Integrating Institutional and Market Approaches: Collective Action Strategies for Water Management in South India

V. Ratna Reddy
Bhagirath Behera

I Background

The age-old water harvesting and storage systems such as tanks and ponds are becoming things of past due to the absence of any maintenance by the State or civil society. Traditionally local people through institutional arrangements managed these systems. These traditional systems of resource management have degenerated over time due to the State interventions and due to the socio, political and economic dynamics at the village level. As a result irrigation under these water bodies too experienced a growing gap between capacities, often created much before independence, and the net area irrigated. In fact, by 1999-00, the net area irrigated by tanks was just 6.52 lakh hectares, almost half of the 13. 71 lakh hectares in 1950-51. Loss of capacity of the tanks is not only the loss of tank irrigation but also loss of groundwater recharge in the tank dominant regions, which are relatively dry and drought-prone and dependent on wells as much (Reddy, 1998). The decline in groundwater tables in some of the regions has become alarming in the recent years resulting in the widespread phenomenon of desertification. Well irrigation recorded a phenomenal rise since 1950-51 i.e., moved from third position to first position in terms of area irrigated by a single source. This has, in turn, created enormous ecological and social problems.

Tanks replenish groundwater table and help maintaining the ecological balance. The declining tank irrigation coupled with the expansion of groundwater development is a recipe for disaster, especially in the fragile resource regions like Rayalaseema in Andhra Pradesh, South India. The literature on tank irrigation identifies numerous reasons such as socio-economic, institutional and physical for the decline of tank irrigation (von Oppen and Subba Rao, 1980a; Reddy, 1990; Shankari, 1991; Reddy et al, 1993; Janakarajan, 1993; Reddy, 1995; Gireesh et. al, 1997). Historically, the decline in tank irrigation is linked with increasing population density (von Oppen and Subba Rao, 1980b). The relation between tank irrigation and population density is portrayed as an inverted 'U' shaped curve indicating that tank irrigation would increase along with population density till a certain point and then declines with any further increase in population density. This may be due to the reason that as the benefits from tanks decline due to increased population pressure (declining carrying capacity) communities loose interest in maintaining them and let them decay. Decline in tank irrigation is also linked to the development of well irrigation though it is difficult to determine the cause and effect. For, as the benefits from community based technology / source (tank) decline people shift toward individual based technology / source (well). This, however, connotes a wrong notion of substitutability between tank and well irrigation while tanks complement groundwater development in reality. The decline therefore is a cummulative effect of policy and institutional neglect.

Traditionally tank systems were providing protective irrigation on a limited scale. They were maintained by village communities, which were nurtured by the benevolent local rulers. Institutional arrangements such as *Dasabandam* and *Kudimaramat* were in place to protect

these systems from decay[1]. Under *Dasabandam*, tank lands were created and given to a person in the village (*poligars*) for the purpose of maintaining the tank. Under *Kudimaramat* community voluntarily participates in maintaining the tank. However, the policy shift towards major and medium irrigation during the British period coupled with the change in the policy perception about irrigation development i. e., treating it as a productive (revenue generating source) rather than a protective source has resulted in the degeneration of these institutions. Besides, overall environmental degradation resulting from population pressure, especially in the drought prone regions, led to silting of tanks and shrinking of their capacities. This, in turn, has led to the shift towards the individual based well irrigation. The declining tank irrigation and expansion of well irrigation has stabilised towards the end of British period and continued till 1980s.

The second phase of this trend was triggered by the advent of energisation of groundwater lifting mechanisms. The new technologies in pumping systems during 1980s coupled with the benefits green revolution have resulted in an unprecedented expansion of groundwater development. Further, the capital-intensive nature of these technologies, especially during the initial stages, has made the groundwater resources privy to large and medium size farmers. For, number of open wells has started drying up in the drought prone regions. In fact, well failure (including bore wells) has become a common phenomenon in the recent years indicating an impending ecological disaster. All the while, unfortunately, the state has been a silent spectator and party to this ecological mismanagement. While there is every reason to protect and strengthen the traditional systems like tanks, there is need for examining their viability and sustainability in the long-run. Economic viability of the tanks, given their scale, is crucial for the communities to realise their importance in improving their livelihoods. Tanks being common pool resources (CPRs), collective action is a pre-requisite to manage them in a sustainable manner. This becomes important in the changing socioeconomic and political scenario. This study is an attempt to explore the economic as well as ecological rationale in strengthening and promoting tank systems in drought prone regions and their sustainability in the long run.

II Objectives and Setting

This paper is an attempt to examine the impact of tank restoration on rural livelihoods in the context of fragile resource regions. Some of the important aspects in this regard include: viability of tank irrigation practices in the context of their size, distribution of water resources across farm size classes and the role of communities in the process. The specific objectives of the study include:

- to examine the impact of the tank restoration programme on rural livelihoods in terms of changes in crop pattern, crop intensity, yield rates, employment, equity, etc., and,
- to critically evaluate the viability, replicability and sustainability of the programme and suggest further interventions for sustainable water resource management in these regions.

Society for Promotion of Wasteland Development (SPWD) has been carrying out the tank restoration programme with the help of local Non-Governmental Organisations (NGOs) in the Rayalaseema districts of Andhra Pradesh. So far 38 tanks have been restored and some of them are converted in to percolation tanks. Rayalaseema region has fairly good elevation, slope from south to north. About three fourths of the soils are red and the rest are black cotton

[1] There are numerous examples of institutional arrangements for managing traditional water harvesting systems across the country. For details see Agarwal and Narain (1997).

soils. The climate is dry with a normal rainfall ranging between 520 mm to 720 mm, the lowest in the state. This region, due to its topography, has limited scope for canal irrigation. Proportion of area irrigated in this region is about 20 per cent of the net sown area. Canals contribute 30 per cent of the area under irrigation while tanks and wells contribute the rest. Crop failure and drought is a common phenomenon, especially in Ananthapur district. Non-farm sector is also relatively backward and hence seasonal migration is widespread in most parts of the region. Tanks occupy a prominent place in the region's agriculture. Tanks are life saving mechanisms in most parts of these perennially drought prone regions.

Table 1: Tank Irrigation in the Rayalaseema Districts

District	1955-56*		1999-00#	
	Number	Area (ha)	Number	Area (ha)
1.Ananthapur	2237	37254	2182	20997
2.Chittoor	6626	72024	8270	63187
3. Cuddapah	1187	29806	1582	13270
4.Kurnool	518	24472	426	4752
5.Prakasam	---	---	701	9765

Note: * net area irrigated by tanks; #command area of tanks. Presently Prakasam district is not part of Rayalaseem, but parts of the present Praksam district originally from Rayalaseema.
Source: Reddy et.al., (1993) for 1985-86 and GoAP (2000) for 1999-00.

Tanks are the traditional rainwater harvesting and storage systems consisting of a major embankment across and (along) the line of the drainage with two side embankments running backwards up to the line of the drainage gradually losing their height. It resembles a rectangular (or semi-circle) catchment basin with only three embankments and the fourth side left open for runoff and drainage water to enter (Rao, 1999). Tanks provide direct as well as indirect irrigation benefits through recharge of groundwater and hence safeguard the economic and ecological sustainability of these districts. However, the importance of tanks is on the decline, especially in terms of area irrigated (Table 1). More than 75 per cent of these tanks are small in size (less than 100 ha of area irrigated). In Chittoor the proportion of small tanks is above 90 per cent (Reddy, et. al., 1993). Though the importance of wells as a source of irrigation has gone up substantially one should not undermine the importance of tanks due to the complementarity between these two in the fragile regions.

Given the importance of tanks in these districts and based on their past experience the Society for Promotion of Wasteland Development (SPWD) has initiated a network for 'promotion of people's management of small irrigation schemes in Rayalaseema' with eighteen NGOs. The network envisages that people should be involved at all stages of the processes from identification of the problem, planning of the rehabilitation package and execution of the work. The involvement of the people is ensured through a mandatory contribution of 25 per cent of the total costs by all the beneficiaries, either in cash or labour. Tank management committees (TMCs) will be set up to facilitate people's participation. The salient features of the TMCs include:

a) TMC is representative of all sections of the village community though contributions are collected only from the farmers in the tank command area (TCA). Size of TMC will vary from 5 to 20 members depending on the size of the village.

b) A third of the members are women. To the extent possible women will be recruited (by NGOs) as organizers for collecting information and interacting with village people about the tanks.
c) Elections are conducted every year and any person can be a member for a maximum of two terms.
d) Official minimum wages will be paid on the basis of volumetric rates. Contributions are also valued at these rates.
e) NGO will open a bank account jointly with TMC and operate it jointly.

III Approach

For the purpose of evaluating the impact of tank restoration on livelihoods we have selected three restored tanks in three districts of Anantapur, Chittoor and Prakasam. SPWD has initiated the tank restoration programme in the early 1990s itself. We have grouped the restored tanks into the ones restored prior to 1996-97 and post 1996-97. The reason for this bifurcation is to examine the sustainability of the restoration programme and its impact. For the purpose of our study we have selected one tank from the tanks restored prior to 1996-97 and two tanks from post 1996-97. Besides a matching sample of 1 village each for the restored tank village, where there is no restoration programme, is selected to compare with and without situations. That is a sample of 3 control villages are selected from the respective districts. Details of the sample villages are presented in Table 2.

Table 2: Details of the Sample Tanks

Tank/ Village name	Mandal	District	Year of restoration	Total No. of HH	No. of Command Area Farmers	Command Area (acres)	Tank Size (acres)
I Restored Tanks							
1 Adepalli/ Adepalli	Chilamathur	Anantapur		73			
(a) Adepalli Cheruvu			1993-94		a) 35	a) 23.96	19
(b) Nallarathi kunta			1993-94		b) 14	b) 12.40	08
(c) Jammala Kunta			1993-94		c) 12	c) 09.18	07
2 Venglavaripalli	Emanapalli	Chittoor		54			
(a) Yerrappagari kunta			1997		a) 03	a) 0.52	---*
(b) Nagannagari kunta			1997		b) 07	b) 2.42	---
(c) Tatappagari kunta			1997		c) 13	c) 4.50	---
3 Akkapalli	Kammarolu	Prakasam		118			
(a) Kannela kunta			1997-98		a) 65	a) 62	a) 23
(b) Rekula Kunta			1997-98		b) 80	b) 146	b) 60
II. Un restored Tanks (control)							
1. Korla kunta	Chilamattur	Anantapur	---	195	68	70	65
2. Valasapalli	Madanapalle	Chittoor		150			
(a) Nagula cheruvu			---		a) 25	a) 80	a) 60
(b) Akkulavani kunta			---		b) 20	b) 15	b) 09
3. Pottipalli	Komarole	Prakasam	---	125	40	60	60

Note: *These are very small ponds (*kuntas*)
Source: Village schedule and also based on the discussions with the community.

Both qualitative and quantitative information were elicited. Group discussions, transect walks, discussions with local NGOs and SPWD were conducted to get an overview of the

situation. This process has also helped us in selecting the sample tanks and finalising the structured questionnaire. Before and after as well as with and without approaches are used to evaluate the impact of the tank restoration. Both these methods are used as complementary, as either of these methods is fraught with problems such as memory lapse in the case of before and after and estimation problems in the case of with and without approach (see for an interesting analysis in this regard Ravallion, 2001). This is known as the 'double difference' method. Here, the problem of memory lapse in getting 'before' information is not serious as the time lag is 7 years in the case of Anantapur and less than 3 years in the case of Chittoor and Prakasam districts.

Three structured questionnaires were prepared in order to elicit information at the NGO (implementing agency), village and household levels. A sample of 25 households was selected from the beneficiaries of each restored tank. These sample farmers were selected using the Probability Proportionate Sample (PPS) to size of the land holding. Another sample of 25 households was selected from a nearby village, which matches with the restored tank village in terms of various socioeconomic attributes, except for the restored tank, using the same method of sampling. This would facilitate with and with out scenario analysis. At the same time we have collected before and after information from the same households in order to cross check the scenarios. An attempt is also made to get the scenario when the tank was functional in the control village, though the reliability of the information depends on the time lag since the tank became defunct. On the whole, we have collected detailed information from 150 households i.e., 75 from the three beneficiary villages and 75 from the three controlled villages. Field visits and data collection were organized during the months of March, April and May 2001. The sampling details are presented in Table 3. Our sample coverage ranges between 21 and 46 per cent of the total households in the programme villages and rages between 13 and 20 per cent in the control villages. In terms of beneficiary farmers (programme villages) sample coverage is much higher. There are no landless households in the sample villages though majority of the households belong to small and marginal category in most of the villages.

Table 3: Details of the Sample Selection

Tank/ Village name	Marginal		Small		Medium		Large		Total	
	Act.	Samp.	Act.	Samp.	Act.	Samp.	Act.	Samp.	Act.	Samp.
Restored Tanks										
1Adepalli	28	09 (38)	30	10 (41)	13	04 (18)	02	02 (03)	73	25 (34)
2 Venglavaripalli	25	12 (46)	17	07 (31)	08	04 (15)	04	02 (07)	54	25 (46)
3 Akkapalli	21	05 (18)	30	06 (25)	67	14 (57)	00	00 (00)	118	25 (21)
Unrestored Tanks (control)										
1. Korla kunta	28	06 (40)	25	03 (13)	72	08 (37)	19	02 (07)	195	25 (13)
2. Valasapalli	79	12 (19)	62	10 (41)	50	08 (33)	10	01 (10)	150	25 (17)
3. Pottipalli	23	05 (18)	63	12 (50)	24	05 (19)	15	03 (12)	125	25 (20)

Note= Act.= Actual number of households in the village; Samp.= Sample households selected.
Figures in brackets are respective percentage to the total households. There are no landless households in any of the villages.

IV Profile of the Sample Villages

As indicated earlier we have two sets of sample villages. Three villages belong to the group where tanks have been restored during the recent years (programme villages) and in the other three villages no tank restoration work was taken up, though they have tanks (control villages). Important socio-economic features of these villages are presented in Table 5. There are wide variations between these villages regarding their socio-economic features. Village size in terms of number of households and average family size differ. In all the cases control villages are bigger compared to programme villages. Average farm size of the household also differ between and with in the groups of villages. The average farm size ranges from 3.25 acres to 4.48 acres. In two of the districts average farm size is more in the case of control villages. On other hand, programme villages have larger SC/ST population. Control villages are better off economically in two districts indicating that households are better off even without tank restoration. Average household income is higher in the control villages in the case of two districts.

Table 5: Socio-economic Characteristics of the Sample Villages

Village	No. of HH	% of Sample	Avg. Size of HH	Avg. size of land holding (acres)	% of households belonging to (farm size)				% of HH belonging to SC/ST	Avg. Income (Rs.)
					La-rage	Med ium	Small	Marginal		
Programme Villages										
1. Adepalle	73	34	5.26	3.79	3	18	41	38	56	8820
2. V.V. Palle	54	46	5.35	3.44	7	15	31	47	15	5495
3 Akkapalle	118	21	5.33	3.25	0	57	25	18	17	6837
Control Villages										
1. Korlakunta	195	13	4.72	4.48	10	37	13	40	26	6650
2. Valasapalle	150	17	5.64	3.30	7	33	41	19	0	6039
3. Pottipalle	125	20	4.12	3.96	12	19	50	19	3	12926

Note: HH= Households.

Agriculture is the major source of income in all the villages. But, income from agriculture is much higher in the villages where tank restoration programme was taken up. Agriculture accounts for above 70 per cent of the household income in all the villages, programme as well as control. Dependence on agriculture is slightly higher in the programme villages. Livestock rearing is the second largest livelihood activity followed by labour activity in the sample villages. There seems to be substitutability between these two activities. That is households having livestock are less dependent on labour. Large proportion of labour income is from farm labour within the village in the case of programme villages while some migration takes place in the case of control villages. Dependency on common pool resources (CPRs) and other sources is substantial in two villages, one each from programme and control villages. Presently these two sets of villages do not differ much as far as their livelihood activities are concerned.

Status of Irrigation

All the sample villages have irrigation tanks of different sizes, more than one tank in some villages (Table 6). In the programme villages all the existing tanks are restored with repairs to bund, feeder channels, distributory channels, etc. Two tanks in Adepalle are converted in to percolation tanks. In Adepalle, the tanks were restored during the year 1993-94, while in the

other two villages they were restored after 1996-97. Tanks are the major source of irrigation in all the sample villages. The extent of area irrigated ranges from 24 to 33 per cent in the programme villages and 15 to 36 per cent in the control villages. These figures are based on the command area of the tanks and not necessarily the effective area under irrigation. Effective area under irrigation would be determined by the quality of tank and the local rainfall during a particular year. Size of the tanks in the programme villages is much smaller compared to the tanks in the control villages. This is mainly due to the reason that small tanks are given priority in the restoration programme. It appears that small tanks are characterised with substantial representation of SC/ST population. The first indicator of impact of tank restoration is reflected in the quality of tanks. The command area served by each acre of tank bed is higher in the programme villages compared to the control villages despite the fact that control villages have larger size tanks (Table 6). These ratios, however, reflect the extent of damage to the tank and the local rainfall, though rainfall is controlled to some extent by the selection of neighbouring villages. Further, size of the tank seems to influence the command area per acre of tank bed.

Table 6: Details of Tanks in the sample village

Village Name	No.	Tank Size (acres)	Command Area (acres)	No. of tanks restored	Command Area / Tank Size	NGO Responsible
Programme villages						
1. Adepalle	3	34	45.54	3.00	1.34	Chaitanya
2. V.V. Palle	3	6.44	07.44	3.00	1.15	Krushi
3. Akkapalle	2	83	208	2.00	2.51	CAFORD
Control villages						
1. Korlakunta	1	83	70	0.0	0.84	---
2. Valasapalle	2	69	95	0.0	1.38	---
3. Pottipalle	1	60	60	0.0	1.00	---

Note: COFORD= Collective Action For Rural Development

Well irrigation complements tank irrigation in most of the sample villages. Both open and bore wells exist in these villages (Table 7). However, all the open wells have dried up in all the villages in the recent years. This is a common feature in the entire region indicating the ecological stress. As a result dependence on bore wells is on the rise. Functioning of the bore wells is critically linked with groundwater recharge in the region. Groundwater, like any other renewable resource, can be exploited indefinitely as long as extraction rate does not exceed replenishment rate. The mismatch between these two is clearly reflected in the sample villages, where even bore wells are drying up especially in the control villages. This is despite the fact that most of these wells are located in the tank command area. The situation is much better in the programme villages. For instance, in Pottipalle (control village) where 52 bore wells have come up in recent years they serve only 10 acres of land since most of the wells have dried up and the extraction rates are quite low. The high density of wells coupled with the poor management of tank has further depleted the water tables in this village. On the other hand, the situation is not bad in Adepalle (programme village) where bore well density is quite high. For, in Adepalle three tanks are restored, two of them are converted in to percolation tanks. This clearly establishes the complementarity between tank and well irrigation and emphasizes the rationale for tank restoration in this region. Apart from the ecological consequences, well failure imposes severe economic burden on the households.

Table 7: Details of wells in the Sample Villages

Village	No of wells Present		Density of Wells (no./cropped area)		Density of Wells (no./command area)		Area Irrigated by wells (acres)	
	Open	Bore	Open	Bore	Open	Bore	Open	Bore*
Programme villages								
1. Adepalle	06	27	0.02	0.10	0.16	0.72	Dried	38
2. V.V. Palle	02	02	0.01	0.01	0.27	0.27	Dried	13
3. Akkapalle	08	13	0.02	0.03	0.04	0.06	Dried	70
Control villages								
1. Korlakunta	12	12	0.01	0.01	0.17	0.17	Dried	Dried
2. Valasapalle	05	15	0.01	0.03	0.05	0.16	Dried	45
3.. Pottipalle	08	52	0.02	0.11	0.13	0.87	Dried	10

Note: Bore wells are located in the command area in all the villages except V. V. Palle hence they serve the command area with assured water supply rather than irrigating extra area.

Institutional set up in the Sample Villages:

It seems that there was no historical background of institutional arrangements as such in the villages. That is prior to tank restoration programmes there were no institutional arrangements in the villages, formal or informal, to manage CPRs. In the wake of tank restoration programme the implementing agencies (NGO's) have evolved the institutional arrangements for managing the tanks. Depending on the vision, commitment to the development and proper understanding of the dynamics of the village problems, different NGOs have adopted different approaches in the villages, as far as the management of tanks are concerned. Enabling the beneficiaries to manage the tank on their own after the NGOs have withdrawn or in the long run is totally absent. The attitude of dependency or looking for external help to carry out works on the tanks is still prevalent among the communities.

However, some attempts have been made in Adepalle and V.V Palle in this direction. Tank Management Committees (TMC) have been formed by the farmers in both the villages with specific objectives (collecting money, organizing the community, monitoring works, etc.), where NGOs play the role of facilitators. In Adepalle, Conflict Resolution Federation (CRF) is formed at the Mandal level, represented by experienced members from different TMCs. The role of CRF is to resolve the conflicts that come up in the process of tank management. This establishes the relationship among the TMCs and their activities in particular and all the villages in general. One of the important role that TMC in Adepalle play is that of restrictions, which they imposed on farmers especially on cropping pattern in the command area to manage the water effectively. V.V Palle is a small village with quite less number of beneficiaries. Theoretically, the emergence of collective action is expected to be much easier in such cases (Olson, 1965). But, the TMC in V. V. Palle is not as effective as expected. For, the TMC mainly confined to maintenance of bank accounts and monitoring the works. Lack of efforts towards capacity building of the community is hindering effectiveness of the TMC. This reflects the commitment on the part of the PIA (NGO).

The situation in Akkapalle is different, as no attempt has been made from the NGO side to form any committee to involve farmers in the process of tank restoration, though the beneficiaries are quite enthusiastic about the tank management. The size of the two tanks is large. These tanks are poorly maintained, as one can observe the tanks with weeds and

siltation. Some people are coming forword voluntarily to contribute towards desiltation and removing weeds from the tank bed. This is an interesting case where after restoration of one tank, farmers realised the benefits from the restored tank and slowly mobilized themselves to request the NGO to restore another tank. This is where the collective action (institution) evolved spontaneously, though serious efforts are needed from the implementing agency to make it effective and sustainable.

Process of Tank Restoration

The process of tank restoration initiated through consultations with the farmers by the NGOs. According to the implementing agencies (NGOs), initially farmers did not show interest at all. Later on when they came to realize the benefits of restored tanks, farmers themselves initiated the works enthusiastically and came out with new proposals to carry out similar works in other tanks or in the same tank. In Adepalle, the impact of the percolated tank spread even to other nearby villages, i. e., demonstration affect. According to the NGO (Chaitanya), by seeing the impact of the percolation tank, neighboring villagers forcibly closed sluices of their tanks to make it a percolation tank.

The process of tank restoration started in Adepalle village in 1993-94 whereas it started in 1997 in V.V Palle and Akkapalle. In the case of Adepalle tanks, which were restored in 1993, the long run sustainability of the restored tanks can be examined. The TMC, which formed at the time of restoration, is working fairly well with the help of NGO. Out of three tanks, two are percolation tanks and the other is irrigation tank. The nature of work carried out in Adepalle include closing down of sluices for percolation tank, desiltation, treatment of catchment area, feeding channels and strengthening of bunds, etc. The entire work took three months to complete. The total expenditure incurred on restoration is Rs.1, 84,000/- of which Rs. 95,000/- is contributed by SPWD and the remaining amount is contributed by the farmers in the command area (Table 8). The share of beneficiary contribution is quite high (48 per cent) by any standard. Beneficiaries have contributed in terms of labour and materials (cement, etc) voluntarily. Besides, desiltation was carried out by the farmers at their own cost i.e., those interested in using the silt. The donor's contribution is used only towards tractor hiring charges at the rate of Rs. 500 per day for a total of 190 tractor days. Tractors are provided to transport the silt to the farmer's fields.

The TMC was formed with 9 members, of which 3 are women. The TMCs is headed by a chairperson and supported by a secretary / treasurer. These members were selected /elected unanimously. So far no elections were conducted to elect the members and the chairperson. They do not even follow the rotation system to change the members or the office bearers. The PIA has left the process of establishing the TMC entirely to the community. In order to manage the limited water in the tank in an equitable manner among all the farmers in the command area, the implementing agency (NGO) with the help of TMC imposed restrictions on water intensive cropping pattern and other agricultural practices. Farmer's response to such restrictions is rather encouraging. At the beginning of the year the TMC organizes a meeting of the command area farmers where the cropping pattern is determined based on the availability of water in the tank. In the event of water shortage the TMC requests the farmers to reduce the area under paddy. Farmers growing paddy continuously are asked to rotate their cropping pattern. This arrangement seems to be working satisfactorily so far.

Table 8: Details of Costs of Tank Restoration

Village	District	NGOs	Amount spent by the NGO (Rs.)	Contribution from the farmers (Rs.)	Total Costs (Rs.)
Adepalle	Anantapur	Chaitanya	95000	89000 (48)	184000
V. V Palle	Chittoor	Krushi Samstha	47978	00	47978
Akkapalle	Prakasam	CAFORD	200000	34000 (17)	234000

In V. V Palle the restoration work started in the year 1997 and took 2 months to complete. The work was carried out on 3 small ponds at the cost Rs. 47,978/-. All the expenditure was born by SPWD through the PIA (KRUSHI). Here farmer's contribution is in a different form i.e., working at a low wage rate. Those farmers' having land in the command area were paid Rs 20 per day and those who do not have land in the command area were paid Rs 25 per day towards wage. The difference in wage rate (Rs. 5/) is the contribution of the farmers. Besides, beneficiary farmers used to put extra hours (1-2) of work every day. Moreover, all the households, beneficiary and non-beneficiary, worked at less than market wage rate indicating the community support for the activity. The main works carried out are desilting (78 per cent of the expenditure), stone revetment (10 per cent), slice (10 per cent) and green cover (2 per cent). Here also TMC was formed with 8 members and 2 of the members are women. The chairperson of the TMC is a woman.

In Akkapalle, the restoration work started in 1997 on two tanks and it took nearly 7 months to complete. These tanks are fairly big compared to the ones in Adepalle and V. V. Palle. The nature of work includes strengthening bunds, sluice repairing, etc., on two tanks. Here, the beneficiaries have contributed money (a minimum of Rs.80 per acre) towards the restoration work. The villagers also took the responsibility to clear the weeds in the tank. But due to unexpected rains at the time of restoration they could not complete the work. However, the cleaning of tank bed is still pending due to various reasons. The tanks are quite big in size and degraded due to long negligence. As a result it required more investment and time to bring them back to the functional form. It was also found that before the restoration the tanks were almost defunct. In fact, some of the households had shifted their occupation to non-agricultural activities due to the total failure of cultivation. Farmers are visibly happy about the condition of the tanks. They are very enthusiastic obout protecting the tank, as the tank brought back their normal life. By the time of our field visits (March-April 2001) no TMC was formed though farmers were keen to form one. The farmers themselves with contributions are carrying out maintenance work. This village seems to be a highly potential location for collective action.

The cost of tank restoration depends on the size of tank and the nature of works carried out. Most of the restoration works are common to all. The major difference is in terms of contributions from the beneficiaries. Beneficiary contribution is not uniform, as it ranges from a negligible amount in V. V. Palle (in monetary terms) to 48 per cent in Adepalle. While V. V. Palle may be an exception due to its smallness (and also nature of people's involvement), the difference between Adepalle and Akkapalle reflects the involvement of the people as well as the role and commitment of the implementing agency.

V Impact of Tank Restoration: Economic and Ecological

Impact is measured in terms of changes in various indicators due to the tank restoration programme. The measurement of impact is based on the information collected from 25

sample households from each village. Impact is measured across different size classes of holding in order to examine the distributional aspects of the impact. Impact indicators are grouped under economic, social and ecological categories. Economic impact is measured in terms of changes in area under irrigation, productivity (yield) of land, value of land, livestock holding and employment. Social impact is measured in terms of changes in migration, health, education and differences in gender equity. Ecological impact is measured in terms of changes in CPRs, drinking water, fodder and fuel wood. In what follows is the assessment of the impact of tank restoration on these factors separately.

Table 8: Impact of Tank Restoration on Area and Productivity in the Sample Households.

Village / Size-class	% area Irrigated	Percentage Change in		
		Area irrigated (per household)	Yield/acre (quintals)	Value per acre (Rs)
Programme villages				
1. ***Adepalle***	10.55	05.26	44.39	37.30
Large	03.94	02.50	36.28	22.95
Medium	06.83	38.10	44.67	25.00
Small	16.93	03.78	41.49	78.57
Marginal	12.02	05.56	61.00	23.15
2. ***V.V. Palle***:	10.75	08.82	26.57	33.33
Large	04.76	00.00	25.00	33.33
Medium	00.74	00.00	28.33	33.33
Small	19.60	00.00	26.75	33.33
Marginal	14.73	216.67	22.93	33.33
3. ***Akkapalle***	29.53	10.34	36.25	28.67
Large	00	00	00	00
Medium	39.06	01.13	27.99	29.35
Small	31.54	11.40	33.30	28.97
Marginal	28.87	21.43	48.98	27.84
Control villages				
1. ***Korlakunta***	26.33	00	00	00
Large	11.11	00	00	00
Medium	26.51	-16.67	00	00
Small	12.15	00	00	00
Maarginal	16.57	00	00	00
2.***Valasapalle***	45.15	00	00	11.50
Large	45.45	00	00	00
Medium	53.24	00	00	12.00
Small	19.10	00	00	20.59
Marginal	25.00	00	00	15.79
3. ***Pottipalle***	35.35	00	00	02.77
Large	29.04	00	00	16.66
Medium	22.81	00	00	00
Small	28.89	00	00	-8.33
Marginal	36.71	00	00	00

Changes in area under irrigation are the prime indicator of any impact on rural livelihoods, especially where the major livelihood activity is farming. It is observed that proportion of area under irrigation has increased, though marginally, among all the households in the programme villages after the restoration of the tanks (Table 8). The changes range from 5 to

10 per cent in the three programme villages[2]. The increase is more in the case of small and marginal farmers in two of the villages while medium farmers gained more in Adepalle. However, area under irrigation in absolute terms is the lowest for marginal farmers in all the villages though in proportionate terms it is in favour of small and marginal farmers. Distribution of area under irrigation is more favourable to small and marginal farmers but this is not due to the programme. On the other hand, area under irrigation is stagnant in the control villages. Apart from the quantitative changes in the area, qualitative changes in the availability of irrigation in terms of throughout the season regular and assured supplies are equally, if not more, important in improving the economic conditions of the farmers. This aspect is reflected in the changes in land productivity, which is measured in quintals of food grains per acre. Food grains include mainly paddy, maize, ragi, jowar, etc.

In all the programme villages land productivity has gone up while it remained same in the control villages. Productivity gains range from 26 per cent in V. V. Palle to 44 per cent in Adepalle, which is the first village of tank restoration. Productivity gains are more in the case of small and marginal farmers, which may be explained with the help of production conditions in agriculture. That is small and marginal farmers are more efficient in terms of land productivity due to the availability of family labour. Along with land productivity land value also has gone up in all the programme villages as well as in two of the control villages. The increase in land value is much higher in the programme villages compared to the control villages. While land values have gone up by 28 to 37 per cent in the programme villages they have gone up by 3 to 12 per cent in the control villages (Table 8). Interestingly, the increase in land prices across size classes does not commensurate with the increase in land productivity. This indicates that small and marginal farmers are at a disadvantageous position in the land market perhaps due to the small size of their holdings.

Income and Consumption: Assessing the impact in terms of annual income and consumption is a tricky business, as they are expected be plagued with strategic bias of the respondents. It is often observed that respondents strategically under report their income and over report their expenditure. In the case of consumption figures are often not accurate due to measurement problems as food items are bought in small quantities in regular intervals. However, the present analysis is relative rather than absolute and hence the biases may not be a serious problem. Both income and consumption levels have gone up in all the sample villages and even across all, except one, size classes (Table 9). Between the programme and control villages two important deviations can be noted. Firstly, the increases in income and consumption are higher in the programme villages. Secondly, income increases are higher than the increases in consumption expenditure in the programme villages while the reverse is true in the case of control villages. This indicates that net gains are positive in the programme villages.

Average household income per year has gone up by more than 35 per cent in the programme villages while the increase is just 1 per cent in two of the control villages and 14 per cent in one village. Except in Prakasam district the average income is higher in the programme villages. Similarly, average consumption per household is also higher in the control villages. In the programme villages the household consumption has increased between 26 and 39 per cent in the programme villages while the increase ranged between 21 and 23 per cent in the

[2] The changes are in terms of effective irrigation, as the command area remains same before and after the restoration.

control villages (Table 9). In most of the cases small and marginal farmers have recorded higher growth in household income in both control and programme villages. On the other hand, in the case of consumption the changes are either neutral or biased in favor of large farmers. Therefore, income gains are not converted into consumption benefits for small and marginal farmers, which may be due to low profitability of farming among these sections (Reddy, 1993).

Table 9: Change of Average Annual Income and Consumption of Sample Households

Village Name / Size-class	Average income (Rs / year / household)			Average consumption (Rs / year / hh)		
	Before	After	% Change	Before	After	% Change
Programme Villages	18230	26872	47	3839	5339	39
1. ***Adepalle***	35833	55167	54	4768	7224	52
Large	13750	18250	33	4694	6265	33
Medium	8586	14571	70	2952	4015	36
Small	8750	8250	-06	2943	3850	31
Marginal	11895	16329	37	3928	5261	34
2. ***V.V. Palle***:	14000	19000	36	6104	7967	31
Large	10100	13332	32	3915	5623	44
Medium	8480	11232	32	3331	4369	31
Small	6086	9021	48	2363	3085	31
Marginal	9452	13999	48	3507	4420	26
3. ***Akkapalle***	0	0	00	0	0	00
Large	14657	21946	50	4388	5488	25
Medium	7000	10000	43	2902	3711	28
Small	6700	10050	50	1804	2349	30
Marginal						
Control villages						
1. ***Korlakunta***	17465	17810	02	4227	5111	21
Large	23000	23000	00	5176	6366	23
Medium	17625	17850	01	4221	4874	15
Small	18400	18650	01	4566	5558	22
Maarginal	10833	11741	08	2945	3645	24
2.***Valasapalle***	14597	16609	14	4378	5374	23
Large	17000	17000	00	4676	5712	22
Medium	16714	19786	18	3369	4257	26
Small	12241	14942	22	5575	6784	22
Marginal	10643	12250	15	3891	4743	22
3. ***Pottipalle***	19454	19704	01	3121	3785	21
Large	26667	26667	00	4262	5354	26
Medium	17050	18050	06	3446	4064	18
Small	21950	21950	00	2951	3436	16
Marginal	12150	12150	00	1825	2286	25

Ecological Impact

Economic impact is critically linked with ecological impact in the agrarian economies. Productivity of land and livestock are dependent on the quality of natural resources such as land, water, common grazing lands, etc. Here we examine the linkages between the tank restoration and natural resources. Our focus is mainly on the availability of fodder, fuel, drinking water and groundwater.

Table 10: Changes in the Availability of fodder

Size-class/village	Before (cattle using various sources in % of days)			After (Before (cattle using various sources in % of days)			Percentage Change		
	Stall fed	CPR	Own field	stall fed	CPR	Own field	stall fed	CPR	Own field
Programme Villages									
1. Adepalle	77.6	11.9	10.4	46.9	28.9	24.2	-39.5	141.5	132.1
Large	75.3	11.6	13.0	69.8	14.0	16.3	-7.4	20.0	25.0
Medium	67.3	16.7	16.0	42.3	30.8	26.9	-37.1	84.6	68.0
Small	84.1	10.2	5.7	41.9	35.5	22.7	-50.2	248.0	295.5
Marginal	76.1	10.6	13.3	0.0	41.9	58.1	-100.0	294.9	337.4
2. V.V. Palle	76.2	9.1	14.6	66.9	11.5	21.6	-12.3	26.0	47.7
Large	81.0	9.5	9.5	65.1	14.0	20.9	-19.6	46.5	119.8
Medium	100.0	0.0	0.0	89.3	0.0	10.7	-10.7	0.0	0.0
Small	68.8	18.8	12.5	68.3	19.0	12.7	-0.7	1.6	1.6
Marginal	75.0	0.0	25.0	73.0	0.0	27.0	-2.6	0.0	7.9
3. Akkapalle	68.4	13.4	18.1	61.7	16.1	22.2	-9.8	19.7	22.5
Large	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Medium	75.0	9.8	15.2	64.6	16.3	19.1	-13.9	66.3	25.6
Small	48.2	23.9	27.9	47.6	24.9	27.4	-1.2	4.3	-1.6
Marginal	50.0	25.0	25.0	45.9	24.6	29.5	-8.2	-1.6	18.0
Control villages									
1. Korlakunta	78.1	9.3	12.6	46.9	23.0	30.1	-40.0	146.9	138.9
Large	75.3	12.4	12.4	75.3	12.4	12.4	0.0	0.0	0.0
Medium	64.7	15.9	15.9	62.6	16.5	20.9	-3.2	3.8	7.6
Small	90.6	4.0	4.0	74.4	11.1	14.4	-17.8	180.4	164.3
Marginal	50.0	17.6	17.6	48.3	20.7	31.0	-3.4	17.2	-4.1
2.Valasapalle	53.6	23.2	23.2	50.8	24.4	24.8	-5.3	5.4	6.8
Large	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Medium	77.5	11.2	11.2	77.0	11.2	11.9	-0.7	-0.7	5.9
Small	37.9	31.0	31.0	29.4	35.3	35.3	-22.5	13.7	13.7
Marginal	33.3	33.3	33.3	33.3	33.3	33.3	0.0	0.0	0.0
3. Pottipalle	62.3	12.3	25.3	70.4	11.2	18.4	12.9	-9.2	-27.2
Large	63.8	8.1	28.2	58.5	9.2	32.3	-8.3	14.5	14.5
Medium	53.8	15.4	30.8	53.8	15.4	30.8	0.0	0.0	0.0
Small	90.5	4.0	5.5	74.4	11.1	14.6	-17.8	178.1	162.2
Marginal	68.4	10.5	21.1	68.4	10.5	21.1	0.0	0.0	0.0

Fodder and Fuel Wood: Fodder availability is seen in terms of dependence of cattle on different sources of feed. The main sources of feed are stall-feeding, common grazing lands (CPRs) and own fields (feeding on crop residue and in fodder fields). Dependence on market for fodder (purchase) is also there but on a very limited scale. Stall-feeding is the single most important source followed by grazing in own lands and CPRs. Availability and quality of CPRs determine the relative shares of CPRs and own lands in the respective villages. Over a period of 3 to 7 years the importance of stall-feeding has declined though it continues to be the most important source in all the villages (Table 10). However, the decline is more prominent in the programme villages. In fact, in one of the control villages (Poottipalle) the incidence of stall-feeding has gone up. In most of the villages the decline in stall-feeding is compensated by both grazing on own fields and CPRs. Across the size classes the dependence on CPRs is more in the case of small and marginal farmers. On the whole, the impact of tank restoration on the availability of fodder is only indicative at the best.

Table 11: Changes in the Availability of Fuel wood

Size-class/village	Before (% quantity from)		Time spent for collection (days per year)	After (% of quantity from)		Time spent for collection (days per year)	Percentage Change		
	CPR	Own		CPR	Own		CPR	Own	Time spent for collection
Programme villages									
1. Adaptable	81.25	18.75	21	76.47	23.53	20	-5.88	25.490	-4.76
Large	0	100	4	0	100	4	0.0	.00	0
Medium	75	25	14	75	25	12	0.0	0.00	-14.29
Small	80.95	9.52	35	80.95	9.52	35	0.0	0.00	0
Marginal	84.21	15.79	33	84.21	15.79	30	0.0	0.00	-9.09
2. V.V. Palle	84.62	15.38	13	86.67	13.33	13	2.42	-13.33	0
Large	100	0	4	100	0	4	0.00	0.00	0
Medium	50	25	8	77.78	22.22	8	55.6	-11.11	0
Small	93.33	6.67	16	93.75	6.25	15	0.5	-6.25	-6.25
Marginal	91.67	8.33	26	92.59	7.41	25	1.01	-11.11	-3.85
3. Akkapalle	45.45	54.55	18	38.46	61.54	19	-15.4	12.82	5.56
Large	0	0	0	0	0	0	0.00	0.00	0
Medium	33.33	58.33	30	33.33	59.26	32	0.00	1.59	6.67
Small	50	50	15	40	60	17	-20.0	20.00	13.33
Marginal	66.67	33.33	8	66.67	33.33	8	0.00	0.00	0
Control villages									
1. Korlakunta	64.71	35.29	18	61.11	38.89	22	-5.56	10.19	22.22
Large	0	100	8	0	100	8	0.0	0.00	0
Medium	40	60	24	36.36	63.64	30	-9.09	6.06	25
Small	33.33	50	10	28.57	87.14	14	-14.3	14.29	40
Marginal	92.31	7.69	30	88.89	11.11	35	-3.7	44.44	16.67
2.Valasapalle	57.14	42.96	27	56.52	43.48	30	-1.09	1.45	11.11
Large	0	100	6	0	100	8	0.00	0.00	33.33
Medium	40	60	30	42.86	57.14	35	7.14	-4.76	16.67
Small	44	56	32	42.31	57.69	35	-3.85	3.02	9.38
Marginal	83.33	11.11	40	78.95	15.79	44	-5.26	42.11	10
3. Pottipalle	65	35	37	61.92	38.10	39	-4.76	8.84	5.41
Large	0	83.33	20	0	85.79	24	0.00	2.86	20
Medium	47.62	28.57	35	45.45	31.82	38	-4.55	11.36	8.57
Small	46.14	38.46	45	44.44	37.01	46	-3.70	-3.70	2.22
Marginal	78.95	10.53	48	83.33	16.67	48	5.56	58.33	0

Household's fuel wood needs are met by collections from CPRs and their own sources. Fuel is also purchased in the market in a limited scale. Here also the impact on fuel wood is seen in terms of household's dependence on different sources. Since purchase of fuel wood by the households is minimal we focus on own and CPR sources. Time spent by the households in collecting the fuel wood reflects the improvement in the fuel wood availability, especially in the CPRs near the village. Own sources like crop residues and wood from own trees is the single most important source of fuel wood in all the villages. In terms of quantity of fuel wood used, small and marginal farmers use more when compared to large farmers because large farmers have alternative sources of fuel such as coal, dung cakes, kerosene, gas, etc. The major source of fuel wood is CPRs in all the villages (Table 11). The dependency on CPRs is more in the case of small and marginal farmers. Similarly, small and marginal farmers spend substantially higher time in fetching fuel wood when compared to large

farmers. Over the period there is a marginal decline in the dependence on CPRs in all the villages irrespective of the status of the tank. However, the impact of tank restoration can be seen in terms of time spent in fetching fuel wood. Time spent in fetching fuel wood has decline in two of the programme villages while it has increased in all the controlled villages. This indicates the improvement in the availability in the vicinity as well as in good quantity and quality. This could be termed as ecological impact because the increased fuel wood demand is met either by CPRs or own lands, which reduces drudgery in the programme villages while it is met by an increase in the drudgery in the control villages. For, purchase of fuel wood is on a very limited scale in the before and after situations in the programme as well as control villages.

Groundwater: Impact on groundwater is the major positive externality of tank restoration. Tank restoration is expected to have a positive impact on groundwater availability. The impact would be more conspicuous in the case of percolation tanks. Here we examined the impact in terms of number of wells, open as well as bore, depth of the wells. Besides, improvement in groundwater situation will ease the drinking water problems. Hand pumps are the main source of drinking water in all the villages. Since, none of the sample villages face any shortage of drinking water, it is difficult to assess the impact even if there is improvement in groundwater availability in the programme villages. On the other hand, other indicators reveal a clear change in groundwater situation in the sample villages.

Number of irrigation wells has gone up in all the sample villages. Number of bore wells is increasing over time as the dug wells are getting dried up. All the dug wells of the sample households in the control villages have dried up. This is true at village level also. Despite the drying of dug wells number of wells have increased in all the villages though the increase is much higher in the programme villages (Table 12). More importantly, groundwater depth[3] has declined substantially (above 20 per cent) in the programme villages while it has increased in the control villages. Groundwater levels are high in the control villages prior to the restoration of the tank in the programme villages. After the restoration groundwater levels have risen in the programme villages. After the restoration the difference in the groundwater depth is substantial between programme and control villages. It may be noted that the improvement in groundwater situation is prominent in Adepalle (Anantapur district) village. This could be due to two reasons, one is that in Adepalle tank restoration was carried out during 1993-94 itself and hence there was sufficient time for recharge and second is that two of the tanks in Adepalle are converted in to percolation tanks, which is more effective in terms of groundwater recharge. In fact, improved groundwater availability in Adepalle had a demonstration affect on the neighboring villages where villagers came forward to restore their tanks. Another important observation is that there is a structural change in the ownership of wells in the recent years. It may be noted that wells, especially bore wells, are no longer privy to large farmers, as more and more small and marginal farmers seem to be investing in bore wells (Table 12). This may be due to the decline in the cost of bore wells during the recent years. Perpetuation of this trend results in equitable distribution of water resources in these fragile regions. However, this is critically linked with the sustainability of groundwater recharge and the quality of technology that is available at cheap prices. For, there are reports (news papers) that frequent well failure in these regions is attributed to poor quality of the

3 Depth of the bore wells was assessed based on the information provided by the sample households on the depth at which groundwater is available before and after the restoration of the tank.

equipment. Average capital cost of a bore well range from Rs. 33000/- to Rs. 83000/- across the villages and these costs tend to be lower in the case of small and marginal farmers.

Table 12: Changes in the Status of Wells in the Sample Households

Size-class/ Village	No. of wells		Depth of wells (ft)		% Change	
	Before	After	Before	After	Number	Depth
Restored villages						
1. Adepalle	08	19	240	178	138	-25.80
Large	02	03	220	170	50	-22.72
Medium	02	03	240	165	50	-31.25
Small	01	05	260	185	400	-28.85
Marginal	03	08	250	190	167	-24.00
2. V.V. Palle	0	01	0	0	@	0
Large	0	0	0	0	0	0
Medium	0	0	0	0	0	0
Small	0	01 (dug)	0	30	@	0
Marginal	0	0	0	0	0	0
3. Akkapalle	02	10	260	165	400	-36.54
Large	0	0	0	0	0	0
Medium	02	08	260	165	300	-36.54
Small	0	02	0	170	@	0
Marginal	0	0	0	0	0	0
Control villages						
1. Korlakunta	05	07	210 (40)	253	40	20.48
Large	02	04	210	270	100	28.57
Medium	02 (dug)	01+00 (dried up)	40	260	-50	0
Small	0	01	0	250	@	0
Marginal	01 (dug)	01+00 (dried up)	35	230	0	0
2. Valasapalle	09	10	220 (42)	255	11	15.91
Large	3 (dug)	00 (dried up)	40	0	@	0
Medium	02	08	220	260	300	18.18
Small	02 (dug)	02+0 (dried up)	40	250	0	0
Marginal	02 (dug)	00 (dried up)	45	0	@	0
3. Pottipalle	0	11	0	249	@	0
Large	0	03	0	265	@	0
Medium	0	02	0	220	@	0
Small	0	05	0	260	@	0
Marginal	0	01	0	250	@	0

Note: Number of Wells includes bore wells and dug (open) wells. Dug wells are indicated in the brackets. Changes are calculated on the basis of functioning wells.
@ indicates changes from zero to positive and vice-versa.

Thus the positive impact of the programme is reflected in all the economic indicators such as area irrigated, land values, land productivity, employment and livestock economy. The improvement in all these indicators in the case of before and after the programme scenarios and with and without the programme scenarios unequivocally supports the rationale for tank restoration in the drought prone regions. And the impact is more in the case of small and marginal farmers when compared to large farmers. Economic impact is closely linked with ecological impact, which is evident from the improved groundwater situation in the programme villages. In fact, availability of groundwater has made growing of rabi crops possible and enhanced the yield rates. Further, the ecological impact is reflected in the livestock economy of the programme villages. Economic and ecological impact of the

programme is emphatic in the case the tanks restored prior to 1995-96. This reflects the long run nature of the ecological benefits and sustainability of the programme. Economic as well as ecological indicators support the viability of the programme, as the short run viability of the programme is often determined by the economic returns from the programme to the community. This is in no way belittles the economic value of the ecological benefits, which are expected to be much higher than the economic benefits. Though measuring the ecological benefits is beyond the scope of the study, ecological impact in value terms, partially and indirectly, is covered in the economic impact on crop production and livestock sector. The economic impact is an indicator of the success of the programme but it does not say much about the economic viability of the programme. Comparing the actual costs and benefits would establish the economic viability of the programme. Therefore, the economic analysis is taken up in the next section.

VI Integrating Markets and Institutions

The rationale for tank restoration is valid not only from the equity and stability points but also from the economic angle. For, per unit costs of restoration are marginal compared to creating new irrigation systems, canal or tank. Tank restoration has another important benefit in terms of groundwater replenishment. There are two ways of restoring these traditional systems. One is restoring them to the old type for providing direct irrigation and another is to convert them in to percolation tanks. Though both of them have advantages and disadvantages, percolation tanks seem to perform better in terms of productivity. On the other hand, irrigation tanks are more equitous. More investments and fallow up measures are required to safeguard equity in percolation tanks. Apart from crop production, tank restoration has other economic benefits such as employment, livestock, etc., ecological benefits such as groundwater recharge, improvement in CPRs, etc., and social benefits such as checking out-migration, equity, etc.

Therefore, restoring these systems will go a long way in addressing the issues of food security, regional imbalances, ecological balance, etc. While there is urgent need for policy intervention in this regard, the need for managing these resources in a sustainable manner is equally important. For, the role of policy in managing these systems is rather limited[4], as these systems fall under common pool resources (CPRs). Collective action is a prerequisite for CPR management. Understanding and promoting collective action is central to commons management. While the role of institutions in promoting collective action in CPR management is well recognised, the process of institutional innovation and change is less understood. An attempt is made here, based on our case studies, to gain some insights regarding how to sustain these systems in the long run.

The policy initiative of SPWD to restore tank irrigation is rational as far as achieving the objective of improving the rural livelihoods in the drought prone regions. While the immediate benefits of tank restoration are conspicuous sustaining these benefits in the long run is the crux of the problem. This aspect is well recognised and the model adopted by SPWD is practical and effective. The focus is on to evolve and strengthen local communities with the help of local NGOs. The stress was on peoples involvement with commitment and involvement. This is achieved through the demand driven approach and user contribution, while discriminating between users and non-users. Demand driven approach is in-built into the SPWDs tank restoration programme i.e., demand is created through demonstration. The

[4] This is not to say that policy does not have any role in this regard. Policy can provide conducive environment for institutional innovation and hence plays a role of catalyst.

principle of users pay has helped the collective spirit and sustenance of the institutions (TMCs here). This emphasises the point that market approaches are necessary to strengthen the local institutions. This study provides useful insights and lessons for larger policy initiatives, though the implementation guidelines are not fully adhered to by the PIAs. And, they help us exploring the possibilities of scaling up of these innovative micro initiatives through policy support. However, there are certain aspects, which need attention in order to sustain the systems in the long run. These aspects are:

- ✓ Communities need to have stronger commitment towards protecting these systems in sustainable manner. The economic benefits can further be enhanced through supporting the community beyond the restoration works in terms of providing irrigation benefits to larger area. That is providing more irrigation facilities through community bore wells, etc. In this context, converting the small tanks in to percolation tanks would provide access to water to more households. While large tanks can provide both direct irrigation and percolation benefits small tanks could be more productive as percolation tanks. In this regard conflict resolution and equity aspects need attention.
- ✓ The most important aspect our study brings out as far as sustaining the traditional water harvesting systems are concerned is the selection of the PIA (local NGO) for implementing the programme. Selection of PIA appears to be critical in the whole process. For, success of the programme depends on the commitment and sincerity of the PIA. In fact, sustenance of the programme is conspicuous in the villages where good NGOs like 'Chaitanya' in Ananthapur, are working.
- ✓ The concept of user charges is not properly followed in the programme. Maintenance works are carried out on ad hoc basis. This is not done in the case of small systems where economic returns are small. Farmers expect that PIAs' have the responsibility to carry out these repairs. Similarly user contribution, labor or cash, of 25 per cent of the costs is not followed. Imbibing these concepts in the programme ensures not only the financial sustainability of the systems but also increases the stakes (responsibility) of the farmers towards maintaining the system.
- ✓ Another important aspect is the follow-up action on the part of the funding agency. This is mainly to ensure equity in water distribution, especially in the case of percolation tanks, through supporting measures to increase the access to water to greater number of households.
- ✓ On the whole, the demand driven approach needs more emphasis in the whole process. Though this is in-built at the SPWD level, this approach is not taken forward by the local PIAs. In most of the cases farmers are enthused and request for the works to be carried out. This is due to the demonstration effect. Efforts on the part of PIA to conduct some orientation programmes and educational tours to the community before selecting the villages and taking up the programme would be useful. This again will depend on the commitment and sincerity of the PIA.
- ✓ While the non-beneficiaries or non-command area farmers are provided place in TMC they do not have any right to water. Therefore, they evince little interest in the activities relating to tank. Though this is a complex issue and needs lot of efforts towards conflict resolution, this is possible through delinking water and land rights. This is effectively done by 'Pani Panchayats' in Maharastra. That is rights on water are given to the households including landless (for details see Deshpande and Reddy, 1991). However, this is not to suggest that it is feasible in the given framework of the

implementing agency. This requires proper and stronger institutional arrangements and its replicability is rather difficult in the absence of policy support.

For, this kind of approach needs more intensive work towards institutional arrangements apart from the requirement of macro policy and legal support. In the absence of such support at the policy level it is rather difficult to ensure equity in resource distribution. It's feasibility gets further complicated in the context of restoring the old systems where customary rights are already established. The approach of SPWD in expanding the tank restoration programme through demonstration affect rather than directly pumping money would set the stage for demand driven approach though it is too early to see the impact on a large scale.

Demonstration will be effective when the economic benefits are substantial. Economic benefits tend to increase with the increase in access to water, quality and quantity. In scarcity conditions and drought-prone regions this could be possible either increasing the availability of water through rainwater harvesting, conjunctive use of water or reducing the pressure on agriculture. As far as institutional feasibility is concerned reducing the pressure on land and water would be more effective. The state should work towards providing appropriate policy and legal environment in order to make effective use of the resources in a sustainable manner.

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