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How Participatory is Participatory Irrigation Management

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ABSTRACT

An assessment of Participatory Irrigation Management (PIM) was carried out in Kuanria Medium Irrigation Project in Nayagarh district of Odisha covering 10 WUAs with a sample survey of 350 farmers. Methodologies developed to assess farmers' perceptions towards extent of participation, utility of irrigation service and performance of water user association (WUA) in the command area (varied from 274.95 ha to 501.70 ha) under the WUAs. Overall participation of the farmers was below average in case of all the 10 WUAs as evident from lower farmers' participation index values (<50%). The irrigation performance found better in kharif season as compared to rabi season in most of the WUA's jurisdiction areas. WUA's performance perceived below average and varied over the space. Analyses of agricultural performances in the WUAs jurisdiction command area revealed that WUAs at tail reach recorded cultivated land utilisation index lower than 50%; the crop diversity index and multiple cropping index were found low as the farmers didn't cultivate any crop during rabi season due to paucity of irrigation water at tail end.

Keywords: Irrigation management transfer, sustainability, impact on irrigation and agricultural performance

INTRODUCTION

Irrigation has played a crucial role to bring green revolution and self-sufficiency in food production in India (Chambers, 1988). The large production gains were a result of agricultural intensification in which irrigation played critical role (Madramootoo and Fyles, 2010). The gap (32 M ha) between the potential created (123 M ha) and utilized (91 M ha) has been increasing. The problems in irrigation sector in India are low irrigation efficiency (30-35%), deteriorating physical structures, inadequate maintenance, low cost recovery (₹ 50 per ha against operation and maintenance requirement of ₹ 250 per ha, Vaidyanathan Committee Report 1991), under-utilization (74%) of created potential, uncontrolled water delivery, tail-end water deprivation, seepage loss, siltation, waterlogging and soil salinity. As a result of the debate over non-performance of publicly supplied irrigation system, the participatory irrigation management (PIM) and irrigation management transfer (IMT) has been advocated as a solution. On the concept of people's management of developmental infrastructures that requires local solution to local problems affecting them, the National Water Policy of India (1987, 2002) stressed on farmers participation in irrigation management. Accordingly, several states in India have been implementing the PIM programmes and transferring the irrigation management to water user associations (WUA) with a view to provide equitable, timely and assured irrigation. 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). About 13.16 M ha of irrigated land has been covered under 56539 numbers of WUAs in the country till the end of tenth five year plan (Ministry of Water Resources, Govt. of India, 2007; Kulkarni *et al.,* 2009). Institutional arrangements governing water use and distribution along with socio-economic scenario influencing impact of PIM have now become issues demanding immediate attention (McKay and Keremane, 2006; Swain and Das, 2008). There has been some concern about the sustainability of the PIM approach and how participatory is PIM (Reddy

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and Reddy, 2005; McKay and Keremane, 2006; Kulkarni *et al.,* 2009). Currently, there is inadequate understanding of the linkage between socio-cultural, institutional and ecological factors affecting the outcome of the PIM reforms in India (Saravanan, 2010). In this context, an assessment of PIM reforms through the study of participatory process in irrigation management and effect on agriculture and irrigation performance was carried out in Kuanria Medium Irrigation Project in Nayagarh district of Odisha state, India.

METHODOLOGY

The study was carried out in Kuanria Medium Irrigation Project in Nayagarh district of Odisha covering 10 WUAs with a sample survey of 350 farmers. Methodologies developed to assess farmers' perceptions towards extent of participation, utility of irrigation service and performance of WUA besides evaluation of agricultural situation over space and time in the command area (varied from 274.95 ha to 501.70 ha) under the WUAs.

Farmers-members' participation in different activities undertaken by WUA (leadership seeking participation, members awareness on WUA activities, attending meetings, voluntary physical / labour and financial contributions, social auditing) is studied with the help of a Farmers' participation index (FPI)

FPI = (Mean participation score / Maximum participation score) X 100

where, mean participation score = Pi / N and Pi = PPj

PPj = Total score of farmers' participation

i = 1,2, ……, N and j = 1,2, ……, K

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

The utility of water delivery service in an irrigation distribution system is assessed from farmers' perspectives on the parameters *viz.* tractability, convenience, predictability and equity. Tractability refers to the ease with which farmers can control and satisfactorily apply water to their land; it is measured on the basis of farmers' perceptions on quantity of water supply, point of water delivery and stream size. Convenience refers to the timing of water delivery as preferred by farmers to enable them to plan their activities; it is determined through timeliness of irrigation, duration of water supply, frequency of getting water. Predictability relates to the farmer's degree of confidence with respect to water supply service, or how much information is available to farmers about the water delivery schedule and the degree of uncertainty associated with this information. Equity refers to the equal benefits derived by the member-farmers from irrigation service. The above-mentioned variables are studied through survey of sample of member-farmers under different WUAs. Farmers' responses on each of the above-mentioned sub-factors were taken on a 5-point continuum scale (1- very poor to 5 - excellent) and mean perception score derived. Perception of farmers on overall irrigation service is also studied on same scale.

A scale developed to assess performance of WUA taking farmers' responses on 20 parameters related to issues like participation, operation and management, water management, financial management and organizational linkage.

Agricultural performance under different WUAs jurisdiction is studied with the help of Cultivated Land Utilization Index (CLUI), Crop Diversity Index (CDI) and Multiple Cropping Index (MCI). CLUI is calculated on the basis of crop wise land area and duration in each season. Cultivated land utilization index has been estimated by summing the products of land area planted to each crop, multiplied by the actual duration of that crop divided by the total cultivated land area, times 365 days.

$$CLUI = \frac{\sum_{i=1}^{n} a_i d_i}{A \times 365} \times 100$$

Where, i = 1,2,3…..n; n = total number of crops; ai = area occupied by the ith crop

di = days that the ith crop occupies; A = total cultivated land area available for 365 days.

Crop diversity index (CDI) was calculated by using the following equation:

$$CDI = 1 - \sum_{j=1}^{n} (a_{ij}/A_i)2$$

Where, aij = area planted to the jth crop in the ith location
Ai = total area planted under all crops.

The CDI is zero for a land area growing only one crop

and approaches unity as the level of diversity increases. This has been estimated for both kharif and rabi seasons.

Multiple Cropping Index (MCI) indicates the sum of the areas planted to different crops harvested during the year, divided by the total cultivated area.

$$MCI = \frac{\sum_{i=1}^{n} ai}{A} \times 100$$

Where, i=1,2,3……..n; ai = area planted under ith crop and A = Total cultivated area

RESULTS AND DISCUSSION

Description of the selected irrigation system

Kuanria medium irrigation command at Daspalla block of Nayagarh district in Orissa (20°20'N latitude and 84°28'E latitude) was selected for study. The project irrigates 3780 ha of land benefiting about 37000 people living in 67 villages under the command area. The canal system has two main distributaries, left and right distributaries, and minors and subminors. The project has two number of head regulators: one located on the left of spillway and another at the right side of the earth dam. The main canal off-taking from head regulators run for a length of 16.5 km and 18.20 km. There are 71 numbers of minors and subminors, having a length of 51.105 km and water courses for a length of 64.69 km. The GCA is 4800 ha and CCA is 3780 ha. The CCA of right distributary is 1868.13 ha and that of left distributary is 1911.87 ha. The main crop is paddy in kharif which is grown over 2000 ha.

Farmers' participation in irrigation management

The farmers' participation in different WUA activities is indicated through FPI. It is evident that overall participation of the members is below average in case of all WUAs which may be due to the fact that major responsibilities in WUA's activities are often taken by the executive committee members and involvement of general members is low. WUA3 is having highest FPI value followed by WUA4 and WUA7. The farmers' participation is lowest in WUA1. It is interesting to note that jurisdiction areas of WUA1 and WUA2 fall under head reach of left distributary and farmers comparatively face less difficulty with respect to irrigation service leading to relatively lower participation in WUA activities. There is not much difference in extent of participation in the WUAs under right distributary.

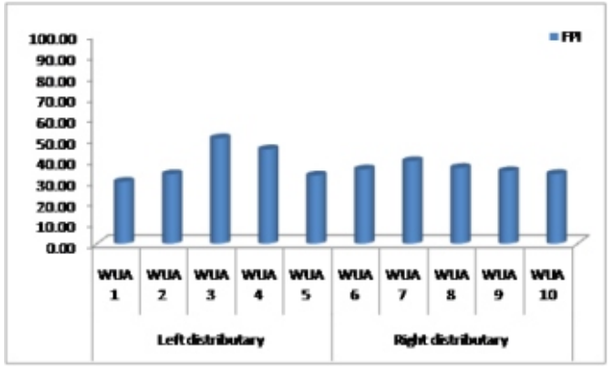

Fig. 1 Farmers-members' participation in different activities undertaken by WUA

Assessing irrigation performance from farmers' perspectives

The utility of water delivery service in an irrigation distribution system is assessed from farmers' perspectives on the parameters *viz.* tractability, convenience, predictability and equity. It is found that all the four factors are relatively higher in kharif season as compared to rabi season (Table 1). Out of these four factors convenience is better in majority of the WUAs during both kharif and rabi season while equity is poor. All the factors are found to be better in the jurisdiction areas of WUAs under left distributary as compared to that of right distributary.

All the four factors are found to be low in case of WUA5, WUA9 and WUA10 all of which are under tail reach which indicate the poorer irrigation service at the tail reach during rabi season.

The tractability and equity in WUA8, WUA9 and WUA10 is below average even in kharif season which may be attributed to the fact that irrigation distribution network is not proper under right distributary. The overall irrigation performance is relatively better in kharif season (Fig. 2) and not much difference between the WUAs except for the WUA8, WUA9 and WUA10 where it is at average level.

The performance is perceived relatively poor especially for the WUA5, WUA8, WUA9 and WUA10 where it is at below average level. Farmers at tail reach (WUA 5 and WUA 10) mentioned about irregular water supply and non-availability of water during dry / rabi season. Similar results observed during study in a major irrigation project (Ghosh *et al.,* 2005).

Table 1: Farmers perceptions on irrigation system performance under different WUA's jurisdiction area

Particular	Left distributary					Right distributary				
	WUA1 (n=42)	WUA2 (n=46)	WUA3 (n=29)	WUA4 (n=28)	WUA5 (n=25)	WUA6 (n=35)	WUA7 (n=54)	WUA8 (n=47)	WUA9 (n=26)	WUA10 (n=20)
Tractability										
Kharif	4.18	4.11	4.10	4.08	4.09	4.22	4.17	2.20	2.02	1.42
Rabi	2.48	2.43	2.45	2.36	2.24	2.65	2.46	1.47	1.67	1.28
Convenience										
Kharif	4.39	4.21	4.04	4.02	3.57	4.40	4.29	3.90	3.80	3.60
Rabi	3.42	3.30	3.27	2.62	2.33	3.36	3.23	3.00	2.63	2.50
Predictability										
Kharif	4.13	3.46	4.41	4.21	4.10	4.22	3.67	2.89	2.73	2.45
Rabi	3.01	2.92	3.02	2.27	2.12	3.44	2.99	2.69	2.47	2.08
Equity										
Kharif	3.60	2.70	4.44	4.14	3.72	4.09	2.30	1.04	1.48	1.13
Rabi	2.00	2.27	2.81	2.07	1.04	2.14	1.94	1.04	1.62	1.10

Minimum and maximum mean perception score is 1 and 5, respectively

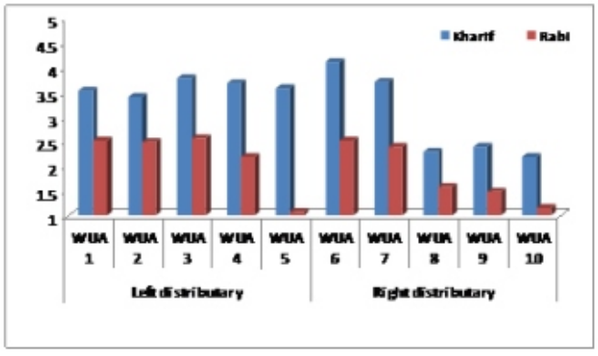

Fig. 2 Irrigation service as perceived by member-farmers of different WUAs

WUA Performance

Performance of WUA was assessed from the farmers' perspectives taking farmers' responses on a total of 20 parameters related to issues like participation, operation and management, water management, financial management and organizational linkage. WUA's performance varies over the space with respect to different issues, most of which perceived below average in all cases (Table 2).

It is found that water management is perceived relatively low performed in most of the WUAs. The operation and management is found relatively better in case of five WUAs (WUA1, WUA2, WUA4, WUA5 and WUA6). Overall performance is perceived below average by sampled member-farmers in all the WUAs which are a concern for effectives of PIM and its long term sustainability. Similar results observed in another study (Ghosh *et al.,* 2010)

Table 2: Farmers' perceptions on WUA's performance

Particular	Left distributary					Right distributary				
	WUA1 (n=42)	WUA2 (n=46)	WUA3 (n=29)	WUA4 (n=28)	WUA5 (n=25)	WUA6 (n=35)	WUA7 (n=54)	WUA8 (n=47)	WUA9 (n=26)	WUA10 (n=20)
Level of participation										
Leadership capability	1.79	1.98	2.38	2.61	1.8	2.14	2	1.65	2.04	1.7
Members awareness about WUA status	1.38	1.83	2.69	2.11	2	1.66	1.89	1.7	1.73	1.7
Productive meetings	1.38	1.57	2.34	1.82	1.16	1.57	2	1.89	1.65	1.65
Voluntary physical / labour contribution	1.29	1.39	2.41	2.14	1	1.6	2.07	1.91	1.65	1.65
Voluntary financial contribution	1.43	1.54	2.83	2.44	1.16	1.83	1.93	1.89	1.69	1.65
Social Audit/ Transparency	1.68	1.72	2.55	2.5	2.72	1.91	2.02	1.87	1.69	1.7
Mean value	**1.49**	**1.67**	**2.53**	**2.27**	**1.64**	**1.79**	**1.98**	**1.82**	**1.74**	**1.68**
Operation and Management										
Removal of silt and weeds	1.81	1.8	2.59	2.54	2.00	2.06	1.94	1.64	1.58	1.6
Repairs/ maintenance of structure	1.69	1.87	2.86	2.36	2.80	2.17	1.85	1.79	1.62	1.6
Protection of structure	1.67	1.83	2.62	2.43	2.96	2.11	1.98	1.85	1.62	1.65
Dispute management	1.43	1.78	1.17	2.07	1.00	1.69	2.07	1.85	1.54	1.65
Mean value	**1.65**	**1.82**	**2.31**	**2.35**	**2.19**	**2.01**	**1.96**	**1.78**	**1.59**	**1.63**
Water management										
Adequate and timely water supply	1.81	2	2	2.54	1.68	2.03	1.98	1.64	1.77	1.6
Information about water distribution	1.5	1.76	2.41	2.25	1.84	1.83	1.76	1.79	1.58	1.65
Efforts to save water	1.07	1.36	2.14	1.43	1.20	1.31	1.43	1.87	1.62	1.6
Mean value	**1.46**	**1.7**	**2.18**	**2.07**	**1.57**	**1.72**	**1.72**	**1.77**	**1.65**	**1.62**
Financial management										
Fund generation	1.71	1.8	1.9	2.33	1.00	2.03	2.09	1.85	1.96	1.7
Utilisation of maintenance and operation fund	1.64	1.82	2.17	2.3	2.04	2.09	2.17	1.89	1.69	1.74
Financial audit	1.5	1.62	1.97	2	1.76	1.77	1.96	1.98	1.69	1.7
Mean value	**1.58**	**1.73**	**1.76**	**2.18**	**1.46**	**1.90**	**2.08**	**1.92**	**1.77**	**1.7**
Organizational linkage										
Horizontal linkages with other WUAs	1.69	2.18	1.66	2.54	1.24	1.89	2.02	1.77	1.65	1.6
Vertical linkages	1.61	2	1.86	2.54	2.00	2.03	2.02	1.98	1.62	1.65
Information and communication	1.54	1.69	1.83	2.21	2.00	1.91	1.96	1.98	1.69	1.65
Discussion with competent authority	1.37	1.44	1.38	1.89	1.76	1.57	1.85	1.98	1.69	1.7
Mean value	**1.54**	**1.82**	**1.68**	**2.29**	**1.75**	**1.85**	**1.96**	**1.93**	**1.66**	**1.65**
Overall WUA performance	**1.54**	**1.75**	**2.09**	**2.23**	**1.72**	**1.85**	**1.94**	**1.84**	**1.68**	**1.65**

Performance of agriculture

The values of CLUI ranged from 40.5 per cent in WUA10 to 62.7 per cent in WUA7. Three WUAs i.e. WUA5, WUA9 and WUA10 recorded values of CLUI lower than 50 per cent which reflects that there is lack of irrigation facility in the tail reaches under left and right distributary. Even in other WUAs, opportunity lies in

enhancing the cropped area by improving the irrigation performance and water use efficiency.

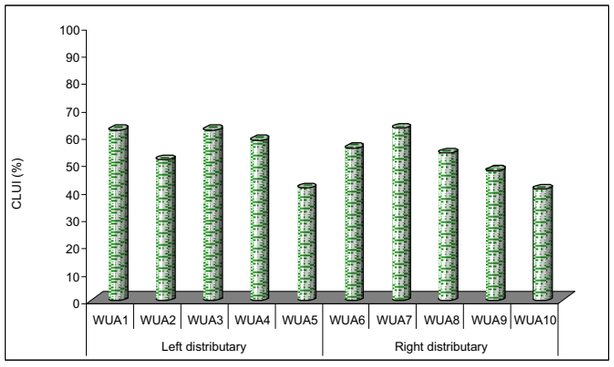

Fig. 3 Cultivated Land Utilization Index (CLUI) of different WUAs

The values of CDI ranged between 0.07 in WUA 9 to 0.224 in WUA 6 during kharif season. It indicates that the crop diversification is poor in general. The main reason for this trend is that the paddy occupied maximum proportion of the land area in kharif season in all the WUAs. Though sugarcane and maize are grown, their relative area compared to paddy is marginal leading to low values of CDI. This provides the scope for the farmers to further diversify to sugarcane and maize for reducing the distress sale of paddy.

The values of CDI during rabi season ranged between 0.477 in WUA 7 to 0.722 in WUA 6. The
For higher CDI value during rabi season is due to the cultivation of crops like sugarcane, vegetables, greengram and blackgram in good proportion. Moreover, the diversification existed in the form of cultivation of other crops like sunflower, maize, groundnut, coriander, onion, potato, chilli and garlic. The values of CDI couldn't be computed for WUA 5 and WUA 10 as there was no cultivated area in rabi season.

The highest value of MCI (170.5%) was recorded in WUA 7 followed by WUA 1 (157.9%) and WUA 3 (154.5), all of which having jurisdiction area at head reach. WUA 5 and WUA 10 recorded MCI values lower than 100 as the farmers didn't cultivate any crop during rabi season due to paucity of irrigation water. It indicates that lot of scope still exists in cultivation of additional crops in jurisdiction areas of WUAs where the MCI values are quite lower.

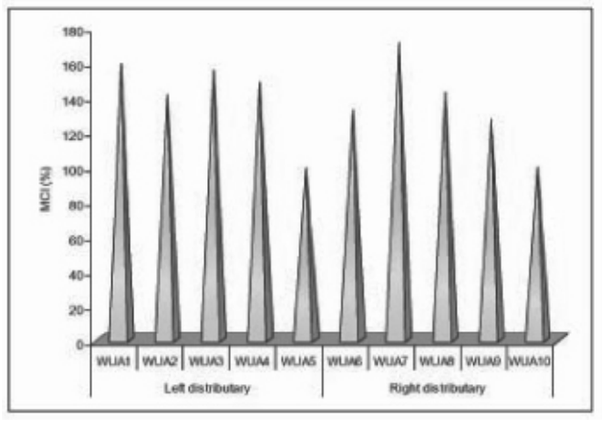

Fig. 4 Multiple Cropping Index (MCI) of different WUAs

CONCLUSION

Extent of farmers' participation in irrigation management of medium irrigation system is below average and varied over the space. The lower participation in head reach reflects the fact of less participation of the farmers where water availability is not that concern, while farmers participate effectively in lower reaches of the irrigation system. The irrigation and agricultural performances also depend of efficient participatory approach and functioning of WUAs, which are found to be below average. Thus the irrigation and agricultural performance has not improved upto the potential.

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