

## Farmers' Participation in Irrigation Management and Influencing Factors in West Bengal

Golam Torab Ali<sup>1</sup> and Souvik Ghosh<sup>2</sup>

### ABSTRACT

Farmers' participation in management of minor irrigation systems through water user association (WUAs) has been attempted since 2012 in West Bengal. Present study was conducted covering 80 farmers, 40 each representing from river lift and groundwater lift irrigation command areas in Birbhum district of West Bengal. The perceptions of the farmers in both river lift and groundwater lift irrigation commands regarding different aspects of WUAs have not varied much. Farmers perceived performance of WUAs with respect to the water management as best in both types of irrigation system. The overall performance of WUAs in groundwater irrigation is perceived relatively better (2.90) as compared to river lift irrigation (2.83) on a 5-point continuum scale. Farmers' participation with respect to water management activities is maximum in both river lift irrigation (67%) and groundwater irrigation (65%) with over all FPI value is 58 and 56.64 per cent, respectively. Stepwise multiple regression analyses revealed that farmers' perceptions on irrigation service utility, social participation, caste and resource position have explained 69 per cent variations ( $R^2=0.69$ ) in the performance of WUAs in river lift irrigation and groundwater irrigation command areas. It is evident that WUAs performance is mainly influenced by the perceptions of farmers on utility of irrigation service as it alone explained 48 per cent variation ( $R^2=0.48$ ). Therefore, WUAs should focus on better irrigation management in their jurisdiction areas fulfilling the objective of more crops per drop.

**Key words:** Farmers' participation, groundwater, irrigation service, river lift, water user association

### INTRODUCTION

Irrigated agriculture in about 42 per cent net sown area contributes to 60 per cent of the country's food grain production. Phases in irrigation development and management in India may be looked as follows: 1950-1970: the era of capital-intensive expansion of irrigation; 1970-1980: the era of irrigation improvement; from late 1980s until present: the era of reform and the central challenge facing irrigated agriculture today and in the foreseeable future is more crop per drop or more crop and less drop. Irrigation development in India has been quite remarkable with an increase in irrigation potential from 22.6 M ha in 1950–1951 to about 123 M ha at present including 42 M ha under major and medium irrigation project, 14 and 67 M ha under minor surface and minor ground/lift project, respectively, making it world leader; but irrigation efficiency (30–35%) is less than expected with a gap (32 M ha) between the potential created (123 M ha) and utilized (91 M ha) that has led to implementation of participatory irrigation management programme (PIM). Participation in management of irrigation systems

in India has been advocated as means to reduce pressures on government finances, improved performance of irrigated agriculture and ensure sustainability irrigation systems. Permitting farmers to play a greater role in India demanded a major shift away from the idea of that government for taking care of farmers (Naik and Karlo, 1998). Transfer of irrigation management responsibilities from government agencies to farmers has been made as an important policy in many countries, including India. As a result, farmers' participation in irrigation management has taken the center stage and the irrigators who were considered as beneficiaries are now considered partners in planning, development, operation and maintenance of irrigation systems (Parthasarathy, 2000). Differential functioning and effectiveness of WUAs under different types of irrigation system has been reported by many researchers. The experiences have been mixed with successes as well as failures. The impact was found positive with respect to cultivated area, cropping intensity, irrigated area, irrigation intensity, crop diversification and crop productivity in states like Odisha, Rajasthan, Gujarat, Karnataka, Andhra Pradesh, Tamil

<sup>1</sup>Ph.D Scholar, Department of Agricultural Extension, Uttar Banga Krishi Viswa Vidyalaya, Cooch Behar, <sup>2</sup> Professor and Head, Department of Agricultural Extension, Institute of Agriculture, Visva-Bharati University, Sriniketan, West Bengal

Nadu (Parthasarathy, 2000; Ghosh et al., 2010). However, it is debated that the shift from government-managed to farmers-managed irrigation system may be one of the contributing, but not the only factor responsible for better agriculture performance. Non-rice producing irrigation systems can be more productive than the rice producing irrigation systems. The effect is found to be varied between sources of irrigation as well as across the command areas of different irrigation systems in the world (Ghosh and Kumar, 2012; Ghosh et al., 2016). The state of West Bengal has implemented the concept of PIM through launching of West Bengal Accelerated Development of Minor Irrigation Project (WBADMIP) during 12<sup>th</sup> Five Year Plan. On this backdrop, present study was conducted to assess farmers' participation in irrigation management and its drivers in West Bengal.

### METHODOLOGY

West Bengal to this date remains primarily an agricultural state, where Birbhum district was randomly selected for present study. Out of 19 blocks in Birbhum district, two blocks i.e. Labpur and Illambazar block was randomly selected. In Labpur block, two villages each under Labpur-I and Kurunnahar Gram Panchayats, in Illambazar block, two villages each under Illambazar and Ghurisha Gram Panchayats were selected following simple random sampling method. A sample of 20 farmers from each of the selected villages was randomly chosen as the respondents for present study. The farmers from Labpur and Illambazar blocks represent river lift and groundwater lift irrigation areas, respectively. Thus, a total of 40 farmers each from river lift, groundwater lift irrigation command areas became the respondents in this present study making overall 80 farmers as sample in present study.

Performance of WUAs under both river lift and groundwater irrigation was assessed on the basis of five parameters *viz.* level of participation, operation & management, water management, financial management and organisational linkage with the help of a 5-point continuum scale with minimum and maximum possible score 1 and 5, respectively.

Farmers-members' participation in different activities undertaken by WUA was studied with the help of Farmers' Participation Index (FPI).

$$FPI = (\text{Mean participation score} / \text{Maximum participation score}) \times 100$$

where, mean participation score =  $P_i / N$  and  $P_i = PP_j$

$PP_j = \text{Total score of farmers' participation}$   
 $i = 1, 2, \dots, N$  and  $j = 1, 2, \dots, K$

$N$  and  $K$  = total number of respondents and total number of activities, respectively.

The absence or presence of gender-based differences in irrigation was measured by gender performance in irrigation index (GPII) developed by International Water Management Institute (2002) on the basis of responses of the farmers on various aspects through following options:

- gender based differences are absent (+),
- mild / moderate gender-based differences exist (+/-),
- gender-based differences present (-)

### RESULTS AND DISCUSSION

During 12<sup>th</sup> Five-Year Plan, Government of West Bengal took up an initiative to include the concept of PIM through launching of West Bengal Accelerated Development of Minor Irrigation Project (WBADMIP) leading to a formation of around additional 848 WUAs covering 25499 ha command area with 50265 beneficiaries by the end of July 2015. Performance of WUAs under both river lift and groundwater irrigation was assessed. The result is presented in Table 1.

With respect to level of participation in WUA's activities, farmers in river lift irrigation perceived three parameters above average, leadership ability being the best and social audit / transparency as poorest (1.63), thus overall mean score of 2.80. The overall participation level (2.85) is found to be marginally high in case of WUAs in groundwater irrigation as voluntary physical / labour contribution is more than average.

The operation and management is perceived to be better in case of WUAs in groundwater irrigation (2.86) while the same in river lift irrigation is 2.64. Dispute management is the lowly perceived factor with respect to the operation & management functions of the WUAs.

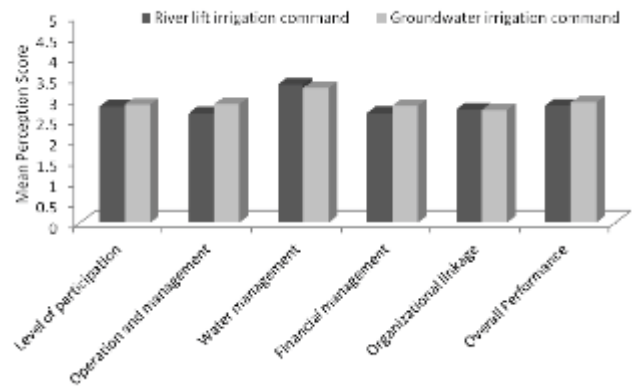
In case of water management farmers under of both river lift and groundwater irrigation systems perceived all the parameters as above average that is significant contribution of WUA in ensuring better irrigation scenario. In fact, the water management is perceived as best (with overall score 3.34 and 3.25) among the five factors on the basis of which WUA's performance was assessed.

In case of financial management, financial audit was perceived less than average in case both type of irrigation

systems; however overall it is found relatively better in case of groundwater irrigation (2.82) in comparison to river lift irrigation (2.65).

As far as organisational linkage is concerned, WUAs under both river lift and groundwater irrigation systems performed similarly and at above average level except in case of discussion with competent authority as per the perceptions of the respective farmers.

The perceptions of the farmers in both river lift and groundwater lift irrigation commands regarding different aspects of WUAs' performance have not varied much. Farmers perceived performance of WUAs with respect to the water management best in both types of irrigation system (Fig. 1). The pooled mean values were calculated to understand the overall performance of WUAs, according to which the WUAs in groundwater irrigation is perceived relatively better (2.90) as compared to river lift irrigation (2.83).



**Fig. 1: Comparative performance of WUAs in river lift and groundwater lift irrigation commands in Birbhum district of West Bengal**

**Table 1: Assessing performance of WUA as perceived by the farmers in river lift and groundwater irrigation projects in Birbhum district of West Bengal**

Particulars	Mean Perception Score		
	River lift irrigation (n=40)	Groundwater lift irrigation (n=40)	Overall (n=80)
<b>Level of Participation</b>			
Leadership capability	4.13 (0.46)	3.93 (0.73)	4.03 (0.60)
Members awareness about WUA status	3.48 (0.51)	3.30 (0.62)	3.40 (0.56)
Productive meetings	2.95 (0.55)	2.88 (0.72)	2.90 (0.64)
Voluntary physical/labour contribution	2.40 (0.55)	2.63 (0.81)	2.51 (0.68)
Voluntary financial contribution	2.25 (0.63)	2.35 (0.70)	2.30 (0.67)
Social Audit/ Transparency	1.63 (0.63)	1.98 (0.58)	1.80 (0.60)
Overall	2.80 (0.55)	2.85 (0.69)	2.83 (0.62)
<b>Operation and Management</b>			
Removal of silt and weeds	3.03 (0.53)	3.30 (0.91)	3.16 (0.72)
Repairs/maintenance of structure	3.00 (0.51)	3.13 (0.72)	3.06 (0.61)
Protection of structure	2.43 (0.55)	2.73 (0.72)	2.60 (0.63)
Dispute management	2.10 (0.59)	2.28 (0.72)	2.20 (0.65)
Overall	2.64 (0.54)	2.86 (0.77)	2.75 (0.66)
<b>Water Management</b>			
Adequate and timely water supply	4.00 (0.55)	3.88 (0.76)	3.90 (0.66)
Information about water distribution	3.40 (0.59)	3.23 (0.70)	3.30 (0.64)
Efforts to save water	2.63 (0.70)	2.65 (0.66)	2.64 (0.68)
Overall	3.34 (0.62)	3.25 (0.71)	3.30 (0.70)
<b>Financial Management</b>			
Fund generation	3.03 (0.48)	3.06 (0.64)	3.04 (0.56)
Utilisation of maintenance and operation fund	2.93 (0.47)	3.08 (0.73)	3.00 (0.60)
Recovery of irrigation fees (when applicable)	2.53 (0.55)	2.83 (0.78)	2.70 (0.67)
Financial audit	2.13 (0.40)	2.33 (0.66)	2.20 (0.53)
Overall	2.65 (0.48)	2.82 (0.70)	2.73 (0.59)
<b>Organizational Linkage</b>			
Horizontal linkages with other WUAs	2.95 (0.60)	3.08 (0.69)	3.00 (0.65)
Vertical linkages	2.75 (0.54)	2.85 (0.66)	2.80 (0.60)
Information and communication	3.13 (0.72)	2.88 (0.61)	3.00 (0.66)
Discussion with competent authority	2.10 (0.67)	2.08 (0.66)	2.09 (0.66)
Overall	2.73 (0.63)	2.72 (0.65)	2.73 (0.64)
Overall Performance of WUA	2.83 (0.56)	2.90 (0.70)	2.87 (0.64)

Note: Figures in parenthesis indicate standard deviation values; maximum and minimum possible score is 5 and 1, respectively

It can be observed from the Fig. 2 and Table 2 that farmers' participation with respect to water management activities is maximum in both river lift irrigation (67%) and groundwater irrigation (65%). Overall FPI value is 58 and 56.64 per cent in case of selected groundwater irrigation and river lift irrigation systems' command areas in Birbhum district of West Bengal. In contrast to this finding of present study, Ghosh et al. (2016) in their study on assessment of PIM in Kuanria Medium Irrigation Project in Nayagarh district of Odisha covering 10 WUAs with a sample survey of 350 farmers reported that overall participation of the farmers was below average in case of all the 10 WUAs as evident from lower farmers' participation index values (<50%). WUA has been successful in devising and enforcing the rules for water distribution, fee collection and conflict resolution in Mula irrigation system of Maharashtra (McKay and Keremane, 2006). Ghosh *et al.* (2010) observed differential functioning and effectiveness of WUAs under different types of irrigation system in Odisha, where farmers perceived overall performance of WUAs in minor irrigation systems relatively better. According to FAO (2003), a paradigm shift in irrigation sector from supply management to demand management has been seen as a fundamental transformation in the management of water resources. Over the last decades the policy agenda of water sector in India has been focused on stakeholders' participation to address the problems related to operation and maintenance of irrigation systems and low irrigation efficiency. Farmers are the ideal persons to manage the system at farm level through formation of WUAs. Once adequate knowledge and skill is imparted to the farmers for managing and running the system and a sense of ownership is developed in the beneficiaries, WUA would be of paramount importance in irrigated areas for efficient management of irrigation system.

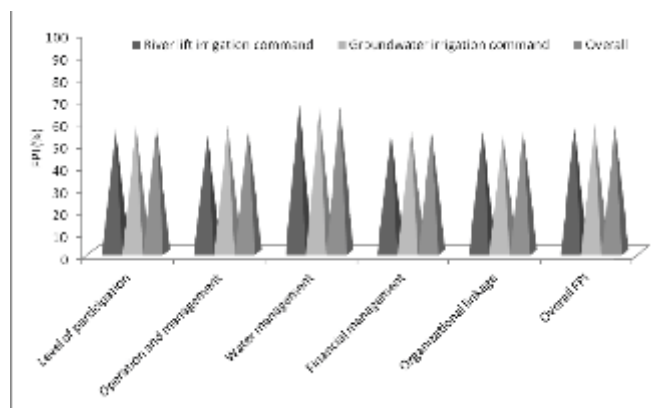


Fig. 2: Differential farmers' participation in various activities of WUAs in river lift and groundwater lift irrigation commands in Birbhum district of West Bengal

Table 2: Farmers participation index (FPI) in river lift and groundwater irrigation projects in Birbhum district of West Bengal

Particulars	Farmers Participation Index (%)		
	River lift irrigation (n=40)	Groundwater lift irrigation (n=40)	Overall (n=80)
Level of Participation	56.00	57.00	56.50
Operation and Management	52.80	57.20	55.00
Water Management	66.80	65.00	65.90
Financial Management	53.00	56.40	54.70
Organizational Linkage	54.60	54.40	54.50
Overall FPI	56.64	58.00	57.32

Gender performance in irrigation was assessed based on an index developed by the International Water Management Institute (2002). In case of the river lift irrigation, majority of the farmers perceived that gender-based differences are absent (+) with respect to seven out of eight parameters in GPII. The farmers perceived that mild / moderate gender-based differences exists (+/-) with respect to difference in functioning of women leaders in comparison to male leaders. However, more than 20 per cent of the farmers perceived that the gender-based differences present (-) in respect to many parameters in GPII. Similar trend is observed in case of groundwater irrigation (Table 3).

Table 3: Gender performance in irrigation index (GPII) in river lift and groundwater irrigation projects in Birbhum district of West Bengal

Different aspects of gender performance	River lift irrigation command (n=40)						Groundwater lift irrigation command (n=40)					
	+		+/-		-		+		+/-		-	
	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)
Difference in farm-level access of women and men to water and related obligations	27 (67.5)	2 (5)	11 (27.5)	24 (60)	1 (2.5)	15 (37.5)						

Difference in participation in forums or networks for collective water management arrangements (in WUA)	27 (67.5)	2 (5)	11 (27.5)	29 (72.5)	1 (2.5)	10 (25)
Difference at leadership level in WUA (whether gender composition of leaders reflect the gender composition of the farmers in the irrigation scheme)	30 (75)	5 (12.5)	5 (12.5)	22 (55)	13 (32.5)	5 (12.5)
Difference in functioning of women leaders in comparison to men	10 (25)	21 (52.5)	9 (22.5)	14 (35)	17 (42.5)	9 (22.5)
Difference in benefit-related functions (e.g., crop choice, use of the produce and of the money gained from sale)	23 (57.5)	10 (25)	7 (17.5)	26 (65)	4 (10)	10 (25)
Difference in resource-related activities, for example, obtaining access to land and credit	25 (62.5)	6 (15)	9 (22.5)	29 (72.5)	4 (10)	7 (17.5)
Difference in technology-related activities such as ploughing, applying fertilizer and irrigating at field level and negotiations over water in forums.	23 (57.5)	4 (10)	13 (32.5)	20 (50)	2 (5)	18 (45)
Difference in labor-related activities (e.g., labor mobilization, calendar of operations)	27 (67.5)	3 (7.5)	10 (25)	22 (55)	1 (2.5)	17 (42.5)

Note: gender-based differences are absent (+), mild / moderate gender-based differences exist (+/-), gender-based differences present (-)

To delineate the factors affecting the farmers' perceptions on WUAs correlation and regression analyses were done. It is evident from Table 4 that the performance of WUAs is significantly and positively related with farmers characteristics like education, social participation, economic status, land holding, wealth ranking and perceived irrigation service utility in river lift irrigation command areas. Similarly, the WUAs' performance in groundwater irrigation command is significantly and positively associated with farmers' education, social participation, economic status, land holding, resource position and perception on irrigation service utility.

Table 4: Correlation between the attributes of farmers and performance of WUAs in river lift and groundwater irrigated areas in Birbhum district of West Bengal

Attributes of farmers	Correlation coefficient (r)	
	WUAs' performance in river lift irrigation command	WUAs' performance in groundwater irrigation command
Age	-0.033	-0.175
Caste	0.259	0.287
Family	0.102	-0.045
Education	0.331*	0.312*
Occupation	-0.002	-0.086
Social Participation	0.386*	0.325*
Economic Status	0.352*	0.319*
Family income	0.149	0.221
Family Expenditure	0.168	0.256
Land holding	0.386*	0.322*



Wealth Ranking Resource Position Perceived irrigation service utility	0.316* 0.143 0.355*	-0.099 0.308* 0.684**
---	---------------------------	-----------------------------

\* significant at 5% level; \*\* significant at 1% level

Stepwise multiple regression analyses revealed that farmers' perceptions on irrigation service utility, social participation, caste and resource position have explained 69 per cent variations ( $R^2=0.69$ ) in the performance of WUAs in river lift irrigation and groundwater irrigation command areas in Birbhum district of West Bengal (Table 5). It is evident that WUAs performance is mainly influenced by the perceptions of farmers on utility of irrigation service. Therefore, WUAs should focus on better irrigation management in their jurisdiction areas fulfilling the objective of more crops per drop.

Gupta and Srivatsava (1999) felt that participatory irrigation management (PIM) is no longer an option but became a necessity. Therefore, it is imperative to give it the status of a National Programme and nurtured and monitored accordingly. This would also require considerable investment in Human Resource Development and capacity building leading to institutional strengthening, particularly of WALMIs and reorientation of work and attitude of Irrigation Department and mobilization of farmers.

There is a growing crisis in water resources management in India and this is becoming increasingly serious as development accelerates (Gandhi and Namboodiri, 2002). Scarcities of water are becoming common and frequent and the quality of water is suffering as well. The management of water distribution across the vast area of the country, and among million of users, in a sustainable manner is becoming challenge. There is a crisis in management of surface water because of huge investment requirement, project implementation delays, problems of maintenance, institutional difficulties and environmental concerns. There is a crisis in management of groundwater because of excessive exploitation against inadequate recharge resulting in receding water tables in many areas. The crucial role of irrigation in food production as well as livelihood needs no emphasis (Gandhi, 1998). Transfer of irrigation management responsibilities from government agencies to farmers is now an important policy that has resulted variable impact over space and time. In this context, initiative of Government of West Bengal to include the concept of PIM through launching of West Bengal Accelerated Development of Minor Irrigation Project (WBADMIP) would ensure better irrigation performance in near future.

Table 5: Stepwise multiple regression between performance of WUAs (dependent variable) and characteristics of the farmers (independent variables) in river lift and ground water lift irrigation command area in Birbhum district of West Bengal

Variables	'b' value	Standard Error	't' value	'F' value	R <sup>2</sup>
<b>Step I</b>					
Constant	0.278	0.453	0.614	33.78**	0.48
Irrigation service utility	0.708	0.122	5.812**		
<b>Step II</b>					
Constant	-0.289	0.480	-0.602	22.47**	0.56
Irrigation service utility	0.789	0.118	6.665**		
Social participation	0.086	0.034	2.512*		
<b>Step III</b>					
Constant	-0.768	0.502	-1.531	18.394**	0.61
Irrigation service utility	0.831	0.114	7.309**		
Social participation	0.099	0.033	3.011**		
Caste	0.086	0.038	2.261*		
<b>Step IV</b>					
Constant	-1.300	0.490	-2.655*	18.942**	0.69
Irrigation service utility	0.829	0.103	8.041**		
Social participation	0.066	0.032	2.055*		
Caste	0.149	0.041	3.667**		
Resource position	0.046	0.016	2.993**		

\* significant at 5% level; \*\* significant at 1% level

## CONCLUSION

The present study revealed performance of river lift irrigation and groundwater lift irrigation systems in Birbhum district of west Bengal. The farmers' participation in irrigation management in both river lift and groundwater irrigation system has helped in better water management in the minor irrigation command areas. The efficiency of water user associations (WUAs) is of paramount importance to bring better irrigation and cropping scenario in minor irrigation command areas with gender mainstreaming eradicating gender differences in irrigation as well as in agriculture.

*Paper received on* : October 19, 2017

*Accepted on* : October 26, 2017

## REFERENCES

- Food and Agriculture Organisation of the United Nations. 2003. Water for food and Agriculture, Issue paper, Ministry of Agriculture, Forestry and Fisheries of Japan and Food and Agriculture Organisation of the United Nations. Publishing Management Service, Information Division, FAO, Rome, Italy.
- Gandhi Vasant P and N.V. Namboodiri 2002. Investments and Institutions for Water Management in India's Agriculture: Policies and Behaviour, in Donna Brennan(ed.) Water Policy Reform: Lessons from Asia and Australia. Australian Centre for International Agricultural Research. Canberra, Australia. 106–130.

- Gandhi, Vasant P. 1998. Rapporteur's report on institutional framework for agricultural development, *Indian Journal of Agricultural Economics*, 53: 552-564
- Ghosh, S. and Kumar, A. 2012. How participatory irrigation management reform influences agriculture performance. *Current Science*, 103(4): 359-360.
- Ghosh, S., Brahmanand, P.S., Mandal, K.G., Nanda, P. and Patil, D.U. 2016. How Participatory is Participatory Irrigation Management. *Indian Journal of Extension Education*, 52, (3 & 4):1-6
- Ghosh, S., Kumar, A., Nanda, P. and Anand P.S.B. 2010. Group Dynamics Effectiveness of Water User Associations under Different Irrigation Systems in an Eastern Indian State. *Irrigation and Drainage*, 59: 559-574
- Gupta, D. and Srivastava, L.P. 1999. Status of Participatory Irrigation Management in India. A Documentary Critique. Institute of Social Sciences Manuscript Report 13, New Delhi.
- McKay, J. and Keremane, GB. 2006. Farmers' perception on self-created water management rules in a pioneer scheme: the Mula irrigation scheme, India. *Irrigation and Drainage Systems*, 20: 205-223.
- Naik, G. and Karlo, A. H. 1998. The World Bank. Technical Paper.
- Parthasarathy, R. 2000. Participatory irrigation management programme: Institutional and financial issues. *Economic and Political Weekly* (August-September), 3147-3154.