	0.381
S5	As a part of the group, it is my duty to share all my resources for efficient tank management	1.3	2.35	-1.05	-4.49**	0.657
S6	Collective use of resources facilitate to establish livelihoods under tank	1.5	1.9	-0.4	-1.40*	0.323
S7	Community participation facilitates the tank users to manage tanks by themselves	1.5	1.95	-0.45	-1.42*	0.24
S8	The philosophy of community participation should be 'for the farmers', 'by the farmers' and with the farmers	1.15	2.45	-1.3	-0.05NS	**0.095 NS**
S9	Official bureaucracy can be reduced by people supervision	1.6	2.2	-0.6	-3.08	0.258
S10	In community participation tank users can get in to at any time managing their tanks	1.5	2.4	-0.9	-0.45NS	**0.007 NS**
S11	Collective use of resources strengthens the efforts of the tank management	1.6	2.8	-1.2	-5.51**	0.480
S12	Any scientific interventions will be fruitful when all the tank users share the responsibility	1.2	2.45	-1.25	-5.52**	0.451
S13	Over a period of time tank users can manage effectively their properties rather than simply users	1.5	2.3	-0.8	-2.99*	0.516
S14	As a stake holder of tank it is my responsibility to participate in all its development activities	1.7	2.65	-0.95	-3.58*	0.725
S15	Community participation is an opportunity to invest in group for tank development	1.6	2.4	-0.8	-3.08*	0.458
S16	I consider all the users priorities while planning the water allocation in the tank ayacut	1.5	1.95	-0.45	-1.55*	0.211
S17	Peoples estimates act as check on excessive estimation of works	1.15	1.8	-0.65	-3.00NS	**0.061NS**
S18	Community participation is nothing but 'one for all and all for one'	1.55	2.25	-0.7	-2.86NS	**0.093NS**
S19	Community participation facilitates more value addition, collective purchase and marketing	1.6	1.9	-0.3	**-0.21NS**	**0.261NS**
S20	Participation of all community members enhance the ability to manage tank water efficiency	1.7	1.95	-0.25	-0.90*	0.284
S21	Community participatory approach helps to develop competency of each tank user	1.75	2.2	-0.45	-1.52*	0.394
S22	Training on water management helps the farmers for better community participation in tank management	1.5	2.55	-1.05	-4.01**	0.474
S23	Officials have to be trained on methods of participating the farmers as a community in tank management	2.5	2.65	-0.15	**-0.57NS**	**0.376NS**

Sr. No.	Positive statements	Mean		Mean Difference	t value	Discriminative Power (Item -total correlation)
		Top 1/3 rd	Bottom 1/3 rd			
S24	The president of tank user group is responsible to prepare and implement programmes on tank management	1.8	2.7	-0.9	-4.20**	0.418
S25	All the tank users are not having equal responsibility in managing and development of the tank	1.65	2.85	-1.2	-6.01**	0.700
S26	I feel it is my responsibility to see that tank is maintained properly	1.9	2.8	-0.9	-4.52**	0.694
S27	Under scarce irrigation water conditions I resort to water and moisture conservation techniques	1.85	2.85	-1	-4.71**	**0.022**
S28	Group interventions give best results under contingency times	1.92	2.95	-1.03	-5.28**	**0.002**
S29	I like to pay levy and other charges regularly in time to meet management cost and other expenses	2	2.9	-0.9	-5.87**	0.601
S30	I feel that I am not fully equipped and qualified for self management of irrigation tank	1.25	2.25	-0.1	-2.86NS	**0.093NS**
S31	I would like to involve in brain storming session for better decision making	1.8	1.83	-0.02	**-0.15NS**	**0.21NS**
S32	It is hard to get common consensus on many issues of water management in community participation	1.6	2.5	-0.9	-3.21*	0.31
S33	I follow the rules of operation for water regulation in the tank ayacut	1.1	2.3	-1.2	-7.15**	0.52
S34	I participate in recommending the estimation of works for administrative approval	1.05	2.65	-1.6	-7.91**	**0.08NS**
S35	Community participatory approach helps to develop competency as per potential of each water user	1.45	2	-0.55	-8.89	0.79
S36	I would like to contribute my efforts and resources for the benefit of the irrigation tank	1.15	3	-1.85	-2.43NS	**0.071NS**
S37	I like to contribute funds and other required support for the tank repair when ever needed	1.85	2.9	-1.05	-5.40**	0.61
S38	Pooling of human and financial resources is a challenge for group leader	1.45	2.2	-0.75	-2.16*	0.62
S39	Management of irrigation system is solely a govt responsibility	1.15	3	-1.85	-2.43*	0.71
S40	Conflict resolution is done effectively by farmers themselves	1.65	3	-1.35	-2.57*	0.46
** Significant at 0.01 level of probability * Significant at 0.05 level of probability NS Non-significant						

Conversely, all thirty negative statements exhibited significant 't' values and item total correlation values, thus they were retained for further analysis (Table 2).

Table 2: Discrimination analysis of Negative statements on attitude of project and non-project tank users towards community participation in tank management

Sr. No.	Positive statements	Mean		Mean Difference	t value	Discriminative Power (Item -total correlation)
		Top 1/3 rd	Bottom 1/3 rd			
S1	Water usage will not efficient when the tank water users organise and do it for themselves	1.1	2.1	-1	-9.04**	0.26
S2	Individual prosperity will be hindered by group rules and regulations	1.5	1.95	-0.45	-4.55**	0.44
S3	Government have to involve in each and every aspect of irrigation development	1.15	2.1	-0.95	-11.08**	0.42
S4	Every tank user should not involve in each and every tank development activity on a regular basis	1.35	1.95	-0.6	-8.39**	0.57
S5	Group interventions not give best results under contingency times	1.1	2.3	-1.2	-7.15**	0.52
S6	Irrigation management is not carried out in a better way through community participation	1.05	2.65	-1.6	-7.91**	0.68
S7	Water usage may not be efficient when the tank users organise and do it for themselves	1.45	2	-0.55	-8.89**	0.79
S8	Government has to involve in each and every aspect of tank development	1.4	2.05	-0.65	-15.04**	0.53
S9	I would not like to involve in brain storming sessions for better decision making on tank management	1.15	1.95	-0.8	-13.68**	0.40
S10	I like to see my fields to be irrigated first without considering other requirements	1.5	2.15	-0.65	-2.16*	0.62
S11	Political interference make community management in effective	1.2	2.5	-1.3	-2.78*	0.76
S12	Quality of work of farming is be greatly hindered due to more involvement in tank management	1.45	2.15	-0.7	-12.3**	0.80
S13	Officials are only fund and training providers rather than irrigation development	1.45	2.2	-0.75	-2.16*	0.62
S14	Social stratification like caste, class and creed in the community will be a big hindrance for unifying actions	1.15	3	-1.85	-2.43*	0.71
S15	Voluntary participation in developmental activities for vested benefits is a draw back in community tank management	1.65	3	-1.35	-2.57*	0.46
S16	Participative decision making is not possible through collective approach	1.9	2.5	-0.6	-2.86*	0.42
S17	Productivity is less by a community than individuals	1.4	3	-1.6	-14.48**	0.46
S18	No chance for improvement of managerial skills of tank users through collective approach	1.4	2.5	-1.1	-11.75**	0.36
S19	The work rendered collectively through community brings less attention and poor image	1.4	2.95	-1.55	-12.83**	0.52
S20	I feel that fisherman never pay the levee or fee to tank development because tank development is not his concern	1.45	2.9	-1.45	-12.30**	0.81
S21	Tank bed clearance, hygienic conditions of the tank led to encroachment of tank bed and catchment area	2.1	2.85	-0.75	-7.51**	0.92
S22	When compared with others in the community I usually feel inferior	1.7	2.75	-1.05	-11.37**	0.83

Sr. No	Positive statements	Mean		Mean Difference	t value	Discriminative Power (Item -total correlation)
		Top 1/3 rd	Bottom 1/3 rd			
S23	When unexpected problems occur in the community I cannot handle them well and I give up easily	1.3	2.9	-1.6	-2.16*	0.62
S24	Community as such can not change the condition of the members	1.7	2.7	-1	-5.93**	0.84
S25	I feel difficult to speak in the community	2.15	2.85	-0.7	-7.15**	0.75
S26	As a member of the community I can not believe in my abilities for achieving success	2.15	2.6	-0.45	-15.04**	0.57
S27	Self centeredness is more crept in to supporting organizations aim rather than benefit of tank users	1.6	2.9	-1.3	-5.6**	0.47
S28	Social audit and grama sabha in village will not reduce the operation and maintenance costs of tank	1.85	2.95	-1.1	-4.36**	0.36
S29	Encroachment of tank area and catchment area which is not influence the tank performance and productivity	2.2	2.8	-0.6	-7.82**	0.48
S30	Community participation increases the gap between small and large farmers	2.15	2.75	-0.6	-7.57**	0.46
** Significant at 0.01 level of probability * Significant at 0.05 level of probability NS Non-significant						

(3) Steps of factor analysis and interpreting the matrix

(a) Factor analysis of collected data : The factor analysis was applied choosing principal component analysis for extraction and varimax method for rotation of the factors. Eliminate dimensions, one by one, whose communality are found to be less than 0.6 (a thumb rule for factor analysis) and re-run it on the remaining indivisible dimensions. The result of communalities as shown in Table 3. indicates that a high amount of variance for all the dimensions could be explained by the factor analysis model. As a thumb rule, communality more than 0.6 is considered as a sufficient condition to keep the dimension (variable) in the factor analysis model. Since all communality values were above 0.6; S22, S29 positive statements and S1, S2, S3, S5, S9, S13, S28 negative statements were dropped from the factor analysis model and were considered for next step i.e. deciding number of components in factor analysis model.

Table 3 : Communality values of the positive and negative statements

Sr. No.	Positive statements		Negative statements	
	Communalities			
	Initial	Extraction	Initial	Extraction
S1	1	0.719	1	**0.518**
S2	1	0.752	1	**0.551**
S3	1	0.762	1	**0.595**
S4	1	0.70	1	0.677
S5	1	0.622	1	**0.548**
S6	1	0.766	1	0.744
S7	1	0.758	1	0.721
S8	1	0.736	1	0.671
S9	1	0.666	1	**0.550**
S10	1	0.680	1	0.763
S11	1	0.845	1	0.796
S12	1	0.699	1	0.662
S13	1	0.649	1	**0.365**
S14	1	0.711	1	0.825
S15	1	0.750	1	0.797

S16	1	0.675	1	0.700
S17	1	0.487	1	0.733
S18	1	0.707	1	0.621
S19	1	0.835	1	0.844
S20	1	0.603	1	0.767
S21	1	0.604	1	0.76
S22	1	**0.590**	1	0.635
S23	1	0.650	1	0.799
	Positive statements		**Negative statements**	
Communalities				
	Initial	**Extraction**	**Initial**	**Extraction**
S24	1	0.710	1	0.769
S25	1	0.742	1	0.624
S26	1	0.688	1	0.906
S27	1	0.818	1	0.686
S28	1	0.811	1	**0.596**
S29	1	**0.596**	1	0.684
S30	1	0.606	1	0.78
Extraction Method: Principal Component Analysis				

(b) Screen Plot and Variation

Incase of positive statements the initial eigen values reduced to less than one after fourth component (Table 4) and the initial four components (factors) could explain a total variation upto 69.78%.

Table 4 : Percentage of variance by various positive components for initial eigen values, after extraction and rotation

Com-ponent	Initial Eigen Values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	**% of Vari-ance**	**Cumula-tive %**	**Total**	**% of Vari-ance**	**Cumu-lative %**	**Total**	**% of Variance**	**Cumu-lative %**
1	9.96	33.30	33.33	9.96	33.30	33.33	6.75	22.50	22.50
2	4.21	14.05	47.35	4.21	14.05	47.35	5.44	18.14	40.64
3	3.58	11.95	59.31	3.58	11.95	59.31	4.85	16.19	56.84
4	3.56	10.47	69.78	3.56	10.47	69.78	3.88	12.94	69.78
5	0.99	3.41	73.20						
6	0.98	2.70	75.90						
7	0.98	2.60	78.51						
8	0.98	2.58	81.09						
9	0.80	2.52	83.62						
10	0.78	2.21	85.83						
11	0.74	2.19	87.02						
12	0.62	1.68	88.71						
13	0.58	1.50	90.21						
14	0.52	1.44	91.65						
15	0.40	1.34	93.00						
16	0.37	1.25	94.26						
17	0.32	1.23	95.49						
18	0.32	1.10	96.60						
19	0.31	1.01	97.54						
20	0.29	0.55	97.61						

Com-ponent	Initial Eigen Values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Vari-ance	Cumula-tive %	Total	% of Vari-ance	Cumu-lative %	Total	% of Variance	Cumu-lative %
21	0.23	0.48	98.10						
22	0.19	0.35	98.45						
23	0.18	0.32	98.78						
24	0.14	0.29	99.07						
25	0.12	0.29	99.37						
26	0.10	0.26	99.63						
27	0.07	0.25	99.89						
28	0.03	0.10	100.00						
Extraction Method: Principal Component Analysis									

The increment in total variation explained by subsequent components was marginal; hence, it was decided to restrict the components in factor analysis to four factors. The scree plot (Figure 1.) drawn for showing the contribution of positive components with the help of eigen values depicts that the plotted line had become steeply declined after eight component which indicates that the percentage of variance showing is very much meager by rest of the components. .

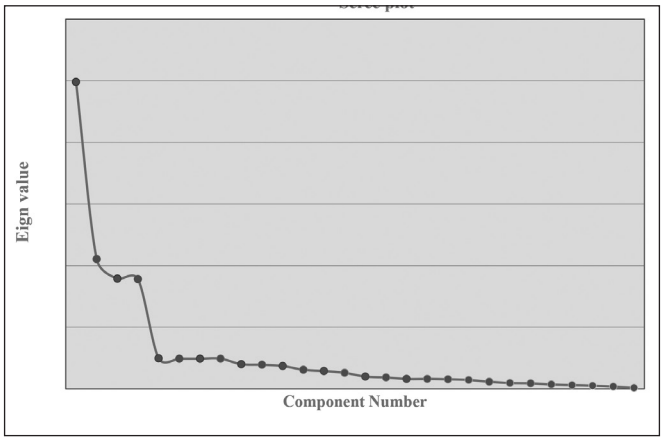

Fig. 1 : Scree plot showing contribution of components (Positive statements) w.r.t. eigen values

Incase of negative statements the initial eigen values reduced to less than one after third component (Table 5) and the initial three components (factors) could explain a total variation upto 71.73%. The increment in total variation explained by subsequent components was marginal; hence, it was decided to restrict the components in factor analysis to three factors. The scree plot (Figure 2) drawn for showing the contribution of negative components with the help of eigen values depicts that the plotted line had become steeply declined after seventh component which indicates that the percentage of variance showing is very much meager by rest of the components.

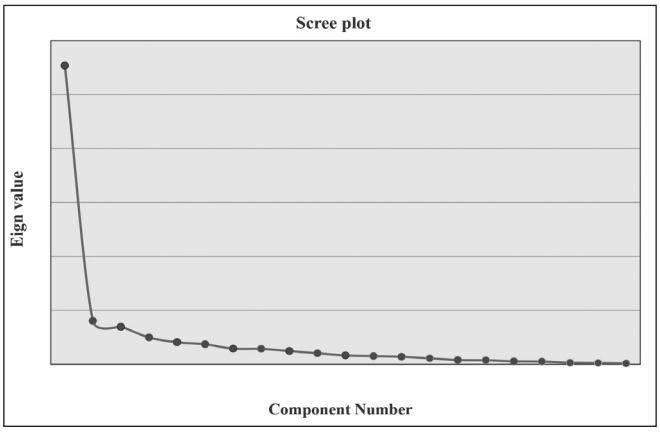

Fig. 2 : Scree plot showing contribution of components (Negative statements) w.r.t. eigen values

Table 5 : Percentage of variance by various negative components for initial eigen values, after extraction and rotation

Component	Initial Eigen Values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.07	48.17	48.17	11.07	48.17	48.17	6.09	26.49	26.49
2	1.61	12.45	60.63	1.61	12.45	60.63	5.93	25.81	52.30
3	1.39	11.10	71.73	1.39	11.10	71.73	4.48	19.48	71.73
4	0.99	4.34	76.12						
5	0.82	3.56	79.69						
6	0.74	3.25	82.95						
7	0.58	2.54	85.50						
8	0.57	2.50	88.00						
9	0.49	2.15	90.16						
10	0.41	1.81	91.98						
11	0.33	1.46	93.45						
12	0.30	1.32	94.78						
13	0.28	1.25	96.03						
14	0.22	0.99	97.03						
15	0.16	0.71	97.74						
16	0.15	0.66	98.40						
17	0.11	0.49	98.90						
18	0.10	0.43	99.33						
19	0.06	0.26	99.60						
20	0.05	0.23	99.84						
21	0.03	0.15	100.00						
Extraction Method: Principal Component Analysis									

The principal components were extracted based on correlation among the variables that were further rotated using varimax rotation. During the analysis, the Kaiser's criterion of choosing final components which had eigen values more than one (Kaiser, 1960) was applied. Since the sample size is less than 100, a factor loading of 0.72 was used as a lower cut of value for selection of variables under each factor (Stevens, 1992). The variables that did not meet the required loadings were deleted. The principle components, eigen values, variance explained and factor loadings for positive and negative statements are given in Tables 4 and 5 respectively.Among positive statements, thirteen statements were discarded i.e. S1, S8, S10, S17, S18, S19, S23, S30, S31, S32, S34 and S36 of table 3.5 and S22 and S29, since they did not load significantly in any component. Among the negative statements, seven were discarded i.e. S1, S2, S3, S5, S9, S13 and S28 , since they did not load significantly in any component and remaining statements were taken for the construction of attitude scale.

The fifth and sixth components were eliminated as seen in table 6, as they have only one (S20) and two (S27 and S28) significant positive statements with regard to their rotated component matrix values of positive statements respectively. As it is evident from table 7 that the fourth (S19 and S20) and fifth components (S11 and S12) are eliminated as they have only two significant negative statements with regard to their rotated component matrix values of negative statements. Finally, four positive and three negative components were retained to measure the attitude of the tank users towards community participation in tank management.

Table 6 : Rotated component matrix of positive statements

Statements	Components					
	1	**2**	**3**	**4**	**5**	**6**
S1	**0.68**	-0.20	0.03	**-**0.03	0.07	-0.10
S2	**0.73**	0.34	-0.05	0.38	0.28	-0.12
S3	**0.72**	0.23	0.07	0.15	0.04	-0.03
S4	**0.62**	0.25	-0.05	0.15	0.19	0.30
S5	**0.66**	0.26	0.07	0.07	-0.05	0.11
S6	**0.63**	0.06	0.02	0.03	-0.08	-0.01
S7	0.29	0.34	**0.74**	0.39	-0.12	0.04
S8	0.58	0.10	**0.71**	0.08	-0.23	0.11
S9	0.11	0.21	**0.71**	0.69	0.10	0.17
S10	0.29	0.33	**0.63**	0.31	0.09	-0.20
S11	0.27	0.14	**0.63**	-0.04	0.01	-0.21
S12	0.41	0.43	**0.65**	0.128	0.26	0.18
S13	0.10	-0.14	0.18	**0.80**	-0.03	0.17
S14	-0.07	-0.09	0.01	**0.73**	0.65	0.20
S15	0.08	0.32	-0.22	**0.72**	-0.16	-0.10
S16	0.50	-0.01	0.37	**0.71**	-0.42	0.08
S17	0.54	-0.28	0.44	**0.76**	-0.33	0.07
S18	0.19	-0.07	0.41	**0.69**	0.33	-0.06
S19	0.07	0.06	0.34	0.49	-0.16	-0.12
S20	0.06	-0.00	0.08	-0.11	**0.67**	0.29
S21	0.24	**0.81**	0.05	-0.17	0.09	0.04
S22	0.04	**0.70**	0.77	0.07	-0.06	0.09
S23	-0.29	**0.68**	-0.12	0.24	0.1	0.20
S24	0.26	**0.63**	0.09	0.18	0.06	0.22
S25	0.57	**0.73**	0.29	0.23	0.10	0.08
S26	0.32	0.44	0.03	0.07	-0.23	0.15
S27	0.36	0.25	0.08	0.01	-0.04	**0.61**
S28	0.38	-0.15	0.29	-0.05	0.13	**0.61**

Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization, Rotation converged in 18 iterations

Table 7 : Rotated component matrix of negative statements

Statements	Components				
	1	**2**	**3**	**4**	**5**
S1	**0.56**	0.14	0.19	0.19	0.16
S2	**0.71**	0.40	0.25	0.03	0.06
S3	**0.64**	0.01	0.13	0.03	0.14
S4	**0.61**	-0.05	0.28	0.30	0.20
S5	**0.77**	0.05	0.38	0.60	-0.24
S6	**0.68**	0.18	0.37	-0.05	0.13
S7	0.32	0.22	**0.82**	-0.18	-0.14
S8	0.49	0.16	**0.71**	0.27	0.15
S9	0.41	0.45	**0.72**	0.40	0.25
S10	0.26	0.34	**0.78**	-0.25	0.13

Statements	Components				
	1	2	3	4	5
S11	0.57	0.50	0.32	0.23	**0.68**
S12	0.31	0.05	0.26	0.01	**0.72**
S13	0.27	**0.85**	0.06	0.27	0.32
S14	-0.13	**0.83**	0.21	0.22	0.00
S15	-0.52	**0.62**	0.15	0.60	0.21
S16	0.31	**0.75**	0.16	0.03	-0.16
S17	0.27	**0.67**	0.37	0.35	0.06
S18	0.07	**0.69**	0.19	0.46	0.06
S19	0.06	0.47	0.12	**0.62**	0.53
S20	0.20	0.91	0.04	**0.77**	0.13
S21	0.56	0.45	0.22	0.06	0.28
S22	0.27	-0.08	0.08	0.31	-0.03
S23	0.39	0.81	0.19	0.25	-0.08
Extraction Method: Principal Component Analysis , Rotation Method: Varimax with Kaiser Normalization, Rotation converged in 10 iterations					

(4) Inter item correlation among the dimensions of attitude of tank users towards community participation in tank management

The results of the Table 8 revealed the homogeneity of the scale. The inter item correlation among different dimensions of the scale had been found to be significantly high. The obtained correlation values indicated high construct validity of the scale. The correlation coefficients between the dimensions of community participation scale ranged between 0.81 and 0.97 which indicated the unidimensionality of the scale.

Table 8 : Inter item correlation among the dimensions of attitude of tank users towards community participation in tank management

Dimensions	Resource sharing behavior	Collective behaviour	Capacity building	Responsi-bility	Involve-ment	Collecti-vism	Self perception
Resource sharing behavior							
Collective behavior	0.91**						
Capacity building	0.94**	0.92**					
Responsibility	0.97**	0.94**	0.89**				
Involvement	0.89**	0.90**	0.92**	0.91**			
Collectivism	0.85**	0.91**	0.91**	0.87**	0.89**		
Self perception	0.86**	0.90**	0.94**	0.86**	0.89**	0.91**	
Community participation	0.82**	0.90**	0.89**	0.85**	0.87**	0.89**	0.84**

** Significant at 0.01 level

(5) Finalising factor analysis model:

After restricting the number of components to seven, factor analysis was again employed to obtain the beta values for each component. The results were compared for consistency. The inter item correlation (Table 8) was observed among the retained seven components which indicates that there was no multicollinarity among the components.After using set of b (beta) values of each variable in different components, regress them. That is y1 = b1x1 + b2x2 + b3x3…, y2 = b1x1 + b2x2 + b3x3…, y3 = b1x1 + b2x2 + b3x3…, y4 = b1x1 + b2x2 + b3x3…, and so on.

The variables which have major contribution to a particular component have higher beta values than for other components. For example, x1 has beta value 0.808 for component one but has lower beta values for remaining four components. On the basis of beta values of variables to a particular component (factor), the components are given a name to represent the group of variables that have major contribution to that particular component (factor). As per the table10, the first component (Y1) resource sharing behavior has major contributions from variables- X1, X2, X3, X4, X5, and X6. Broadly, component 1 (y1) could be named as resource sharing behaviour. The component 2 (y2) has major contribution from variables -x21, X22, X23, X24, X25 and

X26, which could be named as responsibility. The variables-X7, X8, X9, X10, X11 and X12 contribute mainly to component 3 (y3), which could be named as collective behaviour. While X13, X14, X15, X16, X17 and X18 contribute to component 4 (y4), which can be termed as capacity building.With regard to the selection of components from negative variables. The component involvement (y5) has major contribution from variables-S1, S2, S3, S4, S5 and S6, which could be named as involvement. The component (y7) has major contribution from variables–S7, S8, S9, and S10, which could be named as collectivism. The variables–S13, S14, S15, S16, S17 and S18 contribute mainly to component (y7), which could be named as self perception.After calculating the scores of individual respondents for y1, y2, y3, y4, y5, y6 and Y7, the total score for community participation (y) of each respondent could be obtained by adding the regressed value of y1, Y2, Y3, Y4 , y5, y6 and y7. Mathematically, it could be represented as total multidimensional score y=y1+y2+y3+ y4+y5+y6+y7.

(6) Standardization of the scale

(a) Test of reliability

In this study, reliability of the attitude scale towards community participation in tank management was computed by adopting test- retest method. The objective is to ensure that responses are not varied across time periods, so that a measurement taken at any point in time is reliable. The scale was administered to a group of 30 non sample tank users of study area at two tanks with an interval time of 30 days. The two sets of scores were correlated to get the reliability coefficient. The correlation coefficient was 0.83, which was highly significant at 0.01 per cent level of probability.

(b) Test for validity

The intrinsic validity of the attitude scale was determined using Guilford's formula, where in it was defined as the squre root of its reliability. If the reliability coefficient is rtt, then the validity is given by 'rtt'. As the reliability coefficient of the attitude scale was found to be 0.83, the validity coefficient of the scale is "0.83=0.91".

Administration of the scale

The final scale consisting of 39 statements (29 positive and 10 negative) categorized in to 7 dimensions (4 positive and 3 negative) was presented to respondents with instructions to indicate their agreement on five point continuum *viz.* strongly agree, agree, undecided, disagree, and strongly disagree with the weightages of 5, 4, 3, 2 and 1 for positive statements and vice versa for negative statements, The attitude score of each respondent is obtained by summing up the scores on all attitude statements.

CONCLUSION

Community participation is vital for sustainable tank management in water-scarce regions like India. This study introduces a standardized multidimensional scale to gauge stakeholders' attitudes towards such participation. This scale offers precise measurements by addressing overlapping effects among dimensions, enabling accurate analysis. Effective community involvement not only ensures resource sustainability but also reduces public expenditure burdens while enhancing system efficiency and equity. By fostering ownership and responsibility among farmers and local communities, participation leads to improved water resource utilization and agricultural productivity. The developed scale provides a valuable tool for policymakers and researchers to assess attitudes accurately, facilitating informed decision-making for sustainable water management.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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