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Participatory irrigation management through Moral Suasion: A case study comparing the Formal and Informal organisational structures

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Abstract
The decreasing trend observed in the area irrigated by traditional water harvesting structures, mainly irrigation tanks in the last four decades is quite opposite to the trend shown by the area under bore well irrigation, which is expanding radically and is comparable with area covered under major and medium irrigation projects. This shift in usage pattern of irrigation water is mainly attributed to the state interference in operation and maintenance of traditional irrigation structures and the biased provision of the share of the state irrigation budget to major and medium projects. The development of new technologies for groundwater pumping added woes to it. Recently some state governments of India are implementing the policy of free electricity for agricultural purposes to retain their vote bank in rural areas where majority of voters are farmers. This in turn causes a decrease in stabilisation value leading to over exploitation of groundwater resource. In such situations managing the common property resources like irrigation tanks is a difficult task exacerbated with the present political oriented Water Users Associations (WUA's) structure. So under these present circumstances, the current study attempts to find a solution by employing moral suasion (creating awareness, training, educating and voluntary compliance) which can be an effective alternative approach to combat this problem and to encourage the farmers to operate and maintain common property resources. As a part of this a case study was carried out in Nalgonda district of Andhra Pradesh, India for comparing the modus operandi of formal and informal WUAs, which is a part of Participatory Irrigation Management (PIM). The results show that the area commanded by tank irrigation has substantially increased under the informal WUA due to rehabilitation of their irrigation tanks and developing them into a cascade. This in turn had an influence on yield of groundwater pumps in the area as well. The formal one is unable to manage this for long term due to lack of funds and burocratic supervision of Irrigation department. This paper also suggests a modified structure of WUA's for better managerial efforts.

Keywords: Irrigation tanks, moral suasion, stabilisation value, water users associations

Introduction:

Water is vital for all forms of life. Water is essential for production of food grains, household, drinking, sanitation, and industrial purposes and for sustaining the earth's ecosystem. The land and water resources are always constant and this has not been equidistributed. Today's world irrigated area is around 250 million hectares, which is five times of the amount that existed at the beginning of the 20th century (Rosegrant et al, 2002). Much of the expansion has taken place in developing Asia, with India, china, and Pakistan accounting for around 48 % of the total irrigated area (IWMI, 2002). In India the gross irrigation potential have been increased from 22.56 to

76.34 million hectare from 1950 to 2000 (MOA, 2004) by 31.09 % canals, 5.15 % irrigation tanks[1], 58 % wells and 5. 73 % other sources. To feed the country's estimated population of 1390 million people by 2025, production of food grains would need to be raised from the present 208 to 350 million tons (Arora et al, 2003). But India's water resources potential and the country's agricultural economy hinge on the monsoon rains and its spatial and temporal variations. About 53 % of the 328 million hectares geographical area in India falls under semi-arid regions with annual rainfall of 500 to 1,000 mm (Anbumozhi et al, 2001). Facing high spatial and temporal variability of rainfall since time immemorial, India's rural communities have followed a policy of conserving rainwater for subsequent use through water harvesting tanks or small storage structures like ponds built, owned and managed by the local people through community organisations. Almost all monsoon countries in the semi-arid tropics have small water bodies like tanks.

Tanks in Indian context are inextricably linked to the socio-cultural aspects of rural life and have historically been an indispensable part of the village habitat, sustaining its socio-ecological balance. Conserving the tank ecosystems for multiple uses such as irrigation, domestic and livestock use and groundwater recharge is a way to provide a safety net to protect the livelihood of millions in a semi-arid India. In India, the largest concentration of tanks is found in the three southern states of Andhra Pradesh, Karnataka and Tamilnadu and the union territory of Pondicherry, which account for nearly 60 per cent of India's tank-irrigated area. Out of India's 2, 08,000 tanks, these states have nearly 1, 20,000, irrigating 1.8 million hectares of land (Vaidyanathan 2001). The area under tank irrigation have been declined from 4.6 to 3.3 million hectares at national level, where as the total irrigated area under tank in the three predominant states (Andhra Pradesh, Karnataka and Tamilnadu) together has declined from 2.4 to 1.7 million hectares from 1960 to 1997, a reduction of about 30 per cent ((Narayanamoorthi 2002; Janakarajan 1996). Andhra Pradesh is dominated by 70,000 tanks of these three predominant south Indian states.

The pre-eminence of tanks as a source of water storage and supply for multiple uses was ignored after independence (1947). It is due to various factors such as development of large-scale gravity irrigation systems, technology development in groundwater pumping and decline in the tradition of community management. As a result, a large majority of the tanks in the southern and eastern parts of India suffer from inadequate management and maintenance; some have become disfunctional while others are even obliterated.

In case of groundwater there was boost in extractions as private investments have contributed more and majority of wells are private property regimes. The increasing use of groundwater is due to low cost of extraction and technology development added owes to it. In addition to these recently some state governments of India are implementing the policy of free electricity for agriculture to retain their vote bank where the majority of voters are farmers (for instance Andhra Pradesh, Tamilnadu and Maharastra).

In Andhra Pradesh there is a decreasing trend in the area irrigated by traditional water harvesting structures (tanks) mainly in the last four decades. It is quite opposite to the trend shown by the area under the bore well irrigation which is expanding radically and comparable with the area covered with major and medium irrigation projects. This shift in usage of irrigation water is mainly attributed due to the state interference in operation and maintenance of traditional irrigation structures and biased provision of the share of the state irrigation budget to major and medium irrigation projects. In addition to this, from 2004 cropping season the Andhra Pradesh state government announced free electricity policy to gain their vote bank.

Mismanagement of surface water bodies and free electricity policies in turn causes a decrease in stabilisation value of groundwater (Tsur 1993 and Palanisami 2004) leading to over exploitation of groundwater resources. Many studies explained the circumstances for Optimisation of groundwater extractions by increasing the extraction charges, conjunctive use and accounting system (Knap olson, 1995; Hellegers et al, 2001; Natalia et al 2003; Zilberman and Lipper, 1999). But under the said condition, farmers vote for the government for free electricity policy. So the present study attempts to find a solution by employing a moral suasion (creating awareness, training, educating and voluntary compliance) which can be an effective approach to combat this problem and encourage the farmers to operate and maintain common property resources. So a continued progress in water resources utilisation in the future will depend upon the maintenance of the present irrigation structures. The first section of the paper explains the methodology employed for the study, section two explains in brief about the moral suasion, Formal and Informal WUAs roles and objectives and finally in section three we provided the modified structure of WUA by considering the results obtained.

1. Methodology:

Data has been collected from a semi-arid region, Nalgonda district (as 53 percent of the total geographical area in India is under semi-arid and majority of the tanks fall under it) was selected from Andhra Pradesh as a first step in the location of study area. In the second step Pangiri Big tank (PBT), which is managed by Formal WUA, was selected from Tirumalgiri mandal, Nalgonda district based on the availability of historical data for the estimation of stabilisation value of groundwater[2]. Aipoor tank cascade (ATC), which was managed by Informal water users group, was selected purposefully for comparing the modus operandi of Formal and Informal WUAs for the kharif (June- October / November) cropping season in 2004-2005. The Informal group is managing the water resources with the guidance of an NGO (Development of Humane also called as DHAN foundation). The DHAN foundation is helping the farmers by creating awareness regarding management of traditional water harvesting structures, training and educating in water management aspects. The impact of management on water productivity (Kg/ha-cm) is assessed by employing the ANCOVA model and scoring techniques were used to assess the major driving factors for collective and non collection actions.

2. Moral suasion:

Moral suasion is an application of pressure but not force, by an authority to get members to adhere to regulations or policy. Moral suasion is widely analysed in the field of monetary and environmental economics. For instance it is analysed in tax laws and tax compliance models with honesty (Schwartz & Orleans 1977 found in Torgler 2004). Kooten and Schmitz (1992) examined the impact of encouraging the farmers to promote or maintain waterfowl habitat by relying not only on economic incentives but on awareness, education and moral suasion in a pilot project of NAWMP. For improving the environmental performance of agriculture, European agricultural policy played a crucial role to increase the positive externalities by encouraging the rural landscape instead of food production (Weersink, 2002). In the present study NGO is acting as a player to rehabilitate the irrigations tanks by encouraging and awaring the farmers through moral suasion, which intern affects the increase of surface water storage and decrease in groundwater utilisation and overexploitation.

Formal Water Users Association (Participatory Irrigation Management):

Andhra Pradesh is the first state to form Water users associations in November 1997 as a part of Participatory Irrigation Management (PIM) in India to manage the Major, Medium and Minor irrigation systems. As a first step 10, 292 WUAs have been registered and elections were conducted to elect the president of the WUA. The main objectives of this group is to realise the

maximum irrigation potential, improving the efficiency of existing irrigation system, ensuring equitable and reliable water supply and finally managing water resources better by stakeholder participation and withdrawing the irrigation department in Operation and Maintenance (O & M). Managing the common property resources like irrigation tanks is a difficult task exacerbated with the present political oriented water users associations (WUA's) structure (Ratna Reddy and Prudhvikar Reddy, 2002). The overview of the structure represents that the land owners, tenants and other water users under the command area will select the WUA. Each WUA consist of 4-6 territorial committees depending upon the project area. The area under each committee ranges from 150 to 250 hectares under major and medium irrigation projects and 50 to 200 in case of minor irrigation projects.

All the presidents of WUAs will form a distributory committee (DC) and select the president and managing committee under it. All the DC presidents will form the Project committees (PC) and select 7-11 managing committees and president. At the top an Apex committee headed by Minister for major and medium projects is located to formulate policies and guide the entire structure. Irrigation charges or water cess will be collected from the stakeholders by the group (Rs 100 per acre). According to the proposed plan of the entire collected amount 25 percent goes back to the WUA, 25 percent to DCs and remaining to the state government, but still this plan is not enforced. In many cases the objectives didn't reach the expectations and lead to failure of the group, especially in the minor irrigation system. A scoring technique is used to find the reasons for the non cooperation in irrigation tank maintenance. The main factors were due to lack of sufficient monsoon rainfall; tank is under irrigation department and lack of funds from the irrigation department (Table: 1)

Table: 1 Reasons for non co-operation in tank management by Formal WUAs:

Particulars	Ranks						Total scores	Rank of scores
	I (6)	II (5)	III (4)	IV(3)	V(2)	VI(1)		
Tank is Under Irrigation Department (IB)	34 (22.8)	46 (30.9)	39 (26.2)	27 (7.1)	3 (2)	0	677	II
Lack of Funds from (IB)	23 (15.4)	39 (26.2)	50 (33.6)	31 (20.8)	6 (4)	0	650	III
Lack of sufficient Monsoon Rainfall	62 (41.6)	30 (20.1)	41 (27.5)	15 (10.1)	1 (0.7)	0	733	I
Uncertainty in TankWater Supply	19 (12.8)	19 (12.8)	12 (8.1)	40 (26.8)	46 (30.9)	13 (8.7)	482	IV
Non Participation by Bore owners	12 (8.1)	12 (8.1)	4 (2.7)	28 (18.8)	46 (30.9)	47 (31.5)	371	V
Conflicts between stakeholders	0	3 (2)	3 (2)	7 (4.7)	48 (32.2)	88 (59.1)	232	VI

Values in parenthesis indicate Percentages

Informal water users association of Aipoor Tank Cascade:

The Informal group is formed and encouraged with the help of Non Governmental Organisation named Development of Humane Action (DHAN foundation) in 2000 and getting extended till the date. The members of the tank command will select the president unanimously. Participation of the stakeholders is voluntary. DHAN foundation encouraged the stakeholders in getting the funds from District Rural Development Agency (DRDA) for the rehabilitation of the irrigation tank.

In this process they gathered 25 percent of the budget estimates from stake holders for rehabilitation by voluntary compliance and the remaining 75 percent from DRDA. The group is registered as Aipoor Tank cascade association and doesn't follow the water user's association regulations. The tank cascade is under the control of village panchayat. DHAN foundation is helping the farmers in planning the water distribution to stakeholders, training in water management with specialist, and budget estimates for rehabilitation of tank. The main factors (Table: 2) that influenced the stakeholders in cooperation of tank maintenance are a) 75 percent of the funds motivated from DRDA. b) Awaking and educating the stakeholders in tank water management practices.

Table: 2 Reasons for co-operation in tank management by Informal WUAs:

Particulars	Ranks					Total scores	Rank of scores
	I (6)	II (5)	III (4)	IV(3)	V(2)		
Tank is under village panchayat	7 (14.9)	5 (10.6)	25 (53.2)	10 (21.3)	0	130	III
Awaking and educating by NGO	21 (44.7)	17 (36.2)	7 (14.9)	2 (4.3)	0	194	II
Involving all farmers under the tank command	1 (2.1)	5 (10.6)	7 (14.9)	31 (66)	3 (6.4)	111	IV
75% of funds from DRDA by NGO	18 (38.3)	21 (44.7)	7 (14.9)	1 (2.1)	0	197	I
Given positions to farmers	0	0	0	3 (6.4)	44 (93.6)	50	V

Values in parenthesis indicate Percentages

Stake holders of informal WUA responded for the reasons of cooperation in irrigation tank (Table: 3). Participation in tank management practices increased the availability of water from 0.93 to 2.85 months, increased the area irrigated by 0.8 acres and also increased the discharge rates of bore wells.

Table: 3 Impact of management in Informal WUAs:

Sl.no	Particulars	Mean	Sd	T-value
1	Increased area irrigated (acres)	0.808	1.565	3.54
2	Area irrigated by conjunctive use (acres)	1.68	1.955	5.89
3	No. of months water available after rehabilitation	2.85	0.826	23.63
4	No. of months water available before rehabilitation	0.936	0.719	8.921
5	Increased in water discharges Yes No	 43 (91.5) 4 (8.5)		

3. Results and Discussion:

The empirical results of ANCOVA model are presented in the table 4. The results give us that the age of the farmers, educational levels of farmers and distance to the tank at the middle region has positive impact on water productivity but not at significant levels. The Informal WUA`s and distance to the tail ends has positive impact and are highly significant at 1% level. The results say that the Informal group and the farmers at the tail end gaining more yield of 4.223 and 1.992 kg

of paddy per ha-cm of water respectively. The alkaline soils are negatively affecting the yield with higher water consumption due to less water holding capacity. At high pH nutrients become insoluble and plants cannot readily exact them. It could be seen that the coefficient of multiple determination (R^2) was 0.160 indicating that 16 percent of the variation in water productivity is explained by the listed explanatory variables. The unexplained variation might be due to the other exogenous factors. On the other hand F is 5.729 indicates that the model was well fitted to the data. The most important factor that we consider here is highly significance of Informal WUA.

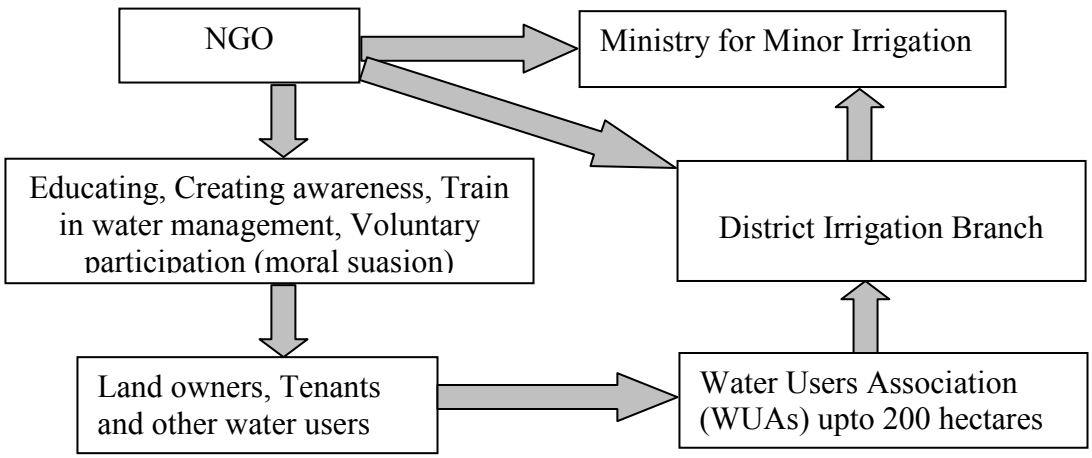
Table: 4 Results of the Impact of the Formal and Informal WUAs:

Variables	Unstandardized Coefficients		Standardized Coefficients	T-value
	ß	Std. Error	ß	
Constant	18.379	1.415		12.986*
Dummy for Informal and Formal WUA (D2)	4.223	0.754	0.406	5.598*
Dummy for distance to the Tank (tail end, D3)	1.992	0.894	0.192	2.229**
Dummy for distance to the Tank (middle region, D4)	0.504	0.828	0.053	0.609
Dummy for the problem in the soil (Alkaline soils, D5)	-0.680	0.778	-0.075	-0.874
Age of the samples (X1)	0.006	0.026	0.016	0.225
Education (X2)	0.059	0.251	0.017	0.233

Dependent Variable: Water productivity (kg/ha-cm), $R^2 = 0.160$, N = 187 F= 5.729

Based on the above discussion regarding the non-cooperation and cooperation and the empirical results it concludes that there is a need in the modification of WUA structure and an organisation to bridge the gap in collective action for the better managerial efforts and water productivity. The NGO has to be involved in the structure to aware, educate and train the stakeholders through moral suasion. In the next step to deviate it from its political structure the land owners, tenants and other water users have to participate voluntarily and select the president of the WUA or giving position to the highly contributed stakeholder for the rehabilitation of tank. The Irrigation Brach or department will be over the head of WUA excluding the DCs and PCs in the case of minor irrigation. Over the Irrigation Branch ministry for Minor irrigation will be located to guide and formulate the policies. The Irrigation department and the NGO will formulate the schedule in training and educating the farmers. The revenue generated from the water charges will be utilised back for the maintenance of the tank to sustain the system by avoiding the other share holders in the system.

Fig: 1 Modified Structure of Participatory Irrigation Management for Minor irrigation in Andhra Pradesh:



Notes:

1. Tanks: Irrigation tank is a small storage reservoir constructed across the slope of a valley to catch the runoff water from monsoon rains. Generally the tanks have a maximum depth of not more than 5 meters although some are as deep as 8 to 10 meters (Palanisami and Easter, 1983). Paddy is the major crop grown under irrigation tanks.

2. Stabilisation value of groundwater is not estimated in this paper, but we consider the theory behind it according to Tsur 1993.

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