



# Participation of Head Reach and Tail-end Farmers and their Relation between Profile Characteristics in Water Users' Associations in Tungabhadra Command Area of Koppal District of Karnataka, India

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

The present study conducted during Kharif 2020 investigates the participation of head reach and tail-end farmers within Water Users' Associations (WUAs) in the Tungabhadra Command Area of Koppal district. The study aims to understand and compare the engagement levels of farmers situated at different positions within the irrigation system. Using an ex-post facto research design, data was collected from 120 farmers across twelve WUAs in Gangavathi and Karatagi taluks. Statistical analysis revealed distinctive patterns in the participation of head reach and tail-end farmers within these associations. The findings suggest that head reach farmers, benefiting from assured water access, exhibited moderate to poor levels of participation in WUAs. Contrarily, tail-end farmers, often facing water scarcity issues, demonstrated better engagement levels, effectively managing available water resources through diverse agricultural practices. Moreover, an in-depth analysis explored the relationship between profile characteristics and farmers' participation in WUAs. Variables such as social participation, economic and achievement motivations, extension contacts, and management orientations significantly influenced farmers' involvement in water management activities. Therefore, the findings emphasize the need for training programs and interactive sessions between farmers, WUA officials, and authorities to enhance effective water resource utilization. Further, understanding the varying levels of participation based on geographical advantage or disadvantage can help tailor strategies to improve equitable water distribution and management within these associations.

*Keywords: Participation; water users' associations; equitable water distribution.*

## 1. INTRODUCTION

The sustainable management and equitable distribution of water resources have been paramount in ensuring the agricultural prosperity of regions dependent on irrigation. In this context, the formation and functioning of Water Users' Associations (WUAs) play a pivotal role in promoting community-based water management [1]. The Tungabhadra Command Area, situated in Koppal district of Karnataka, represents a significant agricultural landscape and the climate in this region is typically tropical, with hot and dry weather for most of the year. The southwest monsoon brings rainfall to this region during Kharif and is likely influenced by the Tungabhadra River, where irrigated agriculture is the backbone of the local economy. As water is a finite and often scarce resource, understanding how farmers at different positions within the irrigation system participate in WUAs is of great importance [2].

Water Users Association (WUA) is a group of water users, such as irrigators, who pool their financial, technical, material, and human resources for the operation and management of a water system [3]. This research paper delves into the dynamics of farmer participation in WUAs within the Tungabhadra Command Area, focusing specifically on the contrasting experiences of head reach and tail-end farmers. Head reach farmers are typically positioned

closer to the water source, enjoying priority access to water, while tail-end farmers, located downstream, often face water scarcity issues and may experience delays in water supply. Understanding the participation of these two groups within WUAs is crucial in assessing the effectiveness and equity of water resource management strategies [4].

Farmers' participation in water users' associations is operationally defined as extent of water users' (farmers) involvement in different activities *viz.*, equitable distribution of irrigation water [5], crop selection and management, scheduling of irrigation water, water delivery system and maintenance of field channels *etc.*, for effective management of irrigation water [6].

## 2. MATERIALS AND METHODS

Ex-post facto research design was adopted for the study. This was considered as most appropriate because the phenomenon has already occurred. The study was conducted in Gangavathi and Karatagi taluks of Koppal district of Karnataka state during Kharif 2020. These taluks were purposively selected, since these two taluks have maximum number of water users' associations coming under Tungabhadra Command Area.

The utilization of irrigation water primarily depends upon its availability, which has got direct

relevance with the locational factor of the farmers viz., head reach and tail end farmers. There are 140 water users' associations present in the district and among these 12 waters users' association comprising two taluks were selected for the study. Thus, from Gangavathi taluk, 6 WUAs (Jeeral, Singanal, hanaval, Hoskera, marali and Narasapura) were randomly selected, and from Karatagi taluk, 6 WUAs (Gundur, Siddapur, Yerdona, Kuntoji, Mustur and Baraguru) were selected. From each WUAs, 10 farmers were randomly selected for the study. Thus, from gangavathi taluk, 30 farmers from head reach and another 30 tail-end farmers were selected. Similarly, from Karatagi, 30 head reach and 30 tail-end farmers were selected for the study. Thus, the total sample constitutes 120 farmers (i.e., 60 head reach and 60 tail-end farmers).

### 3. RESULTS AND DISCUSSION

#### 3.1 Participation of Head Reach and Tail-end Farmers in Water Users' Associations

It is noticed that 51.70 per cent of the head reach farmers had moderate level of participation followed by poor (28.30 %) and better (20.00%) level participation in water users' association. Whereas in tail-end location, 55.00 per cent of tail-end farmers had moderate level of participation followed by 27.70 per cent had better and 17.30 per cent had poor level of participation in water users' associations.

The results showed that there is a difference between participation of head reach and tail-end farmers. The reason for this trend might be that head reach farmers receive extensive assured irrigation facilities due to this they grow high water consuming crops and violate the recommended cropping pattern and frequently irrigate their land even though the crops require less water [7].

But in case of tail-end location, due to the shortage of canal water, farmers take appropriate measure for effective utilization of available water and carry out the suitable crop planning activities like mixed cropping and crop rotation practices and grow drought tolerant crops etc. Hence, the tail-end farmers were judiciously managing the canal water as compared to head reach farmers [8].

It is evidencable from Table 1 that the participation of tail-end farmers was better than the head reach farmers. Since these head reach farmers are ensured of receiving irrigation water in turn good yield by dint of their geographical advantage requires no managerial drudgery in the routine process hence, they do not have an obligation to regularly participate in water users' associations. The tail-end farmers participation was better off since they attribute geographical disadvantage implying uncertainties in receiving their due share of irrigation which is especially denied in critical stages of crop growth leading to crop loss, drought etc. In this context, in order to protect their rights, they have to come together and collectively sort out such disputes reckoning better participation [9].

**Table 1. Participation of head reach and tail-end farmers in water users' associations in Tungabhadra Command Area**

(n=120)				
Sl. No.	Category	Head reach (n1=60)		
		f	%	
1	Poor (<60.71)	17	28.30	<b>Mean= 62.63</b> <b>SD= 3.86</b>
2	Moderate (60.71-64.56)	31	51.70	
3	Better (>64.56)	12	20.00	
Sl. No.	Category	Tail-end (n2=60)		
		f	%	
1	Poor (<62.64)	14	17.30	<b>Mean= 65.21</b> <b>SD= 5.13</b>
2	Moderate (62.64-67.78)	27	55.00	
3	Better (>67.78)	19	27.70	

\*f=frequency, %=percentage

**Table 2. Dimension-wise ranking of head reach and tail-end farmers based on their participation in water users' associations**

(n=120)

SI. No.	Dimensions	Head reach farmers (n1=60)		Tail-end farmers (n2=60)	
		Percentage	Rank	Percentage	Rank
1	Formulation of guidelines	15.29	IV	10.03	VI
2	Planning and implementation activities	17.36	III	16.21	IV
3	Maintenance activities	19.11	II	21.31	II
4	Responsibility sharing	20.90	I	10.38	V
5	Crop planning activities	14.87	V	22.38	I
6	Integrated Crop Management	12.47	VI	19.69	III

### 3.2 Dimension-wise Ranking of Head Reach and Tail-end Farmers based on their Participation in Water Users' Associations

Head reach and tail-end farmers participation in water users' association for each dimension were worked out and ranks were assigned based on the maximum percentage obtained, the results are projected in Table 2. The level of participation of head reach farmers were calculated based on farmers participation in water users' associations and the values obtained under selected dimensions were assigned ranking viz., 15.29 (IV), 17.36 (III), 19.11 (II), 20.90 (I), 14.87 (V) and 12.47 (VI) for formulation of guidelines, planning and implementation activities, maintenance activities, responsibility sharing, crop planning activities and for integrated crop management activities, respectively. Similarly, for the tail-end farmers, the maximum percentage were calculated for six dimensions are, 10.03 (VI), 16.21 (IV), 21.31 (II), 10.38 (V), 22.38 (I) and 19.69 (III) respectively.

### 3.3 Relationship between Profile Characteristics and Farmers Participation in Water Users' Association

Correlation between different independent variables and Participation of farmers in water users' associations was estimated and results of the same are presented in the Table 3. Correlation co-efficient, which indicate the strength of relationship between the independent variables and dependent variable are explained below.

### 3.4 Relationship between Profile Characteristics of Head Reach and Tail-end Farmers and their Participation in Water Users' Associations

With respect to head reach farmers, the independent variables viz., occupation ( $r = 0.39$ ), social participation ( $r = 0.46$ ), achievement motivation ( $r = 0.31$ ) and risk orientation ( $r = 0.43$ ) had positive and significant relationship with farmers participation at one per cent level. Similarly, livestock possession ( $r = 0.22$ ), material possession ( $r = 0.26$ ), extension contact ( $r = 0.27$ ), mass media exposure ( $r = 0.23$ ), cosmopolitaness (0.24), economic motivation (0.26) and management orientation (0.21) had positive and significant relationship with farmers

participation at five per cent level and the remaining variables were found non-significant relationship with farmers participation.

In case of tail-end farmers, the independent variables such as extension contact ( $r = 0.34$ ), social participation ( $r = 0.62$ ), achievement motivation ( $r = 0.42$ ) and management orientation ( $r = 0.53$ ) had positive and significant relationship with farmers participation at one per cent level. Similarly, farming experience ( $r = 0.32$ ), family size ( $r = 0.28$ ), material possession ( $r = 0.22$ ), mass media exposure ( $r = 0.21$ ), cosmopolitaness ( $r = 0.33$ ), economic motivation ( $r = 0.28$ ), and innovativeness ( $r = 0.27$ ) had positive and significant relationship with farmers participation at five per cent level. Remaining variables were found non-significant relationship with farmers participation in water users' association [10].

The possible reasons for the significant relationship of independent variables with their participation in water users' associations are given in following paragraphs.

**Farming experience and family size of the farmers and their participation in water users' associations:** Farming experience and family size shows positively related at 5 per cent level of significant with the tail-end farmers participation in water users' associations. Family members acts as a stimulus in decision making on different farming activities. They aid the farmer in crop planning activities, act as additional man power, responsibilities can be liasoned, buffer the maintenance activities and help in overall management obviously influencing the participation of farmers in water users' associations [11].

**Material possession and farmers participation in water users' associations:** The results indicated that there is significant and positive relationship at 5 per cent among head reach and tail-end farmers. Material possession by nature include communication assets including mobile, TV, radio etc. which uncover them to various new valid information, creates more awareness and knowledge which would persuade their participation in an affirmative manner.

**Extension contact and farmers participation in water users' associations:** Significant and positive relationship between extension contact of both head reach and tail-end farmers with their participation in water users' associations.

Extension agency by objective ensures to disseminate newer technologies and to provide adequate knowledge with regard to various aspects and they also support the farmers to gain knowledge on agricultural technologies and also help the farmers in selecting best water management practices which would contribute to farmers knowledge base along with providing benefits of various associations, schemes and programmes thereby empowering the participation in such water users' associations. [12,13,14].

**Cosmopoliteness and farmers participation in water users' association:** The results indicated that there is significant and positive relationship between cosmopoliteness of head reach and tail-end farmers participation. The cosmopoliteness will expose an individual to the external world, thereby which provides strength and opportunities in agriculture as well as enable the individual to acquire knowledge about improved agriculture practices in their farms. Further, the individuals who interact with other farmers outside their systems are likely to receive cues from other farmers [15].

**Mass media exposure and farmers participation in water users' associations:** Mass media exposure was found positively related with the participation of both the categories of farmers in water users' associations. The mass media exposure made the farmers to update their knowledge on the current agriculture situation, also provides awareness on wide horizon and diversified dimensions of agriculture including irrigation management, their associations, related schemes etc. In other words, exposure to mass media develops modern orientation among farmers influencing positive attitude towards participation [16].

**Social participation and farmers participation in water users' associations:** There is significant and positive relationship between social participation in both head reach and tail-end farmers. This might be that due to enhanced social participation, farmers will improve their self-confidence and they seek more information, guidelines, perform peer review, asses' pros and cons of various technologies [17] and benefits received from membership of various associations and become more attentive thereby enhancing their participation [18].

**Economic motivation and farmers participation in water users' associations:** The

economic motivation had positive and significant relationship with both head reach and tail-end farmers participation in water users' associations. Economic motivation is the basic character upon which other motives are built. It is a psychological condition an individual would orient himself to achieve higher income. When one develops higher level of economic motivation and wants to achieve it, he/she could strive hard and internalize themselves about different aspects of managing technology besides aiming at profit maximization. (22) Economic motivation drives him to participate more in various useful associations especially one which reflects resources and its management hence, excelling their participation [19].

**Achievement motivation and farmers participation in water users' associations:** The significant and positive relationship with both head reach and tail-end farmers participation. Achievement motivation is the important determinant of striving towards excellence and perfection to achieve more. Hence, the farmers with high achievement motivation might have established the pride of becoming the outstanding person in the society. Thus, the farmers with high achievement motivation might have evinced keen interest to learn different components of farming technology meticulously. In turn effecting the virtuous participation.

**Innovativeness and farmers participation in water users' associations:** The innovativeness was found to have positive and significant relationship with tail-end farmers participation in water users' associations. The most important reason for this trend might be that innovativeness is an underlying willingness to change and try new ideas, which also serve as an indicator of the farmers orientation to excel in farming practices persuading his participation and membership across various organizations [20] including water users' associations thereby, concealing their untapped participation.

**Risk orientation and farmers participation in water users' associations:** The results inferred that there is significant relationship between risk orientation with head reach farmers participation in water users' associations. The probable reasons for this finding might be that head reach farmers receive sufficient water to irrigate their land thus they are ready to grow high water consuming crops and practice high-cost [21] agricultural technologies manifesting their higher risk inclination and encouraging participation.

**Table 3. Relationship between profile characteristics of head reach and tail-end farmers and their participation in water users' associations**

Sl. No.	Characteristics	Correlation Co-efficient (r)	
		(n=120)	
		Head reach (n <sub>1</sub> =60)	Tail-end (n <sub>2</sub> =60)
1.	Age	0.01 <sup>NS</sup>	0.02 <sup>NS</sup>
2.	Education	0.02 <sup>NS</sup>	0.06 <sup>NS</sup>
3.	Farming experience	0.01 <sup>NS</sup>	0.32*
4.	Family size	0.06 <sup>NS</sup>	0.28*
5.	Land holding (Acres)	0.02 <sup>NS</sup>	0.02 <sup>NS</sup>
6.	Material possession	0.26*	0.22*
7.	Extension contact	0.27*	0.34**
8.	Mass media exposure	0.23*	0.21*
9.	Cosmopolitaness	0.24*	0.33*
10.	Social participation	0.46**	0.62**
11.	Achievement Motivation	0.31**	0.42**
12.	Innovativeness	0.08 <sup>NS</sup>	0.27*
13.	Risk orientation	0.43**	0.004 <sup>NS</sup>
14.	Decision making ability	0.01 <sup>NS</sup>	0.01 <sup>NS</sup>
15.	Management orientation	0.21*	0.53**
16.	Scientific orientation	0.05 <sup>NS</sup>	0.19 <sup>NS</sup>
17.	Economic motivation	0.26*	0.28*

\* Significant at 5 per cent level, \*\* significant at 1 per cent level, <sup>NS</sup> non-significant

**Management orientation and farmers participation in water users' associations:**

The results inferred that there is significant relationship between management orientation with head reach and tail-end farmers participation in water users' associations. It could be due to the fact that proper planning, production and market orientation towards managerial aspects enhances income from their farm [22]. These association's membership would make the farmers more learned and skillful in ascertaining managerial aspects. Hence, evidencing affirmative association between management orientation and participation [23].

**4. CONCLUSION**

The Study revealed that, moderate level of farmers' participation was found in water users' associations. The correlation analysis indicated that, the head reach farmers had positive and significant relationship with farmers' participation at one per cent level with social participation, achievement motivation and risk orientation had positive and significant relationship with farmers participation at one per cent level. Similarly, material possession, extension contact, mass media exposure, cosmopolitaness, economic motivation and management orientation had positive and significant relationship with farmers' participation at five per cent level and the remaining variables found to be non-significant.

Hence, there is a need to organize training programmes, demonstrations, field visits on scientific water management practices and follow-up activities by CADA officials. Also, there should be frequent meetings to motivate farmers in effective utilization of irrigation water and periodical interaction between farmers, WUAs secretaries/president and CADA officials which enables farmers to have a better understanding.

**5. LIMITATIONS OF THE STUDY**

Because of the researcher's limited time and money, the study was restricted to only two taluks with twelve WUAs and only Kharif season. The study was therefore conducted on a small scale, by limiting it to just 120 respondents. Consequently, the results cannot be carried away further to other fields in the same way. Given this, every effort was made by the researcher to make the analysis as reliable as possible.

**COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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