

REHABILITATION AND MANAGEMENT OF TANKS IN INDIA

A Study of Select States



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Asian Development Bank

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This study was undertaken by the India Resident Mission and was prepared with assistance from R. Saktivadivel and P. Gomathinayagam. For any queries please contact Pratima Dayal, Senior Economist (pdayal@adb.org), Kavita Iyengar, Senior Consultant (kiyengar@adb.org).

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ABBREVIATIONS

ADB	Asian Development Bank
AED	Agricultural Engineering Department
BKVV	Biju Krishak Vikas Yozana
CADA	Command Area Development Authority
CADP	Command Area Development Programme
CAPART	Council for Advancement of People's Action and Rural Technology
CO	community organizer
CPR	common property resource
CGWB	Central Groundwater Board
CWC	Central Groundwater Commission
CWR	Centre for Water Resources
DLIC	district level implementation committee
EC	European Community
ECU	European currency unit
EEC	European Economic Community
EU	European Union
FA	farmers' association
GMO	<i>grama mahila okkutta</i> (rural women's federation)
Gol	Government of India
GV	<i>grama vikas</i>
ha	hectare
HYV	high-yielding variety
ICEF	India-Canada Environment Facility
IMTI	Irrigation Management Training Institute
IWMI	International Water Management Institute
JSYS	Jala Samvardhane Yojna Sangha
LBP	Lower Bhavani Project
MI	minor irrigation
MIP	minor irrigation project
MoWR	Ministry of Water Resources
NABARD	National Bank for Agriculture and Rural Development
NCA	net command area
NGO	nongovernment organization
O&M	operation and maintenance

PRI	panchayat raj institutions
PWD	Public Works Department
RIDF	Rural Infrastructure Development Fund
Rs	rupees
RSVY	Rashtriya Shram Vikas Yozana
SC	scheduled caste
SGVY	Sampurna Gram Vikas Yozana
SHG	self-help group
ST	scheduled tribe
TA	tank association
TRPP	Tank Rehabilitation Project, Pondicherry
TUG	tank users' group
WALMI	Water and Land Management Institute
WIG	women's interest group
WRCP	Water Resources Consolidation Project
WRO	water resources organization
WUA	water users' association

EXECUTIVE SUMMARY

Tanks have been the main source of irrigation in many parts of India for centuries. India experiences extreme climate within its 329 million hectares of geographical area. The hydrological characteristic of the Indian monsoon necessitated creating storage facilities to hold the monsoon rainwater and utilize it later. With extraordinary engineering, managerial, and social skills, an extensive system of rainwater harvesting structures comprising tanks and ponds had been built and maintained by the people for centuries. Many of these multiple use structures were the nerve centers for sustenance and livelihood of the rural communities.

After independence, there has been widespread recognition that the tanks are on a decline. This decline is both in the form of decrease in the relative importance of tanks vis-à-vis other modes of irrigation and a decline in the actual area irrigated by tanks. Many reasons such as silting of feeder channels, encroachments in the tank bed, interruption in the catchment, poor maintenance, and development of well irrigation in tank commands are attributed for the decline in the tank-irrigated area. During the past 2 decades, states in south India have started rehabilitating their tanks. The European Economic Community (EEC), now European Union (EU), the National Bank for Agriculture and Rural Development (NABARD), and the World

Bank provided financial assistance for tank rehabilitation in these states. Besides this, the governments of Tamil Nadu and Karnataka carried out repairs to the tanks from their own funding either directly or with support from nongovernment organizations (NGOs). There are NGOs who had rehabilitated tanks through contribution from tank users and other donor agencies without funds from the government. Recently the government of Orissa has taken up the rehabilitation of tanks in a big way with assistance from the World Bank and EU. The objectives and the model used for tank rehabilitation projects, their process and lessons learned are discussed in detail in this study.

The studies carried out under International Water Management Institute (IWMI)-Tata Water Policy Programme during 2003–2005 documented the reasons for the best performance of tank institutions and the sustainability level of rehabilitation carried out by different governments, funding agencies, and NGOs in different states. From these studies, recommendations for sustaining tank institution and tank rehabilitations were made. Similarly the studies carried out by Bhavanishankar for the Asian Development Bank during 2004–2005 in Tamil Nadu and Orissa brought some additional details. Findings of these studies are included in this report.

A study under the IWMI-Tata Water Policy Programme in 2004–2005 examined the various livelihood options in tank irrigation under different scenarios and gender-related issues in tank rehabilitation in 40 rehabilitated tanks under different models in three states—Tamil Nadu, Karnataka, and Pondicherry. The study concluded that in tank rehabilitation works, augmenting tank water and increasing tank storage have greater impact on the livelihood options of the landless and marginal farmers. The involvement of self-help groups in tank rehabilitation and provision of funding for income generating activity has a marked effect on their livelihood. The tanks are likely to be more sustainable when all the villagers become members of a tank users' group.

There are three types of tank institutions: traditional institutions, government-sponsored institutions, and NGO-sponsored institutions. A comparative analysis of tank institutions is made in this report.

Traditional tank institutions have several advantages with respect to water allocation and maintenance. In most tank systems, the tank users have the most intimate knowledge about their own physical and social environments. Their proximity to the resource use area enables them to utilize their knowledge effectively and to act quickly in solving problems. Further, the shared community understanding among participants affects the way they relate to one another. Rules can be effective only if a shared understanding exists among participants. Individuals who have lived together for a long time are able to develop various social networks and reciprocal relationships with one another. Finally, rules adopted by farmers are more relevant to local circumstances because farmers who decide to adopt the rules have to bear the consequences of their own decision.

The government-sponsored institutions are created essentially to meet the conditions of funding agencies. Hence the organizations disappear once

the project is completed. Government officials entrusted with mobilizing farmers and forming an organization do not have the required outlook or capacity to interact with the community. Organizations formed by experienced NGOs are sustainable and vibrant. NGOs perceive the tank as a component of a watershed or a cascade of tanks. Hence the planning and rehabilitation cover the entire watershed as a whole. The first activity of the NGOs is motivating and mobilizing people and building organizations at habitat, cascade, and watershed levels. All development works are planned and implemented through the users' group. NGOs work at grassroots level to enable communities to build upon their skills, initiatives, resources, and entitlements rather than delivering services or solutions to them.

With the lessons learned from the case studies, a protocol for tank rehabilitation was developed. The protocol details the following items:

- hydrological endowment and selection of tanks for rehabilitation
- institutional framework
- planning rehabilitation components
- investment criteria and financial allocations
- execution of work by water users' associations and self-help groups
- monitoring and evaluation
- training and capacity building

The policy changes and legal support required to implement the protocol are elaborated in this report. The Government of India had given guidelines for tank rejuvenation projects. Based on the appraisal of the guidelines, a set of additional recommendations on policy, institutional, and legal issues has been made in this report.

Most of the important river basins in various states have either reached or are fast approaching their ultimate irrigation potential. The fiscal constraints for physical expansion of irrigation is also becoming

increasingly binding. Unable to generate enough revenue from within, the irrigation sector has a heavy dependence on budgetary sources for new investment, operation and maintenance, and other recurring expenditure. The budgetary cuts imposed resulted in inadequate financial resources to maintain irrigation systems. Ultimately they fell into the vicious cycle of rehabilitation–poor maintenance–deterioration–rehabilitation. Given fiscal constraints, the issue concerns the balance between creating new works and making better use of the already existing irrigation works. India has thousands of tanks and ponds which, if rejuvenated, will contribute significantly to not only increasing food production but also to providing a variety of livelihood options to the rural poor, especially women. This appears to be the best cost-effective option than creating new irrigation works.

The tank rehabilitation had been aimed to increase agricultural production. The benefits had gone to the landholders mainly and landless agricultural laborers marginally as wages. On the whole, per capita income was rupees (Rs)1,126 considering the population. If the tank rehabilitation is planned as a poverty alleviation program along with agricultural production, everyone in the village will benefit one way or another. The per capita income in this case is Rs1,903, showing an increase of 66%.

This study concludes that in view of the increased benefits and from equity consideration, improving the livelihood of the rural community through increasing the gross tank product should be the objective of future tank rehabilitation and rejuvenation projects.

1 CURRENT STATE OF TANK IRRIGATION IN INDIA

1.1 Introduction

A tank is a low, earthen bund constructed across a shallow valley to hold the rainfall runoff from its catchment area. Tanks may be either isolated or in cascades. In a cascade, when the upper tank gets filled, the spill over the surplus weir is led into the tanks lower down, one below the other as a cascade until the last tank spills into a drain or a river. Tanks have been the main source of irrigation in many parts of India from time immemorial. India experiences extremes of climate within its 329 million hectares (ha) of geographical area. Rainfall pattern is neither predictable nor uniform over space and time. The incidence of rainfall is also seasonal, occurring mainly during the southwest monsoon (June to September) in most of the country except the rain shadow areas of the western *ghats* (steep mountainous range), notably Tamil Nadu. Being confined to a few monsoon months, rainfall behavior is highly erratic. This hydrological characteristic of the Indian monsoon necessitated the creation of storage facilities to hold the rainwater of the monsoon and utilize the same at a later date. With extraordinary engineering, managerial, and social skills, an extensive system of rainwater harvesting structures comprising tanks and ponds had been built and maintained by the people for centuries.

1.2 Tanks in India

South and Eastern Indian tanks and ponds (tanks are mostly constructed over the land and have hydrological continuity from one to the other in cascading form while the ponds are mostly dug out and isolated) are known for their antiquity. They were created essentially as multiple-use structures for irrigation, livestock, and human uses. In addition, innumerable small water holding structures called ponds have been in existence in many North Indian states and constructed even after Independence. Although these ponds are primarily meant for inland freshwater aquaculture, they have also been used for irrigated agriculture, livestock, and other domestic use. The predominance of tanks in the Deccan Plateau and in eastern India, including Chhota Nagpur plateau, is due to the unique topographic characteristics of the areas. In the case of the Deccan Plateau, the tracts with undulating topography and rocky substrata are ideally suited for locating tank in the valley depression and carrying out gravity irrigation. In case of the plains in south Bihar and Chhota Nagpur plateau, the indigenous system of the *ahar-pyne* is the outcome of the natural condition and physical configuration of the area, and has been evolved to overcome the obstacles which the locals experienced in irrigation. Similarly,

the somewhat steeper gradients of West Bengal offer greater scope for gravity flow irrigation from small-scale reservoirs (tanks). Tank irrigation has a rich heritage on account of long historical antecedents in eastern India, consisting of eastern Uttar Pradesh (UP), south Bihar (plains as well as plateau), West Bengal and Orissa. In the eastern region, tanks and ponds have been an important supplementary source of irrigation over centuries (Pant, 2004).

South India has more tanks because of its geography, climate, and terrain situations. Most of the land lying between western ghats and the eastern coast misses the intensive rainfall of the dependable south-west monsoon. But the north-east monsoon, which is less dependable, brings more rain over these areas. However, the north-east monsoon is often accompanied by cyclones and pours heavily in short spells. Unless this rain water is collected and stored, these areas will have acute water shortage and drought during the rest of the year. Hence tanks have come into existence in this part of the country in large numbers.

The geological formation of south India is of hard granite gneisses, which helps reduce deep percolation from tanks and ponds. This may be yet another reason for the existence for more tanks in southern peninsular India than in the north. The north-east monsoon is more active in the coastal districts of Tamil Nadu and Andhra Pradesh and they also have the maximum number of tanks. The

southern states of Andhra Pradesh, Karnataka, and Tamil Nadu put together have around 143,000 tanks, constituting nearly 50% of the tanks in India.

1.3 Tank-irrigated Area

A reliable estimate of the number of tanks and ponds existing in different states is not known while the reported number varies anywhere between 200,000 and 350,000. After Independence, the canal irrigation was developed in a massive way, which subsumed a sizable part of the tank-irrigated areas under its command. The Government, under successive planning, had not given due attention or provided adequate finance to keep the tanks in a state of good repair. Most of the public investment in irrigation has gone to major and medium canal irrigation and development of groundwater under minor irrigation. The area under irrigation increased substantially after the beginning of the 5-year plans at the rate of more than 1 million ha per year. But the tank-irrigated areas showed a steady decline during this period (Table 1).

The table shows that tanks are the only source where reduction in irrigated area has been noticed in both absolute (area) and relative (percentage to net irrigated area) terms. Table 1 also shows that tank-irrigated area started declining only after the 1970s. It appears that the area under tank irrigation started declining only after the introduction of the Green Revolution.

Table 1. Source-wise Irrigated Area in India (in hectares)

Period	Canal	Tank	Groundwater	Others	Total
1952–1953	8,613,000	3,468,000	6,339,000	2,588,000	21,008,000
1962–1963	10,568,000	4,651,000	7,430,000	2,420,000	25,069,000
1972–1973	12,983,000	3,822,000	12,377,000	2,313,000	31,495,000
1982–1983	15,808,000	3,165,000	18,593,000	2,406,000	39,972,000
1992–1993	17,247,000	2,817,000	25,884,000	3,114,000	49,062,000
1999–2000	17,609,000	29,160,00	32,536,000	3,223,000	56,284,000

Source: Water and related statistics, Central Water Commission, 2002.

1.4 Tank Irrigation in Different Regions of India

South Indian tanks are inextricably linked to the socio-cultural aspects of rural communities and have historically been an indispensable part of the village habitat. The layout, structure, and construction of these tanks bring out the ingenuity of past generations who constructed the tanks suitably fitting to the gradual fall of the contours. As small-scale irrigation systems, these tanks are easily adaptable to the system of decentralized village administration they have. The precise shape and size of each tank seem to have been determined by the terrain. The overflow of one tank moves into the lower down tank and so on up to the sea or drain. Building this highly interconnected system would have also required civil engineering skills of a high order. Maintaining such an extensive dispersed system and sharing the waters need extraordinary social and managerial skills. The sharing of tank water and other usufructs is perhaps the essence of democratic functioning that prevailed then.

These tanks have many special features. The tank is recognized as having at least four different functions in irrigated agriculture—water conservation, soil conservation, flood control, and protection of ecology of the surrounding area. There are evidences of well-developed irrigation systems in literatures, epigraphs, and as remnants of structures. Behind these existing indigenous systems of irrigation are thousands of years of tradition.

This indigenous system gradually collapsed due to invasions from other dynasties as well as from foreign invasions. The East India Company made material changes in the village community setup. The colonial government employed the village accountants and village policeman (*karnam* and *thalaiyari*) and paid them monthly cash wages. They dispossessed the village artisans and other village servants of their hereditary rights in land plots or in village produce. These changes had eliminated

important functionaries who maintained and managed irrigation. When the East India Company and British Administration introduced the *ryotwari* system (land tenure in which farmers directly paid tax to the government), the responsibility of managing common properties like tanks were transferred and vested with the Government. As the revenue accrued out of these tanks was considerable, the Government was interested in maintaining or restoring the tanks to their former working condition, when tank deterioration took place. The Famine Commission in 1878–1880 examined in detail the subject of maintenance of tanks and recommended that the tanks irrigating above 200 acres could remain in the hands of Public Works Department (PWD) for maintenance and repair; the tanks irrigating lands between 50 and 200 acres should be rehabilitated and handed over to the village panchayat (body of elected representatives) to maintain. The remaining tanks with less than 50 acres of command area should be handed over to *ryots* (tenants under *ryotwari*) directly. The Government accepted this and started the tank restoration scheme in 1883 in Madurai District. The Government tried to revive the *kudimaramath* (voluntary community labor) by bringing legislation called ‘Madras Compulsory labor Act 1858’. The implementation of this Act met with varying success in canal and tank irrigation areas. The efficiency of canal irrigation depends on the canals being periodically cleaned but if repairs to tanks are postponed, the tank can still store water. Hence, the farmers in the tank command area were not enthusiastic about regular tank maintenance. Another important point was that the Act elaborated the obligation of the *ryots* but did not explain the obligation of the Government.

At the time of independence, the economy was overwhelmingly rural and agricultural. The Government had to make all efforts to increase food production to meet the challenges of famine and drought, and achieve self-sufficiency in food. Hence the Government undertook repairs and mainte-

nance of irrigation works without reference to kudimaramath up to 1957. By this intervention, the farmers started to consider all their common property resources (CPRs) as government property. The farmers did not follow kudimaramath, which resulted in gradual deterioration of the physical condition of the systems. Realizing the consequences of the situation, the Government issued orders periodically, introducing the concept of sharing of cost of maintenance both by the Government and farmers. The Government increased its share in

1974 and issued another order in 1976 that the panchayats carry out the kudimaramath works and that the cost be recovered from the farmers. All the above attempts by the Government have not resulted in the expected outcome, thus leading to continuous deterioration of the physical condition of the systems and affecting their performance. What was previously seen as local village property is now seen as government property; hence what was previously local responsibility (for maintenance) has now become government responsibility.

2 THE DECLINE IN TANK IRRIGATION

2.1 Rainfall and Tank Irrigation

One of the common phenomena attributed to decline in tank irrigation is the changes in rainfall pattern and reduced inflow to the tanks. An analysis based on secondary data is made to probe into this. Rainfall in the catchment is the major source of water supply to the tanks. Figure 1 shows that from 1960 to 1984, the fluctuations in rainfall and tank-irrigated area followed similar patterns in Tamil Nadu. Whenever there was decline in rainfall, tank-irrigated area also decreased, and irrigated area

increased as rainfall increased. But after 1984, tank-irrigated area generally decreased even though rainfall increased in certain years. The one-to-one correspondence between rainfall and tank-irrigated areas broke down starting 1980. During the 1960s, the area irrigated by the three major sources in this State—namely canal, tank, and well irrigations—were 36%, 38%, and 24%, respectively. But now the area irrigated by tanks is only 18%, while the area irrigated by wells is three times higher than tanks. The source-wise net area irrigated from 1960–1961 to 2002–2003 at 5-year intervals is presented in Table 2.

Figure 1. Rainfall and Tank Irrigated Area on Tamil Nadu

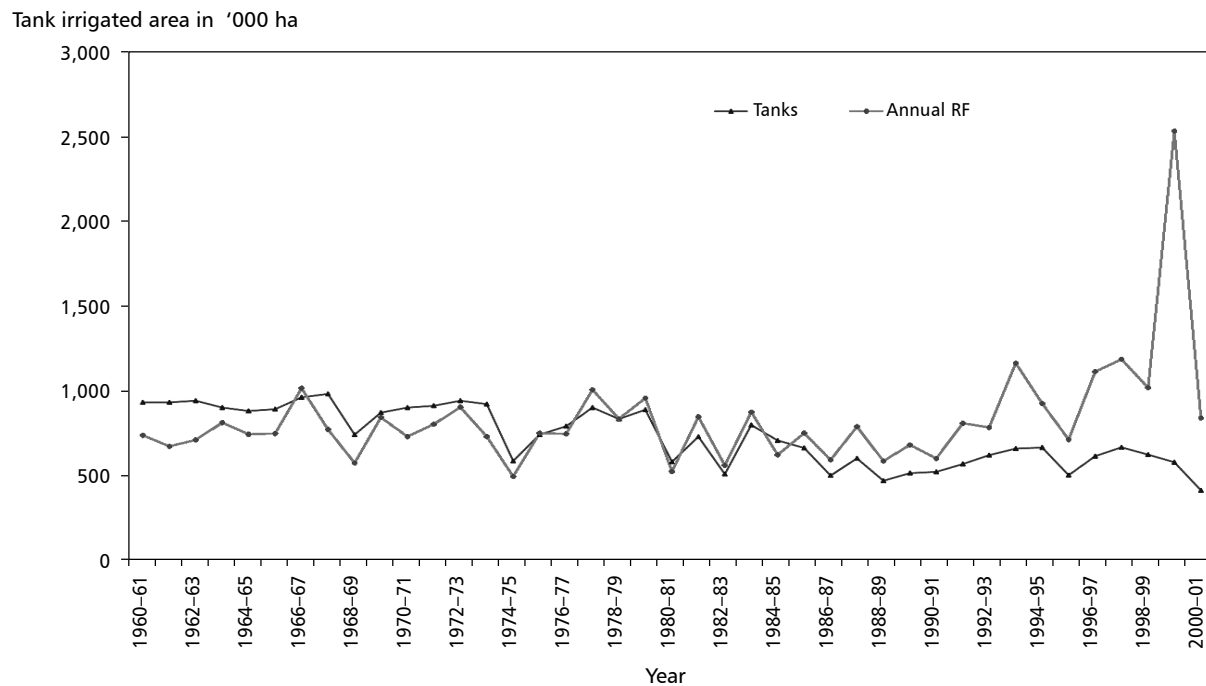


Table 2. Source-wise Net Irrigated Area, 1960–1961 to 2002–2003 at 5-year intervals
(area in '000 hectare)

Year	Normal R.F. mm	Actual R.F. mm	Canal		Tank		Well		Others		Total Area
			Area	%	Area	%	Area	%	Area	%	
1960–1961	925	855	881.8	35.8	936.4	38.0	597.9	24.3	46.2	1.9	2,462.3
1965–1966	947	870	799.2	33.3	902.5	37.6	659.2	27.5	37.7	1.6	2,398.6
1970–1971	946	918	883.7	34.1	897.9	34.6	774.6	29.9	35.6	1.4	2,591.8
1975–1976	946	857	910.4	35.5	749.8	29.2	869.6	33.9	35.3	1.4	2,565.1
1980–1981	943	669	889.1	34.6	590.1	23.0	1,067.4	41.5	23.9	0.9	2,570.5
1985–1986	943	951	774.4	31.0	671.7	26.9	1,029.5	41.1	25.1	1.0	2,500.8
1990–1991	925	715	769.4	32.4	530.9	22.4	1,058.5	44.6	13.9	0.6	2,372.8
1995–1996	923	722	771.1	29.4	512.3	19.5	1,326.5	50.5	14.6	0.6	2,624.5
2000–2001	979	785	833.1	28.8	588.6	20.4	1,449.5	50.2	16.3	0.6	2,887.6
2002–2003	964	731	614.1	26.6	422.3	18.4	1,262.8	54.6	10.7	0.4	2,309.9

RF=rainfall, mm=millimeters.

Source: Department of Statistics, Government of Tamil Nadu

Analyzing the rainfall pattern from 1960–1965 to 2002–2003 at 5-year intervals, out of 10 years there is deficit rainfall (below normal) in 8 out of 10 years (Normal rainfall is based on the preceding 30 years value). During the years of deficit rainfall, rainfall had been observed to occur with a changed rainfall pattern with less intensity. This had decreased the inflow to the tanks and in turn reduced the tank-irrigated area. There are many more reasons for the reduction of inflows like encroachment of supply channels and tank beds, sand mining of supply channels, rural infrastructure development interfering with the natural inflows, and unplanned watershed development cutting off the supply to tanks. Surprisingly, the official records indicate that the number of tanks have actually increased from 29,903 to 39,366, i.e., an increase of 9,463 tanks from 1960 to 2001 (Table 3). The increase is mainly in the number of tanks with *ayacut* (command area of the tank) of less than 40 ha. Even though the number of tanks has increased, the tank-irrigated area has been on the decline.

After Independence, there has been widespread recognition that the tanks are on a decline. This decline can be seen both in the form of decrease in the relative importance of tanks vis-à-vis other

modes of irrigation, as well as a decline in the actual area irrigated by tanks. A number of studies attribute many reasons for the decline in tank-irrigated areas like silting of feeder channels, encroachments, interruption in the catchment, poor maintenance, and the development of well irrigation in tank commands (Raj and Sundaresan, 2005; Janakarajan, 1996; Mukundan, 1988; and Palanisami and Easter, 1984).

2.2 Other Major Reasons for Decline of Tanks

One of the most important reasons for the decline in tank irrigation is the disappearance of village institutions that were managing the tanks. The village level organizations have undergone changes because of a vast increase in the number of irrigators, shift in land control from a small to a large number of landowners, changes in the attitude of farmers, and the spread of well irrigation in the tank command. Today, tanks are viewed more as an "open access resource"; tank communities have lost their capacity and the will to mobilize resource and labor to undertake regular maintenance activity to enforce norms and obligations. Other important reasons attributed are:

Table 3. Area Irrigated by Tanks and Wells, 1960/61–2001 at 5-year intervals
(area in '000 hectare)

Year	Tank Irrigation				Well Irrigation					
	Number of Tanks			Area (ha)	Number of Wells		Sole Irrigation by Wells (ha)			
	<40 ha	<40 ha	Total		Having Independent Ayacut	Supplementing Recognized Sources	Total	Dug Wells	Bore Wells	Total
1960–1961	7,150	22,753	29,903	936,400	652,521	221,168	873,689	594,740	3,186	597,926
1965–1966	8,611	26,730	35,341	902,545	691,747	344,321	1,036,068	654,088	5,089	659,177
1970–1971	8,544	27,278	35,822	897,923	919,932	323,973	1,243,905	755,444	19,183	774,627
1975–1976	7,386	30,593	37,979	749,828	1,282,333	335,663	1,617,996	807,335	62,258	869,593
1980–1981	7,399	30,895	38,294	590,151	1,283,502	374,012	1,657,514	941,774	87,743	1,029,517
1985–1986	7,224	30,421	37,645	671,724	1,337,452	398,221	1,735,673	941,774	136,066	1,077,840
1990–1991	7,281	31,202	38,483	530,933	1,407,022	357,782	1,764,804	888,720	169,807	1,058,527
1995–1996	7,423	31,283	38,706	512,289	1,481,673	315,594	1,797,267	1,326,641	199,886	1,526,527
2000–2001	7,529	31,837	39,366	588,633	1,493,791	339,514	1,833,305	1,221,409	228,055	1,449,464

Source: Department of Statistics, Government of Tamil Nadu.

- The construction of large canal systems has led to the displacement of traditional tank systems. After Independence, the canal irrigation was developed in a massive way that subsumed the tank-irrigated areas. Water resources development has been carried out through successive 5-year plans since 1951. Millions of rupees were invested in creating major, medium, and minor irrigation systems with extensive canal network. Irrigated area reached 56.3 million ha in 2000 as against 21.00 million ha in 1951. Between 1951 and 2000, within the public irrigation sector, major and medium irrigation systems showed a twofold increase, accounting for 39% of irrigation potential created, whereas the private groundwater irrigation recorded a five-fold increase, contributing 47% of the irrigation potential created. The central Government, even under its 5-year plans, had not given due attention or resource to keep the tanks in a state of good repair. While the area under irrigation increased substantially after the beginning of the 5-year plans at the rate of more than 1 million ha per year, the percentage of tank-irrigated areas to total irrigated areas showed a steady decline.
 - The groundwater exploitation got a lift in the form of heavily subsidized electric and diesel pumping and availability of institutional finance. This resulted in financially better-off farmers to go in for well irrigation in the tank command.
- Realizing the importance of tanks, South Indian states have started rehabilitating the tanks in the mid-1980s under state funds as well as under

external assistance. The number of tanks modernized to date is negligible compared with the total number of tanks in India. The general belief is that the tanks are in a vicious cycle of “poor maintenance–decline in condition–rehabilitation–poor maintenance.” On the other hand, proponents argue that tank rehabilitation is a must around which livelihood options of the rural poor are to be built in view of the multiple use of tank water.

In the present scenario of tank degeneration, and tank use and management, the major deficiencies noticed in the tank complexes are (Sakthivadivel, 2005):

- lack of community involvement in tank management and maintenance
- inadequate and unreliable water supply to the tank
- absence of local institutions for management
- large-scale infestation of weeds and loss of grazing land in the tank bed
- encroachment of tank bed and supply channel by the government, public, and private people
- silting of tank water spreads and supply channels
- choked or leaky sluices and damaged weirs
- sluices with missing shutters
- dilapidated and weak or cut-down tank bunds
- meager resource allocations for maintenance
- urbanization and extinction of tanks
- nonsustainable large-scale groundwater development and decline in gravity flow in tank-fed irrigated area

3 THE NEED FOR TANK REHABILITATION

India's water resources potential and the country's agricultural economy hinge on the monsoon rains and its spatial and temporal variations. Nearly 40% of India's land mass falls under semi-arid conditions with annual rainfall of 500-1,000 millimeters (mm); Normal and timely monsoon rainfall is necessary for a good crop. 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 innumerable tanks or small storage structures like ponds built, owned, and managed by the local people through community organizations. Tank systems, developed ingeniously and maintained over the centuries, have provided insulation from recurring droughts, floods, vagaries of the monsoon, and offered the much-needed livelihood security to the poor living in fragile semi-arid regions. The number of tanks rehabilitated effectively is negligible compared to the total number of tanks. With limited water resources, vagaries of the monsoon, and looming water scarcity in many parts of India, the need for rehabilitating and restoring the tanks assumes significance.

One of the goals of Indian policy is to find ways of maintaining the same level of food grain availability per inhabitant in a context of population increase. Food grain production increased in the 1950s and 1960s due to increases in the cultivated area, and due to a tremendous expansion in irrigation and the use of high-yielding varieties (HYVs)

from the mid-1960s onwards. Irrigation has also helped reduce inter-annual fluctuations in agriculture output and India's vulnerability to drought.

Most of the important river basins and states have either reached or are fast approaching their ultimate potential. The fiscal constraints for physical expansion of irrigation is also becoming increasingly binding. In fact, developing more than half of the irrigation potential has been made through groundwater development, which has been primarily done with private sector financial investment. Irrigation financing is also in crisis. Of the total working expenses, the share of repair and maintenance is declining while those of administration and staffing are increasing. Unable to generate enough revenue from within, the irrigation sector has a heavy dependence on budgetary sources for new investment, operation and maintenance (O&M), and other recurring expenditure. The budgetary cuts imposed resulted in inadequate financial resources to maintain irrigation systems. Ultimately they fell into the vicious cycle of rehabilitation-poor maintenance-deterioration-rehabilitation. Under the given fiscal constraints, the issue concerns the balance between creating new works and making better use of the already existing irrigation works. India has thousands of tanks and ponds that, if rejuvenated, will contribute significantly to not only increasing food production but also provide a variety of livelihood options to the rural poor and women.

4 PAST EXPERIENCES WITH TANK REHABILITATION

4.1 Introduction

During the past 2 decades, south Indian states have started rehabilitating the tanks. The European Economic Community (EEC), now European Union (EU), National Bank for Agriculture and Rural Development (NABARD), and World Bank provided financial assistance for tank rehabilitation in these states. Besides this, the governments of Tamil Nadu and Karnataka carried out repairs to the tanks from their own funding either directly or with support from nongovernment organizations (NGOs). There are NGOs who had rehabilitated through contribution from tank users and other donor agencies without getting any funds from government (Gomathinayagam, 2005). Recently the government of Orissa had taken the rehabilitation of tanks in a big way with the assistance from World Bank and EU. The objectives and models adopted for tank rehabilitation projects, their process, and lessons learned are discussed next.

4.2 Ford Foundation and Centre for Water Resources, Anna University Study

The Centre for Water Resources (CWR), Anna University, Chennai carried out an Action Research with Ford Foundation to find out the ways and means to improve the tank irrigation system efficiencies and evolve alternative approaches to tank rehabilitation and management. During the late

1970s, the government of Tamil Nadu approached the World Bank for funding the rehabilitation of tank systems. The World Bank advised the government to take up some pilot studies to find out the ways and means to improve the tank irrigation system efficiencies. Accordingly, a pilot study was undertaken in Pillaipakkam tank, Kancheepuram district. The PWD planned and improved the supply channel, tank bund and other appurtenant works and main distributary channels in the ayacut. The Agricultural Engineering Department (AED) planned and executed the on-farm distribution channels for equitable distribution of water in the entire command area. The study revealed that lining the main distribution channel alone could save 21% of water.

It was decided to extend the pilot study to one more tank to have more data and confirm the initial finding. CWR approached the Ford Foundation to have a research component in the proposed pilot study. Ford Foundation, New Delhi, came forward to fund the research component and sanctioned \$23,000. CWR, PWD, and AED jointly selected Padianallur tank, Thiruvallur district about 20 kilometer (km) north of Chennai on Chennai-Kolkata National Highway for study. This study was initiated with a view to assessing the present status of tank irrigation system, identify deficiencies, and plan measures for improving the system and after interventions, evaluate the results. PWD and AED took up system improvement

measures, while CWR provided coordination between the two government departments on one hand and between the departments and the farmers on the other hand.

In the Padianallur tank, the rehabilitation of tank bunds and its appurtenant work, provision of cross-regulators across the main channel, and lining of on-farm channels were executed after consulting the informal farmers' association (FA). The work was executed by a contractor who was the president of the informal association at that time. Command area development was executed with the objective of equitable distribution of water in the head, middle, and tail reaches by dividing the flow in the main channel in proportion to the area to be covered in each reach. Even before the execution of works was completed, farmers in a number of places had damaged the channel lining provided, as the works executed were not in tune with their needs.

To share the experience gained during the study, CWR again organized an International Workshop in January 1987. The workshop recommended continuing further studies by taking up the rehabilitation program by motivating the farmers into a formal FA and involving them in all facets of rehabilitation, i.e., planning, design, execution, maintenance, and management. Ford Foundation again came forward to fund the research component to take up the study in the tanks selected for rehabilitation under the ongoing EEC Project. Anthony Bottral, Program Officer, Ford Foundation, informed that under similar conditions in the Philippines, the National Irrigation Agency conducted an experiment in which catalysts were placed in the village to motivate the farmers for better irrigation system management. He suggested trying this model in the tank rehabilitation program. This model is popularly known as the 'Philippines model'. CWR prepared a project proposal titled "Alternative Approaches to Tank Rehabilitation and Management – An Experiment."

4.2.1 Objectives

- (i) Selecting four experimental and an equal number of control tank irrigation systems, studying them in detail and understanding the rehabilitation works;
- (ii) Fielding institutional organizers in the experimental tanks to organize or reactivate water users' groups to:
 - a) interact with the implementing agencies right from the planning through execution stages, and
 - b) commit them to operate and maintain the rehabilitated systems in a sustained manner;
- (iii) Studying and documenting the process of farmers' participation and the results of such participation or the lack of it;
- (iv) Suggest changes, if needed, in selecting tanks and in planning and implementation of the rehabilitation measures; and
- (v) Learning to work together in interdisciplinary teams and with the water users.

This field-based action research study was a collaborative endeavor of five institutions—PWD, AED, Anna University, EEC, Ford Foundation, and FAs—to experiment in nonsystem rain-fed tanks. The following criteria were considered for selecting a tank as a candidate for the proposed experiment:

- enthusiasm of majority of farmers
- hydrological features with the dependable water yield for storage
- soil fertility status and scope for diversity of crops
- conjunctive use of surface and groundwater in the command
- incremental benefits that are likely to occur
- number of villages served
- population and its distribution in case of more than one village or hamlet with less disparity
- size and distribution pattern of landholdings

This multidisciplinary team collected 57 vital data covering the following hydrological and socio-economic characteristics:

- (i) village background,
- (ii) hydrology of tank,
- (iii) components of tank,
- (iv) ayacut,
- (v) groundwater status,
- (vi) socioeconomic background, and
- (vii) cost.

A team of irrigation engineers, agronomists, agricultural engineers, and sociologists undertook reconnaissance surveys of the shortlisted tanks and selected four tanks for study under phase I. Based on the experience of the phase I program, some modifications were made for the phase II study. The process documentation was dispensed with in the phase II program. As the PWD had come forward to provide necessary technical guidance to the FAs, it did not contribute much to the study and the technical assistant was also dispensed with. Only implementation officers were placed in the tanks to motivate and mobilize the farmers into an organization and prepare them to take up the responsibility of execution of work by the FA. The following 12 tanks under phases I and II were studied:

	Name of Tank	District
(i)	Kattiamandal	Kancheepuram
(ii)	Kedar	Villupuram
(iii)	Kannangudi	Pudukottai
(iv)	Sowdarpatti	Madurai
(v)	Vengal	Thiruvallur
(vi)	Nandiyalam	Vellore
(vii)	Samudram	Thiruchirapalli
(viii)	Thirupunavasal	Pudukottai
(ix)	Pagadaikulam	Dindigul
(x)	Ayavittan	Madurai
(xi)	Karuppur	Thoothukudi
(xii)	Sennaneri	Thirunelveli

4.2.2 Observations

All these study tanks are diverse—agro-climatologically and socio-economically. The studies throw an insight into the villages, their history, traditions, beliefs and wisdom, castes and conflicts, ups and downs in economy—all centered around the “Tank”. Many lessons were learned in the beginning, during the course of, and at the end of the project. These lessons are summed up and given below.

Farmers’ Organizations: The villages generally have traditional, informal associations other than the official village panchayats. These associations have leaders who are respected by all in the village, some of them, by virtue of their age and service rendered in the past, wield considerable influence in the village. Many of these leaders encourage a second line of leadership to emerge among the next generation. For example, Kannangudi has a clear allocation of responsibility. The elders look after the village affairs and the youngsters look after the affairs of the tank. Both consult each other, cooperate, and coordinate their works for the benefit of the village as a whole. If the farmers have confidence in their leaders, then they trust that their leaders will do everything for them. Wherever this pattern exists, the FA is found to be sustainable and farmers’ involvement is remarkable. But a drawback of this type is that the people put more faith in the leadership and evade responsibilities. For example, Pagadaikulam is one such tank where the office bearers alone shared all the responsibilities. This type of situation leads to a gap between office bearers and members as found in Vengal tank.

4.2.3 Farmers’ Participation in Planning Tank Rehabilitation Works

When the tank modernization project started with EEC assistance in Tamil Nadu, the PWD engineers inspected the tanks, assessed the works to be carried out, and prepared the estimate and work plan.

The tanks were traditionally CPRs managed by the villagers. When the government started repairing them, the concept of village property was gone from the people's mind and the tank was viewed as government property. After the works were carried out, the farmers were not happy and complained that modernization had disturbed their normal water allocation practices. In many places, the cross-masonry works were viewed as hindrance to the flow of water and people had broken the structures as in the cases of Pillaipakkam and Padianallur.

In the study tanks, participatory rural appraisal method was followed to ascertain the felt needs of the farmers. The farmers identified the problems and works required to solve the problem. The engineers agreed to this and estimates were prepared accordingly to carry out the works. Once this was done, the people trusted the officials and provided all help and support. This reassured them that the tank continues to be the common property of the village. This also avoided unnecessary works from being carried out.

4.2.4 Execution of Works by Farmers' Organizations

When the modernization works were entrusted to the FA, many were skeptical about the capability of the FA to complete the work in time and with quality. But the farmers demonstrated that they could do quality work within the time frame, provided they received cooperation and support they expect from the government. The rehabilitation works in Kannangudi tank at a cost of Rs2,303,000 was completed in 26 months. The mobilization of funds by the association during the work is essential to keep the time frame. This depends on the cooperation among the farmers and willingness to contribute. In the Ayavittan village, group rivalry existed and farmers were reluctant to contribute money for any common cause. One of the reasons may be the village's proximity to a big urban center. The work in this tank was the slowest among all 12 tanks.

Persuasion, advice, and even threat by officials were not helpful in making the villagers carry out the work in time.

For the FAs, execution of works costing several lakhs was a new experience. Most of the delay in execution was due to their cautious approach and inadequate cash flow. They always looked for help and guidance. The technical assistants working in this project provided the needed help and advice. The top rung of the official echelon was very helpful, but the middle and lower level officials were not keen to support the associations. In some cases, initially they put minor hurdles and pinpricks. As the project moved on, persuasion and clearing their doubts by the CWR staff started helping to change their attitudes. When the contractors were entrusted with the work, their tender rates were always more than 7–15% of the estimated rates. This provided a buffer for them to meet the unforeseen cost escalations. But as the FA was given the work on nomination at the estimated rates, it encountered losses.

The farmers, with their long association with irrigated agriculture and tank management, are able to visualize the aftereffects of introducing of any new structures in tank system. For example, in the normal design of a canal, more water is carried in the head-reaches and as the canal runs, water is distributed to the branches. Thus, the middle and tail ends receive less water and therefore these canals are designed for smaller capacity. The farmers were against this type of design in Pagadaikulam. They pointed out that as the drainage from adjacent command will also flow in to the canal, the middle and tail end part of it has to be wider as these receive drainage from the head to tail. They were right and the new design was adopted, which satisfied all. In Vengal tank, the construction of a retaining wall blocked the drainage of uplands where dry crops are cultivated. The farmers cut open the wall to ensure drainage for their lands. Other than the villagers, no one could have anticipated this problem.

In Kedar tank, the FA laid a farm road of 4 meters (m) width for 1.5 kilometers (km) length. The road was formed along a distributary channel. For this road, some farmers contributed some part of their lands free of cost. This farm road reduced their transport expenditure on farm inputs and reduced the expenditure to the tune of Rs250 per acre.

4.2.5 Breaking the Barriers for Cooperation

Mobilizing farmers of an entire village will encounter many hurdles. In all these study tanks, the caste barrier was broken through this experiment. The usually excluded scheduled castes (SCs) were recognized as shareholders in the tanks and are given due representation in the executive committees. This was possible because the democratic method of electing office bearers was encouraged. Even in villages like Sennaneri, where a single caste is numerically dominant, all caste people were accommodated in the executive committee. In all the cases, it is not a simple representation but the right to participate in the management of tanks. This also empowers them. As individuals they were reluctant to approach government officials, but as office bearers they have confidence to meet and demand what they are entitled to from the Government. The social discrimination in the use of tank water was minimized.

In financial management, the farmers are quick to grasp any opportunity to adopt new and innovative methods in saving money and mobilizing funds. When they took up the execution of works, the farmers of Sowdarpatti contributed labor and cattle power free to the association. The completion of works and payment for services were well matched to avoid excess payments or nonpayment in Karuppur. This helped them complete the works in good quality on time. The works taken up by the association provided employment to local people, which cannot be expected if an outside contractor did the work.

4.2.6 Lining of Field Channels

Lining of the main canal up to the tail end ensured equitable distribution of water to all. In all tanks, the traditional system of water distribution is followed. This was based on their custom and their concept of equity. The farmers will not accept any change in this. The *pangu* system in Kattiamandal and *karai* system in Kannangudi which are examples of traditional water management practices adopted in tank commands in Tamil Nadu. In these systems, the command areas were divided into a number of blocks and priorities were fixed based on the contributions made by the groups for tank system development and maintenance. As the priority areas are not contiguous, water wastage resulted and water became very scarce. This is now considered against the principle of social justice. First settlers gaining priority over others is seen in the irrigation systems all over the world. In the Vengal tank, traditional water distribution discriminated against the tail enders. Though the water reaches the tail end, the time allocated for the tail end is always during the night. Thus, the discrimination, not apparent, is still there.

4.2.7 Financial Sustainability of Farmers' Organizations

The sustainability of FAs depends on the financial resources available. To strengthen the financial resources of FA, the Irrigation Management Training Institute (IMTI) gave a matching grant toward creating a corpus fund to maintain the tank. The farmers contributed Rs100 per acre and IMTI gave a matching grant of Rs100 per acre. All the study tanks received this. But the interest accruing out of this is not sufficient for maintenance. Hence, the associations mobilized funds through many ways. In Kannangudi, goats are reared to generate funds. Fishing rights from the tanks were usually auctioned in the village and the money received became part of the village common fund. But the government curtails this as of now.

The district administration duly recognizes successful FAs like Kedar for their services. They are made members of the district development council. The financial stability and resources with the association is remarkable in case of Kedar. The FA president was also elected as the president of the panchayat. The FA was able to attract funds from the government under several schemes and carried out many improvements to the tank. Recently, the FA which is rich as well as generous donated money to the panchayat for construction of a school building.

4.2.8 Rural Employment Generation

Tank rehabilitation programs not only helped the farmers, but also agricultural laborers in the village. Usually, these types of rehabilitation works are entrusted to contractors who have a captive labor force. This labor moves from place to place wherever the contractor executes works. Therefore, local laborers would not get any benefit in this form of contract during the noncropping idle period.

As the FA took on the project, it was decided in their respective executive committee meetings that preference had to be given to local laborers and

outside laborers to be engaged only for skilled labor such as masons.

Details of men, women, and skilled laborers from local and outside engaged in this project are furnished in Table 4. It may be seen that the employment generated for local labor varies from Rs200,000 to Rs606,000. So, money allocated for rehabilitation was plowed back into the village. This helped increase the financial status of local laborers.

4.2.9 Problems Encountered

In the estimates, certain quarries were identified to collect broken stone and random rubble. Approved quarries mentioned in the estimates of Thirupunaval, Sennaneri, and Pagadaikulam were closed and the FAs have to obtain the materials from longer distances by paying extra cost. For example, Sennaneri FA incurred about Rs40,000 in added costs.

The execution process in all the tanks dragged on for more than 2 years. The cost of materials and labor increased considerably in the meantime. As the FAs did the work at earlier rates, they incurred considerable losses.

Table 4. Details of Employment Generated

Tank	Internal Laborers				External Laborers			
	Men	Women	Masons	Value (Rs)	Men	Women	Masons	Value (Rs)
1. Kattiamandal	5,528	3,113	–	200,039	2,141	351	–	65,842
2. Kedar	4,956	3,803	–	227,365	–	1,955	2,793	184,528
3. Kannangudi	5,333	11,324	–	606,370	–	–	1,896	27,520
4. Sowdarpatti	6,784	4,872	–	242,680	–	600	652	67,690
5. Vengal	1,881	3,207	181	331,782	1,917	283	1,313	319,498
6. Nandiyalam	5,550	7,778	856	593,940	65	32	82	12,410
7. Tirupunaval	3,773	5,366	–	387,360	354	414	1,536	401,410
8. Samudram	1,086	7,448	–	373,940	–	–	2,942	382,460
9. Pagadaikulam	3,302	3,312	65	312,570	–	–	965	116,940
10. Ayavittan	1,333	985	18	148,160	1,065	1,680	852	271,150
11. Karuppur	3,812	2,055	–	246,125	1,015	723	1,179	169,970
12. Sennaneri	1,921	3,013	1078	382,680	2,145	810	741	261,075

4.2.10 Turnover to FAs

Under the Water Resources Consolidation Project (WRCP), PWD is prepared to hand over the O&M responsibilities below the distributary level of major irrigation systems to the FA. But in the case of the tank system, the Kedar FA through the CWR, Anna University, requested the government of Tamil Nadu to hand over the tank system for sustained maintenance. However, the government of Tamil Nadu is hesitating to do so even after the Chief Engineer, PWD recommended the proposal.

Many departments exercise their control over the tank with command area over 100 acres. It comes under the control of PWD. However, the Revenue Department has hold on the *poromboke* (barren land) and levies a mining charge on silt removed from the tank bed. At times they also control the trees on the tank bunds. The Fisheries Department through fishermen's cooperatives control the pisciculture. The Forest Department is cultivating trees in the water spread area. The panchayat is the local custodian of all water bodies in its jurisdiction. The welfare of farmers who are the end users is not a concern for these departments.

As an experimental measure, the government of Tamil Nadu ordered to entrust the fishing and usufructs rights to the Kedar FA. After enactment of the Panchayat Act, the Kedar FA voluntarily entered into an agreement with the local panchayat to raise fish in the tank and share the profit with them at the ratio of 55:45 with the FA taking 45%. The agreement ensures a reliable income.

In the case of the Pagadaikulam FA, though they have been enjoying fishing rights for over 50 years, the Fisheries Department contested with them and obtained an order from the High Court in their favor. This deprives them of a reliable income of Rs30,000–40,000 per annum.

The FA generates considerable income by allowing the people to cut bricks using tank silt. All these

helped the Kedar FA build up their resource to more than Rs150,000 and take up certain community works such as laying roads, constructing school building, etc. This proves that the sustainability of FA is fully dependent on its capacity to mobilize resources. If the Government wants to turn over the irrigation systems to the FA, it should first ensure a reliable source of income through usufructs rights and fishing rights. The interest accrued from the matching grant is very insignificant. Unless substantial interest is ensured, the success of the FA's take-over of O&M is doubtful.

4.3 EEC Tank Modernization Project in Tamil Nadu

In June 1984, the EEC and Government of India (GoI) signed an agreement to modernize 150 tanks having a command area between 100 and 200 ha. The total command area of these 150 tanks is 18,764 ha, or 3.8% of the command area maintained by the PWD in the State. The average command area is 125 ha/tank.

The project aims to increase food production and rural incomes by achieving higher cropping intensity through improved water management and reduced water losses. The main aim is to obtain a higher production per unit of water supplied and provide equitable water distribution among the farming community. The saving in water use is expected to enable the cultivation of an additional area of 2,653 ha (+14%), giving an irrigated area of 21,417 ha after completion of the project.

4.3.1 Project Components

- (i) *EEC Grant (Civil Works)*
 1. Restructuring of main irrigation/drainage channels, lining of main irrigation channels
 2. Restructuring of tank sluices and weir, desilting of supply channels and tank bunds; improvement to catchment areas
 3. On-farm development works

4. Land grading and shaping, construction of periphery bunds/embankments

(ii) *Tamil Nadu Government's contribution*

1. Establishment charges
2. Machinery, equipment, furniture and their O&M charges
3. Price escalation
4. Appraisal, monitoring, and evaluation in 20 tanks
5. Contingencies and unforeseen costs

The following criteria were followed to select tanks for rehabilitation:

1. Priority to be given to tribal areas and/or drought-prone areas and small and marginal farmers
2. Investment cost at 1985 prices to be less than to Rs16,500/ha
3. Benefit-cost ratio higher or equal to 1.0 except for tribal areas, where it shall be higher than or equal to 0.8
4. Command area less than 200 ha
5. Nonsystem tanks

The project was carried out during 1984–1989. Because of the savings under the present program, and because of the more favorable rate of exchange between the European currency unit (ECU) and the Indian rupee, PWD has requested permission to undertake 60 additional schemes. This was accepted by the Commission provided that the total cost should not exceed the EC grant. Altogether 205 tanks were rehabilitated. The total command area of the 205 tanks is 27,217 ha.

4.3.2 Lessons

The project had the following inherent drawbacks:

1. The data base on which the hydrology of tank was assessed was very weak and it was not on a watershed basis.

2. The government assumed a benevolent paternal role and works contemplated were based on preconceived notions. The knowledge base of the farmers, who are the actual users, was not used. Most of the tanks had problems of encroachment or obstruction in the tank feeder drains, but the project did not pay attention to this component. The farmers were well versed with the control of water in the sluices fitted with plug and socket arrangements, but a steel screw gearing shutter arrangement in which the farmers found difficult to visualize the flow from sluices replaced these old traditional systems.
3. The on-farm development works in the field channels posed cleaning problems as their width were too small.
4. As the work was reviewed by the financial progress, project staff paid much attention to high cost works only. The staff were not inclined to set right any defects pointed out by the farmers, which caused strong dissatisfaction among the farmers.
5. Old weirs were demolished and new ones were built at huge cost based on theoretical flood and not based on whether the tank had breached in the past or not.
6. There was no mechanism to motivate the farmers to take up O&M responsibilities after modernization.
7. The farmers were not involved in planning the rehabilitation.

With the lessons learned from the Phase I rehabilitation, the EU provided another ECU24.5 million as grant. Phase II of the project consisted of the same activities of the Phase I but strengthened and complemented the implementation methods. Phase II was different from the earlier project in the following areas:

1. Selecting tanks for modernization by a social screening process to identify the level of cooperation among the farmers, socioeconomic background, inherent contradictions in the

village, and whether they would be a hindrance to collective action

2. Changing the planning process toward need-based and with the involvement of farmers
3. Reverting to the old type of plug and socket sluices
4. Adopting a rectangular cross section for lined field channels that enabled easy cleaning
5. Minimizing expenditure on surplus weirs

Phase II of the project, carried out during 1989–1996, consisted of:

1. Rehabilitation of 150 tanks, each ranging from 100 to 200 ha, with a total command area of 20,300 ha.
2. Pilot modernization of 80 *ex-zamin* (belonging to *zamindars* or landlords) tanks, each with a command area of 4–50 ha with a total command area of 2,080 ha.
3. Investment costs would be less than or equal to Rs20,000/ha.

The following lessons for future projects emerged from Phase II:

1. The government planned and executed tank rehabilitation without involving farmers in the process. To have an effective rehabilitation and continued sustainability, farmers should be consulted before planning and involved in the rehabilitation process.
2. The yield from catchment and inflows from supply channels are to be assessed more accurately and, wherever possible, measurements be made and recorded.
3. Provision for forming and strengthening of water users' associations (WUAs) should be made.
4. *Ex-zamin* tanks have been neglected for a long time and hence investments to the tanks could be increased.

When the project was going on, the currency value of EU grant appreciated and another 100 PWD

tanks with a total command area of 13,769 ha were rehabilitated. This was considered Phase II–Extension project.

Unlike phases I and II, the Phase II–Extension contained many changes and new components. They are:

1. The cost of rehabilitation provided was Rs11,500/ha
2. Selected lining of field channel was carried out against complete lining followed in earlier projects
3. More emphasis on training of officials and farmers
4. Community organizers (COs) were employed to mobilize farmers
5. Catchment treatment and community wells were included as components
6. Crop demonstration to motivate diversification of crop

Due to the further appreciation of the value of ECU against Indian rupees, additional funds were available. Hence, a windfall fund project was added. Many NGOs in Tamil Nadu working with rural people in small tank commands promote participatory management of tanks. It was planned to utilize the services of these NGOs to motivate and mobilize farmers in the chain of tanks improvement program. This component was significant and pilot in nature on four counts:

1. Farmers' organizations were entrusted with planning and execution of tank modernization program.
2. NGOs were entrusted with mobilizing and helping farmers.
3. The chain of tanks included not only PWD tanks but also panchayat union tanks.
4. Farmers contributed 10% of the cost of works.

Farmers' organizations planned and executed rehabilitation in eight tanks with a total command

area of 1,082 ha. The following chains of tanks were rehabilitated with NGO involvement:

Vallakulam chain of tank	7 tanks	49 ha
Villur chain of tank	16 tanks	589 ha
Nanjoor chain of tanks	17 tanks	468 ha

Thus, with EEC assistance, the rehabilitation of 600 tanks in the state was carried out. Even during the progress of works, both the government and the EEC modified their policies based on the lessons learned.

4.4 NABARD Tank Rehabilitation Project in Tamil Nadu

NABARD under its Rural Infrastructure Development Fund (RIDF) helped rehabilitate 65 tanks in the first phase and subsequently 44 tanks. The main features of the NABARD project are:

- Constitution of tank WUAs and farmers' involvement right from the planning stage
- Lining of field channels up to tertiary level
- Improvement of catchment drains to harvest rain water
- Impart training to farmers in latest agronomic practices and to raise income through agro forestry and fisheries development

The project is conceived from the EEC model modernizing structures and creating an infrastructure by organizing and effecting irrigation management by farmers' participation. NABARD gave assistance for 90% of the works except desilting, which was given only 20–25%. The balance shall have to be provided either by state government or by farmers, or both. But if the cost of desilting is less than 25% of the total cost, NABARD will give 90% per the usual norm. NABARD stipulated that a satisfactory and comprehensive tank maintenance policy, including O&M responsibility and the respective roles and responsibilities of various concerned agencies for sustainable tank maintenance, is

defined and approved during implementation. The role of WUAs in setting and collecting water charges and their responsibility for O&M of the tank are some points to be clearly spelt out.

4.5 World Bank and Tank Rehabilitation Project in Tamil Nadu

4.5.1 Water Resources Consolidation Project

The government of Tamil Nadu initiated the implementation of the WRCP with World Bank assistance. The WRCP is a sector investment program that would respond to various challenges of planning and management of water resources by combining rehabilitation and modernization investments with new, major thrusts in O&M and farmer participation. The WRCP is a 7-year program covering the entire state of Tamil Nadu with the objective of increasing the productivity of the existing irrigation systems through environmentally responsive water resources planning, allocation, and management.

4.5.2 Tank Rehabilitation

The leftover money in the World Bank funds for the WRCP was used to rehabilitate 620 tanks in Palar, Vaigai, and Thamiravaruni basins. The rehabilitation of selected tanks covers strengthening earthen bunds, laying filter and rip-rap, reconstruction of totally damaged sluices, repairing surplus weirs; rehabilitating supply channels and drainage channels, repairing canal structures, and selective lining of channels. In view of the quantum and large-scale spread out of works, the implementation of remedial measures should conform to acceptable quality standards and that adoption of technical specifications should have optimum conformity. The bank also issued guidelines on specifications to be supplemented by the Indian Standard Codes. There was no insistence on farmers' organization and turnover component of WRCP. It was a blueprint approach and PWD decided the rehabilitation works and executed them through contracts.

4.6 EEC Tank Rehabilitation Project in Pondicherry

The experiences gained in Tamil Nadu made a lot of changes in the model followed by EEC when they started funding the Tank Rehabilitation Project, Pondicherry (TRPP), in 1999. There are 83 tanks in the state and all the tanks are taken for rehabilitation including the tanks in cascade and the *anicuts* (check dams) that divert water to the tanks. COs motivate the villagers to form tank associations (TAs) and participate in rehabilitation works. All village communities are members of the TA. Each household has two memberships (landholder and spouse). The TA needs to approve the estimates prepared by PWD. The contribution by community is 12.5% of estimated cost, which can be paid in installments, half at the start of work and the remaining at the end. The time frame for completion of works is rigid and short. A major component of rehabilitation is desilting of tank beds. NGOs are given the task of motivation and developing the organizational capacity of the TAs. One NGO has to look after several tanks. Women self-help groups (SHGs) are also involved in support services and income generation activities like tree planting and fish rearing. A project monitoring unit (PMU) in PWD at the state level is created to monitor the progress of TRPP. The PMU coordinates the activities of PWD and agriculture department with NGOs and the TA. This model contemplated institutional transformation at a higher level like restructuring PWD into the water resources organization (WRO).

The PMU is working with government to bring in legislation for transferring management and maintenance to TAs. Ultimately, the project will transfer tank and feeder channels to TAs with the rights to the use of usufruct. As a number of organizations are involved, coordination among different agencies is a problem and causes delay in planning and implementation. The main weakness in this model is the strict adherence to time frame which leaves the works halfway through. TAs could not build their

capacity within the project period and the sustainability of the TAs and tanks becomes a question.

4.7 Tank Rehabilitation Project in Orissa

4.7.1 Minor Irrigation in Orissa

There are traditional tank systems in the western and southern parts of Orissa, which were under the Madras presidency during the British rule. Nearly 40% of the total minor irrigation (MI) schemes are located in this region. Even after the independence these MI projects (MIPs) were maintained by the Rural Engineering Department, which was formed in 1962 and later in 1980, the MI Organization was established for the schemes having more than 40 ha of ayacut and less than 2,000 ha.

In Orissa, MI schemes are those with a net command area (NCA) ranging between 40 and 2,000 ha. The estimated NCA under MI schemes ending June 2003 was 558,508 ha, amounting to about 21% of the total NCA of irrigation schemes in the state. There were 3,696 MI schemes of which 2,200 were classified as fully operational, 740 as partially derelict, 582 as completely derelict, and 174 under construction. The command area of these defunct or partially defunct schemes amounted to 159,032 ha, which is about 28% of the NCA of all MI schemes. There are 983 diversion weir MI schemes and the rest, 73%, are storage reservoir schemes.

The net area irrigated by tanks (including the schemes maintained by the Panchayat Raj Department) in Orissa in 1950–1951 was about 546,000 ha, which was about 54.22% of the total net irrigated area in the state. From 1955 to 1956, it started declining over time in absolute figures and not in terms of proportion to the total net irrigated area. In 2000–2001, the net area irrigated by tanks in the state was 305,000 ha, which was about 14.59% of the total net area irrigated.

MIPs are currently being developed/rehabilitated/maintained through various state, central, and external aided projects. Some projects are:

- a) EC-assisted MI project in Orissa (rehabilitation)
- b) NABARD-funded MI project
- c) Biju Krishak Vikas Yozana (BKVY)
- d) Central Government funded Accelerated Irrigation Benefit Project (AIBP)
- e) Western Orissa Development Council-funded project
- f) Food for Work Programme (rehabilitation)
- g) National Food for Work Programme (rehabilitation)
- h) Rashtriya Shram Vikas Yozana (RSVY) (rehabilitation)
- i) Sampurna Gram Vikas Yozana (SGVY) (rehabilitation)
- j) Special funds available with district collectors, members of legislative assembly (MLAs), and members of parliament (MPs) are also being used for developing MI infrastructure

Funds available under these projects are used for a range of activities like construction of new projects, completion of incomplete projects, rehabilitation of derelict projects, and maintenance of projects.

4.7.2 Selected Study Schemes

Since the schemes are scattered and the chain types do not exist, the individual schemes have been selected by considering factors such as backwardness, drought effect, rehabilitation requirements, and representativeness of state. The details of selected schemes are given in Table 5.

Out of 47 schemes, 6 schemes belong to Panchayat Raj Department and the rest are under the MI Department. Seven of them are diversion weirs and the remaining are reservoir schemes. Per MI classification, 25 schemes are supposed to have developed full potential, whereas 19 of them are partly derelict and 2 of them completely derelict. The total command area is 7,043 ha and the average per scheme is 150 ha. The average actual *kharif* (monsoon) irrigated area during the last 3 years is 104 ha, which is just 63% of certified *kharif* area. However, only in 10 schemes, the actual *kharif* irrigated area is less than 50% of the certified *kharif* command and in 23 schemes, it is more than 80%. Only 11 schemes have *rabi* (winter) irrigated area with an average area of 17 ha. The total *rabi*-irrigated area is just 2.7% of the total *kharif* certified area, whereas the designed *rabi*-irrigated area is 11% of the total *kharif* designed area. However, the average actual *rabi*-irrigated area for the last 3 years is even less than 50% of the *rabi* certified area. It clearly indicates that the schemes are lagging in *rabi* irrigation although the potential exists.

4.7.3 Physical System

The systems constructed before independence do not follow design standards; hence, the occurrence of incidences of overtopping and breaches like in Kemposara MI project of Keonjhar district. Schemes of pre-independence period do not have proper canal systems. The structures in 41 schemes need either major repair or complete renovation. Only 5 schemes have good distribution network due to recent rehabilitation under the EC- assisted project.

Table 5. Selected Minor Irrigation Schemes

No. of Districts	Scheme	Sub-basin	Agro-climatic Zone
21	Mahanadi subbasins Tel, Ong, and Suktel	Western Central Table Land	Bolangir
21	Baitarani	North Central Plateau	Keonjhar
5	Brahmani	Mid-central Table Land	Dhenkanal

The waterbody/reservoir is also used for bathing, washing, and fishing purposes. Pisciculture is practiced only in very few schemes. In the schemes closer to the urban areas, farmers are not interested in agriculture and *pani panchayats* (PPs). O&M is generally with the department except schemes where O&M of conveyance is handed over to WUAs or PPs. Field-to-field irrigation is followed in all schemes and there are no field channel arrangements. The major and minor maintenance works are being taken-up by the MI department based on the budget allocation (about Rs220 per ha of command area) and through contract system. The role of farmers in these works is limited; the budget provision is also insufficient to keep the system functioning at its full capacity.

None of the projects in the MI sector undertakes scheme rehabilitation holistically. The EC project is attempting to rehabilitate the distribution system and transfer the irrigation management to WUAs after providing adequate training on all aspects with specific emphasis on O&M. In the EC-assisted project, the WUA implements the rehabilitation works in the distribution network after prioritizing the essential and secondary requirements. There is every possibility that the financially strong and influential farmers have hijacked these since there is no advance for the rehabilitation works from the government.

Other than the EC, the MI sector receives fund from NABARD and Gol for (a) completing the ongoing schemes, (b) taking up new schemes, (c) bringing in additional command area, and (d) forming PPs. The MI department obtained Rs20 crores from Gol to rehabilitate schemes in Ganjam and Gajapathy districts through PPs following a similar approach to the EC project.

4.7.4 Projects in MI Sector

MIPs are currently being developed/rehabilitated/maintained through various state, central, and

external-aided projects. The government of Orissa, Gol, NABARD, and EC currently support the MI sector in:

- Construction of new MIPs
- Completion of incomplete schemes
- rehabilitation
- formation of PPs
- employment generation

4.7.5 Institutions – PPs/WUAs

Literature on the traditional modes of water management through communities themselves is few and not comparable to the voluminous literature available in Tamil Nadu. In Southern Orissa, which borders Andhra Pradesh, the traditional systems work very similarly to those in northern Andhra Pradesh because under British rule, they were a part of the same British-administered province. In the northern and western parts of the state, traditional management of tank systems followed the types developed in Madhya Pradesh and Bihar where the village panchayats controlled the tank systems. During the British rule, irrigation panchayats developed and managed the tank systems and remitted the water tax to the governments, retaining a part as commission for running the panchayats.

Historically, there were no formal WUAs but all farmers participated in water distribution, and O&M of tanks as and when necessary. The *chaukidar* (watchman) called the farmers the previous night so that in the morning one person from each family participates in the group work. Disputes among beneficiaries, between tail end and upper end, were resolved through village headman or *mukhia*. Due to farmers' participation, equity, efficiency and sustainability of water use were visible to some extent without the interventions of outside agencies. The farmers decided the O&M of the tanks to prevent wastage of water. Meetings were held in the evenings, usually at the temple. The farmers used to

decide on reducing the frequency of irrigation when the tank did not have sufficient water during years of deficient rainfall.

The two types of farmers' organizations in Orissa are: PPs under the Pani Panchayat Act and WUAs under the EC-assisted MIP. Under the EC project, which is being implemented in 50 schemes, WUAs are formed and registered under Societies Act, 1860. The Pani Panchayat Act was enacted in 2002. The engineers from the Water Resources Department are in-charge of forming the PPs, whereas under the EC project, COs have been recruited for this institutional formation and further support. The PP has to contribute 10–20% of the total rehabilitation cost, whereas in the EU project WUAs do not contribute to the project cost.

Women's role in PPs/WUAs is negligible. In the PPs/WUAs of the selected schemes, only 5% of the members are women. Even in the 50 EC-aided schemes less than 10% are women members. The role of women in irrigation management is not yet effective in Orissa.

The EU-assisted MI project in Orissa that started in 1997 had a limited focus on the conveyance system. The head works and catchment requirements and the institutional aspects are completely absent. The EU project is attempting to rehabilitate the distribution system and transfer the irrigation management to WUAs. The NGOs were involved in mobilizing farmers only for the initial 4 months. The Asian Development Bank (ADB) consultant's report is in Annex 1.

A comparative analysis of MI systems in Orissa and Tamil Nadu is presented below.

1. Minor irrigation systems in Orissa consist of both tank storage systems and diversion systems. The tank storage systems are isolated and scattered and they do not exist in cascade form. In Tamil Nadu, many tank storage

systems exist in cascade form. When these tanks get their water supply from a nearby river or canal in addition to their own catchment runoff, they are known as system tanks.

2. Orissa tank systems can be broadly classified under two categories. Tanks located in Southern Orissa are very much similar to South Indian tanks in their construction and O&M, while tanks in the northern and western parts follow the types developed in Madhya Pradesh and Bihar where the village panchayats controlled the tank systems.
3. Historically, no formal WUAs existed in Orissa, but all the farmers participated in water distribution and O&M. The tanks were managed by the chaukidar and mukhia through traditional institutions. But in Tamil Nadu the tanks are managed by traditional institutions exclusively created for this purpose from time immemorial.
4. Recently PPs under the World Bank's WRCP and WUAs under the EC project were established in Orissa. The Government passed the Pani Panchayat Act 2002 detailing the responsibilities and duties of PPs. In the EC project, the head works are maintained by the MI department while the WUAs look after the conveyance and distribution systems.
5. From the physical system point of view, in Orissa, schemes are designed to supplement the kharif irrigation requirement as about 60% of the kharif requirement is met by the effective rainfall. The leftover water at the end of kharif season is used for rabi cultivation. In most tanks, the area that can be grown with rabi crop is earmarked and designated as "rabi certified crop area." Very little conjunctive use of surface and groundwater is taking place. In none of the schemes studied by the ADB consultant, groundwater utilization was found. In Tamil Nadu, the conjunctive use of tank and well water is predominant.
6. Many schemes constructed before India's independence are not according to design stan-

- dards. Tank bunds, sluices, weirs, and head regulators all need repair and replacement in varying degrees.
7. Encroachment in the foreshore and waterspread areas is visible but not alarming in Orissa. Only those tanks located in a catchment where mining is taking place are heavily silted up. Out of 47 tanks taken up for the study, only 4 tanks are heavily encroached and silted up. Compared to Tamil Nadu tanks, encroachment and siltation are not very serious problems in Orissa tanks.
 8. There are no field channel arrangements in Orissa tanks. Field-to-field irrigation is followed in all schemes. In Tamil Nadu, field-to-field irrigation takes place only in the farmer's plots and not between farmers.
 9. In Orissa tank systems can be grouped into fully operational tank, partially derelict tanks, and completely derelict tanks. In Tamil Nadu all tanks are in operational condition but several of these tanks have not been operated for years due to adequate water supply.
 10. In schemes closer to urban areas, landowners in Orissa are not interested in agriculture and formation of PPs. Tenancy is the mode of cultivation. Landowners in urban and peri-urban areas are keen on tank rehabilitation so that groundwater is recharged and land value appreciates.
 11. In Orissa, a major chunk of O&M allocation by the government goes to staff salary. This practice is not followed in Tamil Nadu where all funds earmarked for O&M go into actual works.
 12. Water management in the tank command is in primitive stage both in Orissa and Tamil Nadu. Conflict between head and tail end farmers is pronounced in Orissa.
 13. Tank water is put into multiple uses such as bathing, livestock use, and irrigated agriculture use.
 14. Water rates vary from crop to crop from season to season in Orissa. In Tamil Nadu, water rates are included as part of the land tax and it varies whether land is used for single or double cropping.
 15. Both in Orissa and Tamil Nadu, water/land tax is collected by the revenue department although PPs/WUAs exist.
 16. Objectives of tank rehabilitation in Tamil Nadu started with increasing agricultural production through better conveyance and on-farm development works and water management, then moved to water augmentation to tank supply coupled with increasing agricultural production; later it aimed at improving livelihood of the local community through multiple use of the tank and its water. In this process, catchment treatment and augmenting water supply, multiple use of water, groundwater recharge, and conjunctive use of surface and groundwater assumed significance. In Orissa, improving the storage structure and increasing the productivity through better water management are still the basis of rehabilitation. Increasing the rabi irrigated area and improving the gross tank product is one of the basic objectives of tank rehabilitation. Hence, the focus of tank rehabilitation is different in the two states.
 17. In Orissa, in the EC project, the WUA is implementing the rehabilitation works. A similar exercise was also carried out in a limited way in Tamil Nadu under the EC-assisted tank rehabilitation project Phase II—Extension and windfall programs.
 18. Rabi irrigation in Orissa covers only 6.4% of total net command area of all MIPs. There is a great potential to increase rabi irrigation through better technical and institutional changes in the existing MIPs.

4.8 Tank Rehabilitation in Karnataka

4.8.1 Present Status of Tanks in Karnataka

Historically, the construction of tanks and their maintenance were seen not only as an ingenious method

of conservation of water resources, but also as a strategy for human survival. Communities, therefore, evolved tank management practices in such a way that incentives for the individual household and the community were provided. Though Karnataka is known for tank management by the local communities, maintenance and management practices introduced by the State in recent years have undermined the importance of community participation. The consequence is that a large number of tanks in Karnataka today become ineffective or in some cases defunct, the area irrigated by tanks has declined, and the local ecosystem deteriorated.

The tank was meant not only for agriculture but also served as a resource base for many other activities like collection of fodder and fuel, making of bricks, pots, and baskets, etc., with women always offering their assistance in these processes. Hence, the tank and its surroundings used to be the common property of the village and its people. With the maintenance of natural resources through a continuous process of use and conservation, the eco-balance was maintained and this directly benefited women. This enabled better subsistence for people living in these villages.

Two hereditary village functionaries, *thoti* (sweeper) and *neerugandi* (one who fills water in the fields) have traditionally played a key role in most tanks. In the past, the tank functionaries received land grants (*inam*) in the tank command area in return for their services. Several welfare-oriented legislations after independence in 1947 witnessed the abolition of the *inamdari* landholding pattern and hereditary village offices. Also, there were changes in the land use pattern affecting the catchments of the tanks. The gradual spread of alternate means of irrigation (bore well and use of diesel or electric pumps) has contributed to the decline of community interests in maintaining and managing tanks. All these processes have led to the current state of degradation of tanks in the state.

4.8.2 Tank Administration in Karnataka

Karnataka has 36,672 tanks with a command area of around 690,000 ha distributed in 27 districts. About 90% of these tanks have a command of less than 40 ha. The actual irrigated area is about 35% of the total registered potential of tanks. Since 1997, minor irrigation activities are handled by the Department of Minor Irrigation (DMI). The administrative perception of a tank seems to be purely in engineering and technical terms while expertise from other fields (e.g., agronomy, hydrology, watershed and social sciences) for a holistic management of tanks is woefully missing. The DMI looks after the tanks with command area of 40–2,000 ha, while tanks with less than 40 ha command area are in the care of *zilla* (district) panchayat, and those with above 2,000 ha are with medium and major irrigation departments. One of the major reasons for the decline in tanks is lower budgetary allocations, both on capital investment and maintenance, and repairs. The data indicate that investment in minor irrigation sector declined from 64.6% in 1991–1992 to 25.6% in 1995–1996. Out of this, nearly 63% of this investment went to tanks having a command area of above 40 ha which are under the control of DMI, while the category of tanks constitute only 9% of the total tanks in the state. Effective July 2001, water rates have increased by twice or thrice the previous rates. Previously it was Rs8–225 and it now is Rs15–400. However, low cost recovery contributes to the poor O&M of the irrigation systems, which in turn, makes it even more difficult to collect the water charges currently levied. The senior staff of DMI is convinced that involving users is crucial in the O&M of the structures.

The government of Karnataka recognizes the importance of tank rehabilitation. However, no holistic planning or management has been contemplated for the sustainability of the benefits. Neither the improvement of catchment of the tanks to increase the flow but to arrest the flow of silt nor

the need for hydrological analysis based on existing data and available technology have been considered as integral to the tank rehabilitation package. Moreover, the linkages between irrigation and agriculture, horticulture, safe drinking water, etc., need to be more clearly established to help ensure that improved water management translates into concrete improvement in livelihoods. The minor irrigation sector requires a coherent strategy for development. The linkage between the sector and the major irrigation sector appears weak. Tank improvement and management have not been dovetailed into the overall improvement program of the watershed/sub-basin to integrate all uses of water and all available water resources to maximize benefits. Detailed water accounting/auditing of each watershed has to be carried out. Issues such as improving the groundwater regime to enable conjunctive use, catchment area treatment to reduce further silting, integrating programs like fisheries, strong irrigation-agriculture extension, etc., have not been considered in the planning process. Moreover, involving communities such as WUAs, panchayat raj institutions (PRIs), etc. in planning, implementing, and managing the tank system has not been put into action.

4.8.3 Water Users' Cooperative Society

Raju et al. (2003) argue that the process adopted in the formation of water users' cooperative societies (WUCS) seems to have failed to translate ideas incorporated in the policy document such as public awareness, stakeholders' mobilization, membership enrolment, formation, and training into practice due to:

- (i) the target-oriented approach followed by officials;
- (ii) lack of orientation to ground level functionaries;
- (iii) the concerns in community mobilization being essentially confined to the principles of the water policy rather than addressing sustainable community participation; and

- (iv) the formation of WUCS, which was considered a necessary evil to obtain resources earmarked for tank rehabilitation.

The government of Karnataka amended the Karnataka Irrigation Act 1965 in 2000 to provide scope for establishing WUCS for command areas extending from 500 to 700 ha. The analysis of operational feasibility revealed that establishing an institution on command area basis by clubbing more than one tank under a cooperative act would be a nonviable proposition. The government of Karnataka has changed this provision through an Act in 2002, which provided organizing tank users' groups (TUGs) under the Societies Registration Act for individual tanks. In a significant and far-reaching step toward strengthening rural decentralization, the government of Karnataka has transferred all the tanks having a command area of up to 40 ha to the control of *gram* (village) panchayats with effect from April 2004 and is in the process of evolving required operational guidelines for gram panchayats to function effectively.

4.8.4 Community-Based Tank Rehabilitation Project

The state of Karnataka has taken a much-needed initiative to rehabilitate minor irrigation (MI) tanks, numbering 2,000 on a pilot basis through community-based approach. The main focus has been on small tanks (below 40 ha of command area) with a view to improving the livelihoods of marginal and small farmers, besides landless families and households. In the community-based tank rehabilitation project, the premise is that utilization of local knowledge systems enables the communities to participate in the project, feeling responsible and taking pride in designing the rehabilitation plan and implementing the same.

As part of the initiative, the government of Karnataka has set up a separate and autonomous society called Jala Samvardhane Yojna Sangha (JSYS) as

a special purpose vehicle. JSYS has power to make decisions faster and even simplify procedures for effective implementation of World Bank projects. JSYS has initiated tank users' associations on a pilot basis and launched different studies to study the current situation and suggest strategies.

Rehabilitation of tanks with community participation is expected to have an overall positive impact on the immediate environment. Rehabilitation of tanks results in an augmented supply of irrigation water, better recharge of groundwater, improved quality of drinking water, increased production and productivity, enhanced employment opportunities, and better well-being of the stakeholder communities. Moreover, project interventions or activities would help in better management of natural resources and improvement of the overall environment and local ecology. An analysis of a range of rehabilitation interventions and the possible impacts of such interventions are:

- (i) Most of the time, silt removed from the tank bed is disposed off near the tank, which gradually shifts back to the bed during monsoon. Improper disposal of silt may create environmental problems.
- (ii) Increasing the full tank level of a tank may cause submergence of foreshore lands, impact on the downstream use of water in a cascading system, and may cause conflicts.
- (iii) The unscientific use of land and neglect of the catchment leads to soil erosion and degradation of land resources. Encroachment on feeder channels and foreshore areas, and cultivation of these lands add to sedimentation and silting of the tank structure.
- (iv) Rehabilitation interventions are expected to contribute to reasonable environmental conservation, and improve the productivity of land in the project area. Major benefits are for the farmers having lands in the command area of the tank. Nevertheless, renovation and rehabilitation of the tank would benefit other sec-

tions of the society by way of using excavated silt as organic manure, recharge of groundwater, and increased opportunities for employment.

Potential environmental benefits from rehabilitation are:

- (i) increase in the tree cover;
- (ii) rehabilitation of degraded lands in the catchments;
- (iii) increased bio-diversity and preservation of soil biota;
- (iv) reduction in soil erosion, including loss of nutrients;
- (v) improved soil moisture regime and hence, better vegetative growth;
- (vi) increased fodder production, greater management of fodder resources;
- (vii) increased bio-mass production and soil improvements;
- (viii) increased groundwater recharge and groundwater availability;
- (ix) improvement in quantity and quality of drinking water;
- (x) increased storage capacity and increased quantities of water available for irrigation; and
- (xi) clean and better environment.

Potential socioeconomic benefits of rehabilitation are:

- (i) reduction in the risk of crop failure;
- (ii) improved production and higher income;
- (iii) equitable distribution of water for command farmers;
- (iv) improved nourishment (through fisheries development);
- (v) increased opportunity for gainful employment;
- (vi) reduction in seasonal migration by landless and poor households;
- (vii) increased family income;
- (viii) improved quality of life;
- (ix) improved interaction among different communities;

- (x) improved livestock and milk production;
- (xi) minimizing tank breaching; and
- (xii) increased availability of water for livestock and humans.

Potential risks associated with a rehabilitation project are:

- (i) change in the diversity of flora and fauna;
- (ii) alteration of surface runoff process;
- (iii) change in groundwater recharge and more abstraction;
- (iv) check dam failures;
- (v) waterborne and water related diseases;
- (vi) environmental pollution of silt removal;
- (vii) water logging, salinization, and alkalization;
- (viii) shift from subsistence to commercial agriculture;
- (ix) pesticide and insecticide pollution;
- (x) switching to mechanization, less labor-intensive technologies; and
- (xi) soil fertility depletion due to extensive farming.

The capacity building and training interventions of the community participated project was focused to build the operational and technical skills of implementing agencies as well as the users' group. The experience of JSYS during the past 4 years shows that exposure visits and onsite hands-on training are more effective than the structured modules.

4.9 NGO Experiments

4.9.1. Grama Vikas, Karnataka

Grama Vikas (GV) is a rural development NGO, manned mainly by women, in Mulbhagal taluk (block) in Karnataka's Kolar district. Its tank programs are more than 2 decades old. It started the tank program by providing small cash subsidies and loans for those who apply desilted earth from tanks as manure. According to the organizers, the program serves the poor and marginal landholders who own tank ayacut as well as small areas

of dryland in the same villages. The organization selects its target villages based on its own assessment of participation by people, having a good SHG, and having presence of a *dalit* (backward caste) population, and small and marginal landholders.

The long-term average annual rainfall in this district is 750 mm, with the lowest recorded at 560.3 mm and the highest at 1,215 mm. The rainfall record of this area shows that there is drought every alternate year while there are floods in the other. Scanty rain and deforestation have reduced green covers, increased soil erosion, and reduced percolation to groundwater.

Because of the proximity of Kolar to the state capital, Bangalore, and dictated by market forces emanating out of the metropolis, the district agricultural economy has transformed into a "silk and milk" revolution with growing of mulberry and mushrooming of dairies which was achieved by indiscriminate and high-risk exploitation of groundwater through bore wells. Groundwater levels have now gone down to below 400 ft; most dug wells have gone dry and so have many tube wells. Most marginal and poor farmers (owning less than 2–3 acres) belonging to scheduled castes (SCs), scheduled tribes (STs), and other backward communities are the hardest hit by the changing commercial cropping pattern that is nonsustainable and has lowered the water table to such an extent causing migration, environmental damage, and ecological disaster to this area. The shift in cropping pattern in favor of cash crops has serious consequences as the fragile agriculture is threatening food security for vulnerable and at-risk families. GV, working in 265 villages in Mulbhagal taluk, is attempting to place commercialization of cropping pattern as one of the items in public agenda through sensitization campaigns. It carries out actual desilting of tanks to demonstrate its utility of increased storage in tanks and to afford relief to marginalized communities by way of wage employment. With periodic droughts

and scarcity conditions becoming increasingly common in the district, the plight of tanks forebodes an ecological and human disaster. The solution as per GV is an integrated project for recharging groundwater by undertaking a comprehensive tank management project for the area as a whole.

GV has been working with policymakers and opinion builders about the urgent need to desilt tanks. As a pilot project to prove the benefits of desilting tanks and to provide employment to the poorest of the poor in its projected area, GV in collaboration with people and their participation has helped desilt 13 tanks in Mulbhagal taluk. Initially, GV directly financed a tank desilting program in 2 tanks with funds from the Dutch institutional donor, NOVIB. In 1997, GV experimented with sharing the cost of tank desilting with people. The women SHG Federation took a bank loan for desilting by using donor funds received from NOVIB as collateral.

The five stages in financing the desilting of tanks are:

- Stage 1. GV bore the entire expenditure of desilting two tanks.
- Stage 2. GV bore 60% of the expenditure of desilting of tank and people contributed 40% by way of labor.
- Stage 3. People (women SHGs) bore 75% of the cost through loans from banks under NABARD's bank linkage program.
- Stage 4. 100% cost-bearing by people through loan from GV
- Stage 5. 90% grants from donors for desilting (Present) and 10% contribution from the members

Once a tank is selected, the SHGs existing in the village are used as a vehicle to implement the tank desilting works. No specific resource-based organizations are established for tank management. The organization believes that the SHGs shall take up all future development issues related to the tank.

The tank works done by GV includes eviction of encroachments, jungle cleaning, stone revetments on the bund, casing of the tank, repairs to the sluices, check dam construction, and desilting works. The cost estimate for tank desilting is based on the farmers' willingness to desilt. Hence they have no fixed plan for a given tank on how much desilting works they will do in a given period of time. The desilted earth is used by the dryland holders as manure. A part of the earth is also used to reconstruct the bund by "casing". The organization believes that they are using only a small amount of money for casing the bund considering the total requirements for the tank desilting works needed to be done. Hence, it is noted that desilting—removal of large volume of earth from the tank bund and disposing it in the drylands—is the core of the cost from the funding perspective.

Box 1. Sample Costs

Baduvana kere (tank) in Minijenahalli in Mulbhagal taluk of Kolar district has about 27.75 acres of irrigated area served through its 17.5 acres of water spread. It has undergone tank rehabilitation and desilting works over the last 3 years using about Rs800,000 by Grama Vikas. These funds have been spent for desilting (Rs615,000), tank bund strengthening (Rs75,000), tree planting (Rs60,000), and check-dam construction (Rs 50,000). According to the villagers some more works are still left to be completed. Apart from this, the *zilla panchayat* (district government) has spent around Rs80,000 on bund strengthening works in the same period on this tank. The unit cost based on the irrigated area being served by the tank stands at Rs32,000 per acre. The villagers feel that more desilting work needs to be carried out.

Mallikunta in Nagamangalam village of Mulbhagal taluk has around 44 acres of *ayacut* (selected part of tank command area) with 28 families. The tank which is heavily encroached has been revived with funds amounting to Rs585,000. Most of the funds are meant for desilting alone and a small amount is meant for bund strengthening and supply channel works.

The works are estimated based on the perceived needs of the village farmers (not necessarily the water users alone). Also, no strict engineering estimation guides the tank rehabilitation components (bund strengthening to the standard specifications is not followed). Usually engineers or technically trained staff are not placed in the project for planning or implementation. Women staff who work as program officers and organizers in the GV do the planning, implementing, and monitoring.

- *Bund Repairs:* As long as the villagers feel that their bund requires a certain quantity of earth, that amount of earth will be dumped, thereby making the bund stronger. In all tanks visited, the bund is stronger and the quantum of material used is over and above specification, at least for the height of the bund.
- *Desilting:* The desilting works are done by using manual labor for digging and loading, and tractors for transporting. A typical tractor would cost Rs800/day of rent and require 11 laborers for loading, with a total labor cost of Rs440. In a given day, around 25 cubic meters of earth is desilted and moved to the fields. Roughly two thirds of the total cost goes to the tractor and the rest goes to the laborer. A typical tractor in the beneficiary village utilizes their household labor and makes the wages for themselves. The tractor is hired either from the same village or from the nearby village.
- *Organization for Implementation:* The village level tank desilting project is implemented through the SHGs. Typically, a best performing SHG is given advance payments from the sanctioned budget of the project. The SHG operates a bank account signed by its secretary/president along with a signatory from the federation of SHGs housed at Honnesethalle, the GV headquarters. All the accounts are audited and properly monitored. According to the organizers, the SHGs are the center of the project and activities revolve around them.

It is relevant to understand the rural women federations called locally *grama mahila okkutta* (GMO). This federation is a spin-off organization of GV and registered as a separate society and housed at the GV headquarters. Usually, SHGs are formed at the neighborhood in the villages constituting the most deprived women. They have elected office bearers who are changed every year. Around 15–17 SHGs are clustered across the village and each cluster has an office. Usually, the tank projects are operated from this office at the village level. They too have a board whose members are elected every year. The GMO or the apex federation is housed at the GV headquarters. The SHGs are represented by two members from each cluster in the general body of the GMO as members. The GMO has a secretary, president, administrative officer, accountant, and 18 paid staff. The treasurer of the federation is appointed and is a signatory to all bank accounts. All transactions are through banks. The GMO takes up group promotion, networking, and advocacy at the district level. The federation is also linking with the state level networks and works for enacting good policy at the state level. GV has undertaken a project to desilt the tanks using NABARD loans under a self-help linkage program. Around Rs900,000 have been taken up as a loan with 12% interest. This has been executed and completed using the SHGs. However, as the SHGs faced difficulties in repaying these loans, it has been repaid from grant funds provided by the donors. This experiment, according to them, is a statement of their strength in experimenting with loan funds for a natural resource management activity.

The farmers express the impacts of the tank desilting works as:

1. protecting and saving the tank from encroachments,
2. improvements in tank irrigation,
3. improvements in the crop yields in drylands, and
4. improvements in groundwater recharge.

Although desilting of tanks with local involvement, notably of women, has already started, it is a mammoth task and the government needs to be pressured to change its rural development strategy of focusing on major irrigation projects that benefit only a few affluent farmers; it needs to pay attention to the minor irrigation tank projects that benefit marginally poor and subsistence farmers.

The project in many ways is a pioneering experiment. The following observations were made based on discussions with GV staff and field visits:

1. SHGs formed with the women are used as the vehicle for implementing the project. There is no separate organization for the resource conservation of the tank. This is different from the usual model of resource-based/users' organizations that most organizations promote.
2. The cost of tank works proposed by GV ranges from Rs30,000 to Rs50,000 per acre of irrigated area served by the tank. The organization believes this is a small amount compared to the real needs of the tanks.
3. The project involves 10% contribution from the villagers for the works. GV believes that this 10% contribution is achievable; and beyond this will not be feasible.
4. There is no full-fledged engineering staff to estimate the needed work to be carried out for each tank.
5. The bund strengthening and typical rehabilitation works are limited to around 10–20% of the project cost and the desilting component stands at more than 70% of the project component.
6. The projects are implemented beyond 1-year period because of the large volume of silt being removed.
7. The use of the project is seen more as a desilting and application of silt for the drylands rather than an irrigation project alone. The major and immediate beneficiaries of the project are the dryland users.
8. The demand for silt in the drylands is seen as the factor deciding the cost of the project and so there is no limit for a given tank. The work depends on funds made available for the tank rather than decided based on predetermined local factors.
9. The project does not use engineers or technical people at the village level for planning and implementing. However, managing the work is based on simple calculations of labor and tractors engaged.
10. A family in the beneficiary village on an average gets Rs7,000–14,000 per annum as wage laborers by working on this project. Their family's contribution to desilting activity is limited to Rs1,000 or less.

4.9.2 Development Humane Action Foundation, Tamil Nadu

For the purpose of discussing Development Humane Action (DHAN) Foundation's action in tank-related works, we divide the areas where tanks are taken up for development into four broad zones:

1. Areas where tank are the only source of water: Coastal plains of Ramnad and Thiruvallur districts in Tamil Nadu
2. Areas where conjunctive use of tanks and wells exist: Madurai, Kancheepuram
3. Areas where tanks are the source of recharge: Theni, Pondicherry
4. Tank-based watersheds: Chittoor district in Andhra Pradesh

In taking up conservation and development of tank programs, the DHAN Foundation has taken up three broad approaches depending on the local context and the amount of funds made available under different programs of government funding. They are:

1. Isolated tank development works
2. Tank cascade development works
3. Tank-based watershed works

The program has a number of necessary components to ensure that the interventions are sustainable in the long term. The measures that are proposed in the rehabilitation of tanks comprise improvements not only to the physical works, but also institution building and the software aspects like O&M of water resources. They comprise the following activities:

(i) Selection of Tanks

The tank irrigation systems taken up for rehabilitation are spread over the three states of Tamil Nadu, Andhra Pradesh, and Pondicherry. The development blocks are selected based on the scope for working with the marginal communities in tank-fed agriculture. The villages and tanks are identified in such a way that there is a demand and willingness of the farming community to participate in this program. Some important criteria used for tank selection are:

- presence of small and marginal cultivators in majority
- good scope for improvement based on the tank hydrology
- incidence of poverty (identification of poor families through wealth ranking)
- good leadership and cohesiveness in the community
- willing farmers to contribute a part of the project cost through labor and/or money, while the landless will contribute labor
- willingness of the community to execute the works themselves without involving contractors; maintain and manage the system thereafter
- participation of both women and men in planning and implementing the program

By and large across all areas, DHAN has five major activities, which shall be adopted in the project's implementation. These activities are evolving processes and not rigid across the teams that implement these projects.

(ii) Rehabilitation of Tanks

Rehabilitation includes not only restoring these components to their originally designed standard but more important, facilitating the efficient water management and improved cropping practices. However, DHAN Foundation's program components will be limited to the availability of funds and the willingness of farmers to contribute and work together for their tank. This practical approach in taking up the conservation works is followed rather than a technically predetermined level of works in the tanks.

The rehabilitation works include mostly the following:

- closing of breaches on bunds caused by floods
- bringing the bund to the standard size by adding new earth to them
- clearing of bushes and excavating the supply channels and making them free of silt
- repairs or reconstruction of sluices to reduce the leakages
- plantation works on the bund and other works needed for managing the tank systems

The process adopted to draw the plans for rehabilitation will be done through a graded approach, discussed below.

(iii) Prioritization of Works

The people felt needs and priorities are given importance in formulating detailed work plans and cost estimates, as the planning itself is done with people's involvement. The works included in the tank rehabilitation follow an order of priority, which the users perceive as most important. They are:

(1) Acquisition of Water

- encroachment eviction
- cleaning and desilting feeder channels to augment water inflow into the tank

- clearing of weeds and other undesirable vegetation on the tank bed

(2) Tank restoration

- restoring tank structures like tank bunds to their original design so that they are strengthened adequately to withstand floods
- repairing or reconstructing water regulation structures like sluice outlets and surplus weirs to prevent loss of tank water
- involving landless under wage employment
- planting and preserving fodder, fuel, horticulture, or herbal plants in the tank foreshore and on the tank bund

(3) Improvements to water use efficiency

- replacement of damaged or missing shutters in sluice outlets, which prevents wastage and facilitates easy regulation of water to command area
- restructuring the existing water distribution channels and providing distribution boxes and selective lining in the distribution systems, as may be required in the tank command area, to improve the water use efficiency of the system

Tank-fed agriculture is a gamble as the tanks depend on adequate and timely onset of monsoon rains for their water storage. During deficit rainfall years or during the years of delayed onset of monsoon or early withdrawal, the farmers in the tank command face difficulties. Under this component, DHAN proposes to provide community dug or tube wells in the tank command or in nearby wastelands or in the water-spread areas. These assets help farmers ensure crop production by supplementing tank water and by practicing conjunctive use. This is subjected to the availability of funds, technical feasibility of digging wells, and the agreement of the farmers.

Field demonstrations and crop diversification are put out in a number of areas from high water requiring food crops like paddy to low water requiring commercial trees like coconut, cashew, and crops like pulses or chili. This approach enables the farmers to build their confidence and strictly plan their cropping pattern based on water availability in the tanks. The farmers are given appropriate advice regarding the crops and cultivations.

Under this component, *vayalagam nilayam* (plant clinics) at tank cascade/block level are promoted. These clinics will disseminate information and train farmers on improved water management and agricultural technologies, integrated pest management, bio-fertilizers, organic farming, etc. Apart from this, farmers are encouraged to go for seed production and exchange of seeds.

The intensive activities of the tank program are during rehabilitation works. During this period, which ranges from 3 to 6 months, the farmers participate in meetings, labor, purchases, and problem solving. However, the intensity of their collective action needs to be kept throughout the year. Therefore, microfinance group activities have been identified as the platform to bring farmers together at frequent and regular intervals with a meaningful purpose. These groups are formed with the tank farmers as members and they are encouraged to save, lend, and take loans from banks under any credit project.

DHAN Foundation also mobilizes the support of philanthropists to create endowments that will be made available in the villages through the tank FAs to conserve and develop these common properties. Sir Ratan Tata Trust, Mumbai had donated Rs5 million to this endowment program for establishing endowments in 500 small tanks. An equal amount will be mobilized by the villagers for the same tanks. The fund would become a rallying point for the villagers and would be made available for small

repairs and development works. DHAN Foundation also expects that philanthropists interested in water resources would come forward in a big way to support these efforts. Apart from this, under the watershed program, DHAN Foundation raises a 25% contribution from the farmers; the same is put as a corpus for their associations at the end of the project period.

4.9.3 Institute for Youth Development, Karnataka

Institute for Youth Development (IYD) is an NGO working since 1978 with an emphasis on organizing and promoting youth participation in development. IYD is engaged in participatory tank rehabilitation. The objective is to rehabilitate all natural resources and CPR with the evolution and reestablishment of traditional decision-making and management mechanisms at the village level and to create a regenerative, self-supporting agro-eco system. IYD conducts participatory rural appraisal in the village and a perspective plan is prepared by the villagers for a comprehensive rehabilitation of tank, watershed, command area, and other CPRs. Soil conservation, check dams, and afforestation are carried out in watershed development. Tank desilting is done and the removed earth is used to strengthen the tank bund, application in drylands, road-building, and filling pits in the village. Improved agronomic practices and crop planning are the activities in the command area. All the women in the village are grouped and formed into SHGs and they are empowered with income-generating activities. A cooperative society is formed to look after the entire tank from watershed to command area. They are also taking up activities to augment their financial resources. Farmers have to contribute 30% of the cost of rehabilitation and IYD will ensure 70% from donor agencies like the Council for Advancement of People's Action and Rural Technology (CAPART). Their contribution can be both in cash and in manual labor.

4.9.4 Palmyra, Pondicherry

The Palmyra, an NGO in Pondicherry, has initiated a tank rehabilitation project with the assistance of Indo-Canadian Environment Facility. The weaknesses of this model are:

- Tank proper alone is the main focus of rehabilitation.
- Tank hydrology and augmentation of water to the tank are not given importance.
- Government machinery is not involved.

4.10 Lessons Learned

Tank rehabilitation projects had undergone many changes over the years in terms of their objectives of rehabilitation, funding pattern, and physical components selected for rehabilitation and institutional changes.

Tank rehabilitation was started 2 decades back purely as a physical rehabilitation to increase agricultural productivity with very little emphasis on institutional strengthening and poverty alleviation. Examples of this type of rehabilitation are those implemented by the State of Tamil Nadu under EEC phase 1 funding of late tank rehabilitation. Focus has been shifted to poverty alleviation through increased agricultural production (World Bank funding in Karnataka for JSYS and EEC funding in Pondicherry). Multiple uses of water and tank beds and bund for income generation are given importance in these rehabilitation projects. The landless and poor are included in tank user's groups (TUGs). Funding for income-generating activities through SHGs are provided for in the tank rehabilitation budget. Institutional strengthening of TUGs through NGOs are included as a component in the tank rehabilitation. TUG formation through an NGO is a prerequisite for taking up tank rehabilitation (NABARD). Water distribution through lining of canals in the distribution system was given preference initially (EEC phases 1, 2, and extension). Now with water

scarcity looming large, the emphasis has shifted to water acquisition and augmentation through catchment treatment, supply channel improvement, encroachment removal, desilting, raising of tank bund, and improvement of control structures. Water augmentation to tanks is now the focus (JSYS, NABARD). Rehabilitating a system of tanks (cascade) instead of taking up individual tanks has advantages.

The practice previously adopted in expending the entire allocated budget to physical rehabilitation work without providing funds for training, capacity building, and minor modifications of the rehabilitated system has a deleterious effect on the functioning of rehabilitated works. A major complaint in most of the rehabilitated system is that rehabilitation is considered a one-time activity and when the stipulated period of rehabilitation is over, neither the implementing agency nor the NGO revisits the system to provide advice and/or to carry out minor modifications and repair, if any. Moreover, no fund was left for making any small modifications in the rehabilitated system to make it work smoothly. Also, the time-bound left work unfinished in several tanks when the implementing agency left. The TUGs did not have adequate funds or the capacity and training to complete the work in all aspects. The result is an unfinished system functioning poorly.

Farmers' involvement with their contribution with labor and cash in the rehabilitation processes is important. For their complete involvement, they must understand what the rehabilitation project is going to offer to them and what their specific roles are in decision making, implementation and maintenance, and management of rehabilitated system. If the TUGs are convinced that tank rehabilitation is going to provide benefit to all, then they have provided as much as 30% of total budget as their contribution to rehabilitation as we had seen in many tanks rehabilitated with NGOs' help (DHAN, IYD, Palmyra).

Institution building—which includes awareness creation, formation and strengthening of TUGs,

training, and capacity building—is given least importance in many rehabilitated projects. When the implementation phase is over, both the implementing agency and NGOs leave the work spot abruptly with very little arrangement for the TUG to interact with those responsible for tank rehabilitation. Arrangements must be made for the project implementers to visit the rehabilitated tank periodically and provide support for a year or 2 after the construction work is completed. Instead of an abrupt withdrawal, a gradual withdrawal strategy needs to be introduced to strengthen the maintenance and management component of tank rehabilitation.

In many tank rehabilitation projects, farmers have proved capable of carrying out rehabilitation work in an effective way, in terms of quality and cost effectiveness. However, they need more time and training to carry out the rehabilitation work due to their inexperience and for want of adequate financial resources. In this connection, they require adequate advances and training to complete the work in time. In the event that the TUGs are not willing to implement the work, the TUGs suggest that rehabilitation work be allocated to a contractor approved by the general body of the TUG. Experience shows that these contractors recruited from within the village or from neighboring villages do the work more satisfactorily than others from far-off places. Such recruitment and implementation will go a long way in ensuring the quality of work and creating an environment for the ownership of the project implemented.

Provision of dead storage for human and livestock use, and artificial recharging of groundwater wells have been increasingly preferred (tanks under JSYS). Use of tank storage for artificial recharge at times of scarcity (using tank as percolation pond) is fast catching up and thereby the number of wells in the command area is increasing. Because of wells, orchards and cash crops are replacing cereal crops and crop diversification is taking place. Provision

of dead storage through desilting is a most preferred component of tank rehabilitation

It is now accepted that in view of the multiple uses of the tank and its appurtenant structures, everyone in the village community including the landless must become members of the TUG. Involvement of two members from a household (one man and one woman) in the TUG as practiced in Pondicherry is a better proposition as many men migrate for work while women stay at the village level to take care of the family, livestock, and agriculture.

Formation of SHGs at the hamlet/village level is fast spreading. The training as SHG members considerably help them to actively participate in tank rehabilitation work. The SHGs had taken a contract of tank rehabilitation and completed the work in a satisfactory manner under JSYS. SHGs formed at the village level should actively participate in tank rehabilitation work and subsequently make use of tank infrastructure to support their livelihood through usufruct income from tank bed and bund and fishery and forestry.

5 LIVELIHOOD AND GENDER ISSUES IN TANK IRRIGATION

Sophia and Anuradha (2005) examined the various livelihood options in tank irrigation under different scenarios and gender-related issues in tank rehabilitation. This was based on a research study of 40 rehabilitated tanks under different models in three states of Tamil Nadu, Karnataka, and Pondicherry. This chapter reports the findings of this study on these issues.

5.1 Livelihood Options before Tank Rehabilitation

Statistically, the rain-fed tanks receive full storage only in 2 years out of 10. They get half filled in 3 years and less than one third filled in 3 years. They go dry in the remaining 2 years. With this precarious condition, the marginal farmers have to work in other fields to earn their livelihood during years of less rainfall and deficit inflow to the tanks. Moreover in the years of poor storage, farmers have to switch over to rain-fed dry crops. Cultivation of these crops is not as labor-intensive as paddy. Most landowners use household members and do not employ outsiders. Under this situation, the option for the landless and other marginal farmers is to migrate to nearby urban centers to earn a living. All able-bodied male and female members do this but the old and the children remain in the villages. Generally, those who remain earn their livelihood through cattle grazing, poultry rearing, collecting fuelwoods, etc. This opportunity is not always available to all. If lands are kept fallow, fodder is not

available and results in distress sale of cattle. The entire economic activities of the community are thus decided by whether tank gets filled or not.

If the tanks do not get filled regularly, maintenance works of the tank systems is poor, thus reducing tank flow. The wells in the command area are also not getting sufficient recharge and poor distribution network adds to reduced irrigated area. As a result, agricultural labor availability and income from tank-irrigated systems are reduced. Combining the above factors makes temporary migration and daily commuting to nearby towns as a way of life. For example, in Samudram tank, Thiruchirpalli district, about 37% of the total 626 households migrate during a dry year to nearby urban towns and to other states as workers in small-scale industries and other types of income-generating activities. The presence of 60 wells in the command area of 109 ha in Samudram tank could not sustain the agricultural activities, which compels about 29.5% of the landed households to migrate to neighboring villages as agricultural labor.

5.2 Employment-generating Activity during Tank Rehabilitation

Tank rehabilitation projects in the beginning years (during the 1980s) were implemented by contractors and focused mainly to benefit the farmers. Usually rehabilitation works are entrusted to contractors who have a work force, which moves from

place to place where the contractor executes works. Contractors do not employ local labor. However, in the tanks where rehabilitation work was implemented by the local community with stakeholders' participation, the local landless and the poor are employed to work on the project and earn wages. This provided the livelihood during implementation of rehabilitation works.

Table 6 gives data on local and external labor engaged in tank rehabilitation projects. The table also shows that a minimum of 0.05% to the maximum of 0.31% of the total estimated cost is plowed back to the village, which helped increase financial resources in these villages.

5.3 Other Benefits during Rehabilitation

The Maragondanahalli villagers adopted an innovative idea to use the removed silt during desilting work. There were big depressions in the front and backyards of many houses. Some houses were built in these pits. In these depressions people used to dump cow dung and waste, making them a breeding ground for mosquitoes. The people agreed that the silt could be dumped in these pits and some of them rebuilt their houses in the filled-up place. This idea was laudable on three counts:

1. It led to reduced costs
2. The environment became clean
3. The removed silt was used beneficially

Even a road was formed using the silt. A total of about 2,000 loads of silt was removed. The removal of silt created a 5-foot deep pond in one acre in the tank below sill level. This dead storage is used for other uses like bathing, cattle and fish rearing. In Chunchadenahalli, the tank was silted up heavily. The removed silt was applied to drylands and made them fertile. As observed in Karnataka, tank silt application in dryland increased dryland productivity to more than 100%—from 3 quintals of *ragi* (finger millet) to 8 quintals per year in Chunchadenahalli. This method of land reclamation brought additional areas under crop and provided employment opportunities and livelihood. In Keelakuilkudi in Tamil Nadu, two SHGs in the village were given 9.5 acres of wasteland by the panchayat, where the tank silt was used to improve soil fertility. The SHGs cultivated horticultural plants on this land for their livelihood.

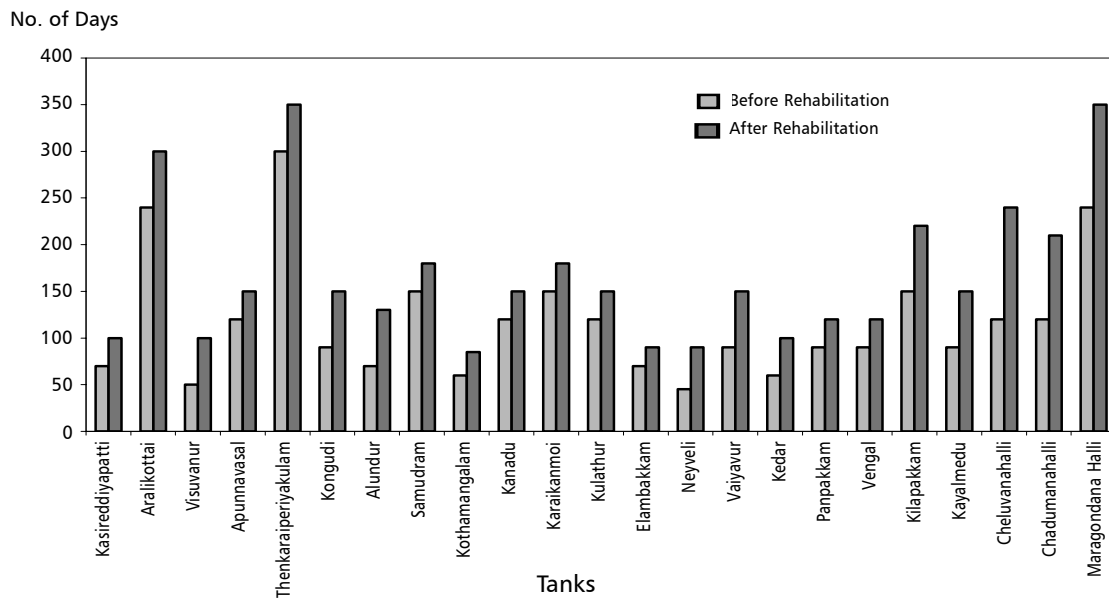
5.4 Postrehabilitation Impact

In most study tanks, people opined that the rehabilitation components like catchment treatment, tank storage improvement, and water distribution system

Table 6. Gender-wise Employment Opportunity and Value Earned During Tank Rehabilitation

Name of Tank	Local Labor (person-days)			Total Value (Rs)	% of Value to Total Estimated Cost	Total Estimated Cost	Outside Labor (person-days)			Total Value (Rs)
	Men	Women	Masons				Men	Women	Masons	
Kedar	4,956	3,803	–	2.27	21.78	0.10	–	1,955	2,793	1.85
Vengal	1,881	3,207	181	3.32	33.70	0.10	1917	283	1,313	3.19
Samudram	1,086	7,448	–	3.74	20.77	0.18	–	–	2,942	3.82
Maragondanahalli	4,050	–	–	1.22	3.95	0.31	–	–	–	–
Dimbachamanhalli	1,989	1,011	–	1.62	20.82	0.08	–	–	–	–
Cheluvanahalli	1,132	558	–	0.93	18.25	0.05	–	–	–	–
Chunchadenahalli	1,080	3,721	–	1.76	11.16	0.16	–	–	–	–

Note: - implies not available.

Figure 2. Tank-wise Storage Capacity Before and After Rehabilitation

improvement not only strengthened the tank structures, but also increased the tank's storage capacity (Figure 2).

The marginal farmers are concentrated in the tail end of the tank system. They have experienced that field channel lining, as one of the components of tank rehabilitation, has not only reduced wastage of water through conveyance loss but also ensured equitable water distribution between head and tail ends, providing better livelihood. Increased water availability in the tank for more number of days in turn increased the intensity of agriculture, changes in crops and cropping pattern, agricultural production, and livestock population. As evidenced from the Vengal tank, a comparison of before and after rehabilitation reveals that the intensity of agriculture has been increased to a considerable extent. In Vengal tank, before rehabilitation, they cultivated only 250 out of 440 acres during the first season and only 350 acres during the second season. But after rehabilitation, the area cultivated increased to 300 acres and 440 acres during the first and second season, respectively. In some cases as in Laandai and Alundur tanks, in addition to the command area, tank water was supplied to 70–

200 acres of drylands adjacent to tanks. These changes increased the demand for labor, enabling the landless and poor to get more employment, thereby reducing migration. For example, in Vengal tank the increased irrigated area in a year had created additional 10,000 work days, which greatly curtailed migration.

5.4.1 Livestock

Increased water availability in the tank led to increased biomass production, thus providing opportunities for increased livestock rearing especially the small ruminants. For example, in Somangalam tank in Tamil Nadu, even schoolchildren cut grass for cattle before and after school hours. In Maragondanahalli village in Karnataka, the Agriculture University recommended growing grass on the tank bund to reduce soil erosion and protect the bunds. But villagers are permitted to cut the grass for their cattle. Similarly in Cheluvanahalli of Kolar district, Karnataka, the TUG grows grass on the tank bund and gives it to five women who are from vulnerable groups. As observed in most tanks, the tank bed, tank bund, and harvested lands are allowed for livestock grazing. Thus, the

increased availability of grass due to tank rehabilitation helped increase livestock population in almost all tanks. Increase in livestock population due to increase in biomass production enabled milk production of about 200–500 liters on an average. The average cost of milk is about Rs9 per liter. Though giving milk to the milk societies is a common practice, an exceptional case was identified in Kilappakkam village, Tamil Nadu. Due to lack of transport facilities, this village has neither a milk producers' cooperative society nor people coming to buy milk. Women in this village make curd and sell it in the adjacent villages for which they have to walk about 10 km a day. However, the women find it beneficial to sell curd than selling milk because of the associated risk. If milk gets spoiled it goes to waste whereas curd, if not sold within a stipulated time is converted to buttermilk and sold for a better price.

Those engaged in livestock grazing in most tanks are either school dropouts or elderly members of the households. This could be attributed to the fact that the able-bodied members of the households are engaged in on-farm and off-farm work. Another feature observed in Samudram tank in Tamil Nadu is that, people not only graze their own livestock but also perform the task on lease for others. The large landholders who also own large herds of livestock give their animals for grazing on lease. They have their own mechanisms for fixing up the lease. For example, if the ruminant gives birth to two lambs during the leasing period, one is for the owner and one is for the person who tends the animal. If the goat or sheep is sold, the income is likewise shared equally between the owner and the grazer. In case of any mishap during the leasing period the losses will be shared on mutual consent. In the case of Alundur tank, livestock owners engage labor who work alongside the family. The labor is provided a monthly salary, food and accommodation, and clothes during festival season. Thus, tank rehabilitation by increasing biomass production not only paved way for increased livestock population, but

also provided a livelihood for the landless poor and especially to older people who cannot engage in strenuous physical labor.

5.4.2 Fuelwood collection

In most study tanks, the poor are allowed to cut juliflora that grow as wild tree on the tank bunds for fuelwood purposes. However, in addition to satisfying their fuel needs, the poor are also able to make revenue out of it. In Pelasur tank in the Polur taluk of Thiruvannamalai district in Tamil Nadu, children below 12 years are earning a minimum of Rs600 per month through juliflora cutting and selling. They cut juliflora from tank bed and bunds and manage to cut about five bundles a week. Depending on the size of the wood each bundle costs Rs25–40. On average, they are able to earn Rs150 per week. Cutting juliflora not only provides livelihood, but also helps reduce tank maintenance costs. Another highlight is that villagers are happy that the schoolchildren are thus infused with a work culture which helps them become responsible citizens.

5.4.3 Tank Rehabilitation and Groundwater Recharge

Increased groundwater table through recharge is another important impact of tank rehabilitation. Both irrigation and drinking water wells are benefited through rehabilitation. In Vallakondan-samudram, Rajaboopalasangam and A. Punnavasal villages, wells in and around get recharged due to tank rehabilitation and supplement tank irrigation and, in some cases, even act as the main source of irrigation during lean period. Thus, the augmented recharge directly benefits the landholding farmers and indirectly benefits the poor and landless through an increase in employment days.

The availability of drinking water was made possible by increased storage. Due to water in the tank,

drinking water wells that are constructed both in the tank bed and tank bund are recharged throughout the year. One bore well in A. Punnavasal serves as drinking water source for nearly 15–20 villages, while in Visuvanur the *oorani* (farm ponds) fed by tank supplies 1,500 pots of water per day to Visuvanur and to adjacent villages. This reduces the drudgery of women who otherwise need to walk a long distance to get a pot of water. Women, who are saved from this drudgery, are able to use the time for personal health care, children's development, and income-generating activities. Moreover, good quality of drinking water available throughout year cuts down waterborne diseases.

The water table in both open and bore wells has risen considerably due to tank rehabilitation. Even the abandoned wells have been well-revived, leading to water markets. Even the poor farmers without wells know that the easiest way to access water for irrigation is to buy from a neighboring well owner. The improved productivity of wells due to groundwater recharge is by far the most valuable benefit to farmers associated with tanks. For example, in Alundur tank farmers asserted that land value has risen in the command area due to groundwater recharge. It was constantly reported in majority of the tanks visited that if the tank gets filled once, the supply of drinking water is assured for the next 1–3 years.

5.4.4 Other Income-Generating Avenues

Apart from depending on livestock for their livelihood, able-bodied family members of marginal farmers and the landless are engaged in other income-generating activities within and outside the village. These activities can be classified as on-farm and off-farm activities. Some on-farm activities directly related to tank rehabilitation are livestock rearing and selling of milk products, fishing, preparing organic manure, and pottery and brick-making. Though these activities are normally practised in most villages, those that form the

integral part of the tank rehabilitation project as identified in JSYS implemented projects in Karnataka tanks are employment during work execution, promotion of bio intensive kitchen gardening with low cost bucket drip, foreshore plantation and maintenance, opportunity to grow short-duration crops in the tank bed, fisheries development, provision of cattle loan, petty business, horticulture nurseries, opportunity to grow fodder on tank bund, etc. Some off-farm activities being practised in the village are gemcutting as observed in Samudram, embroidery work in Somangalam and Elampakkam, matchworks in Kasireddiyapatty, and silk-weaving in Vaiyavur and Ukkal in Tamil Nadu.

Box 2. Machine Harvesting

Mechanical work always decreases the need for manpower in any kind of work. It affects the income of labor, but simplifies work, making the process economical, hassle-free, and less time-consuming. In Elambakkam tank situated in Sriperumpudur of Kancheepuram district in Tamil Nadu, the landowners prefer machine harvesting.

In manual harvesting it takes 3 days to harvest an acre of paddy-field, the cost being Rs1,000 and food for the farm-hands while with a machine, an acre of land can be harvested in an hour at Rs1,200–1,500 and women are freed from the hassle of feeding the farm-hands. The only loss is straw, which gets smashed by the machine. For postharvesting activities, additional labor works out to be more expensive and wastage of grain is also higher compared to machine harvesting. Hence machine harvesting is preferred.

In addition, some income-generating activities in which either men or women are involved are construction labor, small-scale business, firecracker making, working in textile and sugar mills, sugarcane harvesting, mosaic stone fixing, lorry driving, cleaning, working as railway labor, etc. Irrespective of gender, involvement of the younger generation seems very high. Some factors for this attitude

are education and lack of interest in agriculture. Improvement in transport facilities is another important avenue for youngsters to go out to mills, companies and industries, and construction. Attractive wages also seem to be one of the deciding factors for outsourcing jobs because agriculture is not remunerative both in terms of outputs and wage for laborers compared with other labor works. As a consequence, the labor shortage to perform agricultural tasks led to mechanization that according to the farmers of Ukkal in Tamil Nadu seem economical.

Tanks can be classified according to the availability of water: tanks holding water for one season (for 4 months), tanks holding water for two seasons (for 8 months), and tanks holding water for three seasons (above 8 months). Water availability in tank has been observed to not only affect the crops and

cropping pattern in the command area but also the livelihood options of marginal farmers, the landless poor, and women.

In villages where the tank holds water for one season farmers grow paddy. Those who own a well either grow paddy as a second crop or as an annual crop. The landless depend on farm work and supplement their income with livestock. Even small and marginal landholders also depend on livestock and other small ruminants as a source of supplemental income for their livelihood.

Where water is available in the tank for two seasons, livelihood activities of the villagers deviate from conventional practice. Farmers raise two paddy crops with tank water and those who own a well raise one paddy crop followed by one annual crop like sugarcane, banana or mulberry, as in Karnataka.

Box 3. Duck Rearing in Kilappakkam

Kilappakkam tank is in the Tirukkalukundram taluk of Kancheepuram district in Tamil Nadu. The tank has a storage capacity of 0.96 cubic meters and a registered *ayacut* of 155.035 hectares. The total households in this village are 745, of which 92% are marginal farmers and landless people. In this village, three households practise duck rearing. An agent in a nearby town purchases ducks from Andhra Pradesh and gives them to these households on lease. The ducks are reared in September and returned to the agent in April. The initial investment toward lease that is to be paid is deducted as and when the households give eggs to the agent. Each household takes 150–500 ducks on lease. The cost of one duck is Rs65 and 150 ducks cost Rs9,750. If the tank has sufficient water, the ducks get nutritious food and it can lay 100 eggs in 6 months. The cost of one egg is Rs2 and the total amount each household earns from selling eggs from 150 ducks in 6 months is Rs24,000. Taking the health risks involved only 140 ducks are returned to the agent at Rs40 per duck. The total income in 6 months from rearing ducks is Rs30,100.

In addition to grazing in the tank and fields, the ducks are also fed paddy *karukka*, the lowest grade paddy, which costs about Rs3,600 during the 6-month period. In a week, 150 ducks can consume a 70 kg bag of paddy *karukka* costing Rs150. Farmers pay the village *panchayat* a grazing fee at Rs3 per duck for grazing in the tank and tank command area. This amounts to Rs450 for 150 ducks. Health risk expenditure is about Rs200. Expenditure incurred during the grazing period includes to and fro transportation charges of Rs3,000. All together the total expenditure incurred during 6 months of grazing period amounts to Rs7,250.

The net income in 6 months hence amounts to Rs22,400. If water in the tank is low, the gross income will reduce to Rs7,500 as only 75 ducks are able to lay eggs during 45 days of the 6 months, but the expenditure remains the same. This causes a huge loss. One individual in the village could earn Rs70 per day by engaging in other activities, making Rs8,400 in 6 months. Despite this, duck rearing is advantageous even when the tank is filled to a low storage.

Box 4. Duck Rearing in Somangalam

This case elucidates an orderly procedure practiced in Somangalam village, Kancheepuram district, Tamil Nadu. Nearly 10 families of Vettaikara Naiker community are involved in duck rearing as their main source of livelihood. They have 150–300 ducks per household. They purchase 100 ducks costing Rs7,000 from a village called Ponmar. According to Elumalai, a duck rearer, ducks reach adult stage and start laying eggs within a month of purchase. Duck rearing is undertaken from November to April. Water availability in the tank increased for two seasons and the farmers raised two crops, providing ducks nutritious nosh both from the tank and the harvested fields. During this period, a duck could lay eggs continuously for 3–4 months. The market rate per egg is Rs2. On an average, total income with 100 ducks in 3 months is Rs18,000. When ducks are sold back, they get only Rs5,000. The total income is Rs23,000 from 100 ducks in a 6-month period. However, transportation costs from Ponmar to Somangalam are Rs700 and an additional cost for karukka paddy is Rs2,700 for 6 months. Rs100 is incurred for health risks and Rs300 paid to village panchayat, at the rate of Rs3 per duck. If feed is insufficient, additional costs of grazing in neighboring villages is Rs300. Total expenditure for the 6-month period for 100 ducks amounts to about Rs4,100, and hence the net income is Rs18,900.

For the remaining 6 months, some households take on other work while some continue with duck rearing if they are able to meet the basic feed expenses. However, tank water is low, affecting the intake of ducks, and only 50 of 100 ducks are able to lay eggs for about 45 days. So net income is drastically reduced to only Rs100. Although there is no benefit of rearing ducks during the lean season, hereditary practice compels households to continue. If engaged in construction work for 150 of 180 days, the household can earn Rs10,500 in 6 months.

Because of this change in cropping pattern, the marginal, landless poor, and women get more employment days, which in turn reduces migration. Also because of increased water availability in tank due to rehabilitation, in Kilappakkam, Somangalam and Elambakkam tanks, some marginal farmers and landless poor households were engaged in duck rearing for their livelihood. Two types of cases—duck owning and rearing ducks for lease—are presented in boxes 3 and 4.

The significant aspects in this case study are: gender equality, flexibility of work culture, and social settlement of the duck-rearing families. Either spouse takes the ducks to wet tank or fields. If one takes the ducks for grazing the other brings food and the roles are inter-changeable irrespective of the gender. The normal cultural barriers for household chores are broken and this flexibility promotes harmony. In Somangalam village all the duck-rearing families live in a street as they belong to a particular caste. It is evident from the cases (see boxes) that water productivity of the tank provides

Box 5. Group of Contract Laborers as Mini Contract Laborers

In Pelasur, located in Polur taluk of Thiruvannamali district, Tamil Nadu, people migrate in groups as contract laborers to different places for sugarcane harvesting. They are registered as a group in local sugar mills. The groups normally belong to one family. Each group consists of minimum 10 members of which at least 3 are male. During summer, the school going children also join the group.

Each person cuts up to a ton of sugarcane a day, so the group cuts about 10 tons a day and earns Rs700, which is divided among the group at the rate of Rs70 per person. Wage is equally shared among the members irrespective of their gender. Apart from this they are also given 0.75 kg of rice and Rs5 as a daily allowance. One member of the group is allotted the responsibility of cooking and the rice is cooked together. Each member in the group generally gets about 15 kg of rice per month. The sugar mill directly deposits the group's payment in the group's bank account.

the basis for livelihood to the marginal and landless poor. The increase in water availability after rehabilitation has paved the way for divergent livelihood options.

In tanks where water is available for more than 8 months, the livelihood options are obviously very high. Even in such a situation of adequate resource, seasonal outing in groups as contract laborers especially for sugarcane harvesting as observed in Pelasur and for small business as observed in A. Punnavasal tanks are not uncommon (see Box 5).

5.5 Role of Self-Help Groups

Formation of SHGs at the hamlet and village levels is fast spreading throughout the southern states of India. As a main activity, these SHGs have developed the savings habit among group members; the savings are then used for loans. In each village of 40 tanks visited there are 2–17 SHGs consisting of 15–20 members in each group. Many groups have savings and provide them as loans to their own group members at 2% interest per month. They also take bank loans. For example in Vaiyavur tank, Kancheepuram district, Tamil Nadu, one group took a bank loan of Rs1 lakh and shared this among 10 members to buy cattle. In many other villages, the loan is used for various income-generating activities like purchase of cattle, seeds, pesticides, and agricultural equipments; petty business like fishery; for children's education, marriage, etc. For example in Kulathur, Trichirappalli district, Tamil Nadu SHGs are engaged in preparing vermicompost, local bio-insecticide (*poochi veratti* or insect chaser), herbal tonic, and crop growth stimulator for local consumption.

The focus of SHGs is not only microfinancing and income-generating activities but also tank rehabilitation. In view of multiple uses of the tank and its appurtenant structures, all members of the village community including the landless, must become members of the TUG. The project also should ensure

that women stakeholders participate in all stages of the project cycle and ensure tank rehabilitation benefits for all categories of women. In the past, women were strategically excluded by stipulating landholding criteria. But the project in Pondicherry provides space for women in the TUG irrespective of landholding. Dual membership for each household further empowers women as stakeholders. Thus, involving two members from a household (one man and one woman) in TUG as practised in Pondicherry is a better proposition as many men migrate out for work while women stay in the village level to take care of the family, livestock, and agriculture. Further rehabilitation projects as in the case of JSYS- implemented project in Karnataka also emphasize mainstreaming the vulnerable group who forms major part of the indirect stakeholders in the rehabilitation process. As indicated by Boregowda and Ramanand, an analysis of 100 TUGs formed during the first year of rehabilitation project in Karnataka indicates that nearly 18% and 22% of TUG members and executive and supervisory committee members belong to vulnerable groups, respectively. The efforts at gender mainstreaming reveals that nearly 47–50% of the TUG members are women followed by 26–41% as executive committee members and 0–75% as check signatories. Thus, gender mainstreaming in the tank rehabilitation process has become an integral part of recent projects. The change not only increases the membership strength of the TUG but also empowers women who were once the backbenchers with less social status and improves their bargaining position both at the household and group levels.

As identified in the tanks visited in Karnataka and Pondicherry, capacity building of SHGs and vulnerable groups is a built-in component of tank rehabilitation project. Intensive training inputs are given for the sustainability and efficient functioning of TUG and livelihood aspects. Training components to SHGs involve farmer's field school, technical training on agriculture, and exposure to new agricultural practices like system rice intensification (SRI) and

training on managing the finances of SHGs, exposure trip to model TUGs and dairy farm, training on leadership and book keeping, training to promote vermicompost, orientation on integrated tank development planning process, etc. All these training and exposure enabled the members to articulate in meetings and empowered them with confidence financially and in venturing into new enterprises.

JSYS used the potential of SHGs well. The formation and strengthening of women's interest groups (WIGs) and their effective functioning coupled with capacity building through training and exposure trips facilitated women to access 4–52% of wage labor from tank rehabilitation work in Karnataka. Apart from employment as wage laborers, several women SHGs executed small civil works on contract from TUGs. In Cheluvanahalli tank, for example, the SHGs contracted tank rehabilitation work and completed it satisfactorily. Another pioneering example is GV in Mulbhagal taluk in Kolar. GV initiated SHGs constituting mostly of deprived women. GV also undertook a project to desilt the tanks using a NABARD loan with 12% interest under an SHG linkage program. Under the scheme, once the tank is selected, the best performing SHG existing in the village is employed to implement the

tank desilting works. Thus, the project was executed and completed by the SHGs.

5.6 Findings of the Study

1. There are two different types of tank rehabilitation projects: one focuses on agriculture production to benefit mainly the farmers; the other focuses on developing the tank system as a whole and creating livelihood opportunities for different stakeholders, including the landless. Among these, the latter provides more space and livelihood options to earn a living.
2. In tank rehabilitation work, augmenting tank water and increasing the tank storage has greater impact on the livelihood options of the landless and marginal farmers.
3. The involvement of SHGs in tank rehabilitation and provision of funding for income-generating activities have a marked effect on their livelihood.
4. Since all villagers are members of the TUG, all are benefited in one way or the other. The key outcome of the second type of tank rehabilitation is that these tanks are likely to be more sustainable than those implemented under type one.

6 TANK INSTITUTIONS

6.1 Traditional Institutions

Even today, villagers have traditional institutions in many tanks to manage the tanks effectively as a common property despite the presence of the external factors that led to the decline of tanks. Indigenous management practices and the villagers' ability to adapt themselves to the changes in water supply, groundwater development, changes in cropping pattern, and socioeconomic changes like land transformations give an insight into the traditional institutions.

Everyone in the village had equal interest in the upkeep of irrigation channels and tanks. The proceeds of communal land and trees and the annual sale of fishing rights in the tanks were the sources for the common fund. Their functioning reflected very well the rights enjoyed by the village societies over water resources. The community had complete control over water. The organizations have well laid out rules and regulations to manage water effectively. The traditional system of water distribution was based on their beliefs, customs, and the concept of equity as the villagers perceived. The water allocations ensured smooth sharing among all members without any exception. The performance of the tank irrigation systems depended on the outcome of such decisions made.

The important functions of any irrigation institution are: water acquisition, water allocation and distri-

bution, maintenance, decision making, enforcement of decisions, and conflict resolution. The traditional irrigation institutions have well-defined rules regarding the role and responsibility to be played by each member of the community. The source of water to the tanks is mainly rainfall and the tanks can be either isolated or in a cascade. When the tanks are connected to a nearby river or stream, reliable water supply is assured. The priority of the irrigation institution is water acquisition in case of river-fed and cascade tanks.

6.1.1 Irrigation Functionaries

All traditional irrigation systems have common irrigators. There are two types of irrigation functionaries in the traditional institutions. One is at a more supervisory level as an enforcing authority and the other at a lower level involving hard labor. The first type is called *nattamaikar*, *patel*, or *kavaimaniam*. They also have to organize village temple festivals. The most important function is to call for a meeting of *ayacutdars* and take decisions. These will be implemented under their supervision. The second level of irrigation workers are known by many names, *neerkatti/neergandi* (one who fills water in the field), *neerpaichi* (one who irrigates lands), *kanduvetti* (one who observes and irrigates), *kambukatti* (one who carries a stick as a symbol during irrigation), *kavalars/shena* (watchman), *thottti* (sweeper), etc. In all tank systems, no farmer is permitted to operate the sluices. In some systems

when water is sufficient, the farmers themselves irrigate their fields. Common irrigators will be appointed during scarce periods only. The common irrigators may hold the post hereditarily or temporarily for a period ranging from a month to a year. They are usually from backward castes but in some tanks caste representations are given. The posts are offered through auction also. Whatever be the mode of appointment, the villagers pay them in kind and cash through the association.

The traditional institutions have well-defined conventions evolved over a long time such as the opening and closing of sluices, allocation of water to various segments, and rationing rules in times of scarcity. Though based on customs and traditions, they are clear, specific, detailed and accepted by all *ayacutdars* (farmers in the ayacut) as reasonably fair. These institutions have a mechanism of enforcing the rules and punishing the violators.

6.1.2 Water Management

The traditional institutions plan the crop and area to match water availability. This is not merely dividing the shortage among all. But a prudent way of ensuring social justice is evolved. By such planning, all the farmers are sure of harvesting a successful crop in part/full extent of their land. The maximization of crop production during good years and minimization of losses in crop production in bad years are ensured by the collective decision of the traditional institutions.

The traditional institutions, based on their experience, involved the sequence of opening the sluices to have a minimum wastage of water. The locations of sluices, alignment of canals, return flows, and seepage water have all been effectively used to the advantage of water conservation. These have been followed by the institutions for a long time. Water management practices have been perfected over time by experience.

6.1.3 Resources Mobilization

Traditional tank institutions mobilize funds through various means. The proceeds of communal land and trees and the annual sale of fishing rights in the tanks were some sources for the common fund. The landowners make a voluntary and agreed-upon share contribution in kind (usually paddy) from the field produce to the common fund after each harvest. The rate of contribution is fixed per unit of land area and collected according to landholding of the individuals. All traditional institutions have regular subscriptions like the above. The fund thus raised was spent not only on the cleaning of channels and tanks, but also for the purchase and distribution of manure, support of temple festivals, and to feed travelers. In the past when the tanks were a common property resource, the village enjoyed the right to fish in the tank. This was the main source of income. But after the tanks became government property, the PWD or panchayats, as the case may be, auctioned the fishing rights. But still the traditional institutions, by virtue of their hold over the villagers, bid and take the right from the authorities at a lesser amount. Then they re-auction and the profit earned is the main source of fund to the committee in many tanks.

When these funds are inadequate, the traditional institutions augment additional funds through innovative methods. They levy *ayacut vari*, a tax based on landholding. Depending upon the extent of repair and maintenance work and the deficit in the fund, the rate per acre is decided. In some villages, all agricultural products are sold through a commission agent. This commission agent is selected through an auction by the committee. Farmers cannot sell their products to others and no other agent can purchase in this village. From this auction the committee receives income. In some villages, traditional institutions had constructed community halls for village and private functions. The rent collected from the user is an income to the institution.

Thus, augmenting financial resources is an important activity in the sustainable functioning of any institution. The traditional institutions are quick to grab any opportunity to adopt new and innovative methods of fund mobilization. The rates fixed and the revenues collected are not only sufficient to manage the affairs of the institution, but also used for village development activities. The villagers willingly contribute and defaults are rare.

6.2 Government-sponsored Institutions

After the second irrigation commission's report (1972), the Command Area Development Programme (CADP) became the major effort toward improving water use efficiency and productivity of irrigated agriculture. The Government, through command area development authorities (CADAs) started creating WUAs below the outlets. Well-documented examples include the pipe committees in Sriramsagar in Andhra Pradesh (Singh et al., 1994), village organizations in Sone in Bihar (Pant and Verma, 1983), and others (Datye and Patil, 1987). The organizing effort in Ukai-Kakrapar Project in Gujarat differed from others in that organizations were based on minor canals serving 300–500 ha rather than outlets.

6.2.1 WUAs and the Government of Karnataka

The Karnataka government enacted the Irrigation Act of 1965, which was amended in June 2000 to turn irrigation management over from the irrigation department to WUAs at primary, distributary, project, and state levels. At present, the approximately 2,000 water user's committees (WUCs) registered under the Cooperative Act are making progress in forming project level federations in major irrigation systems.

The WUCS cover an area of 500–750 ha with the membership of people who use the tank water—farmers and others—by paying a membership fee

of Rs106. The WUCS have a managing committee elected democratically with representation from minorities, including women, SCs/STs, etc. These principles apply to major, medium, and minor irrigation systems in the state. The task of forming WUCS is entrusted to CADA in major and medium irrigation and to the Department of Minor Irrigation for minor irrigation tanks.

During the colonial period, the Karnataka Tank Irrigation Act of 1911 took note of the tank as a special water body emphasizing a decentralized form of management. The policy makers have tended to brush aside the well-established tank policy that existed during the colonial periods while drafting the Irrigation Act of 1965 and also succeeding in amending the same Act in June 2000. As a result, more and more focus was on major and medium irrigation and less on tank systems, one of the major reasons for the decaying of tanks in the state.

The state launched a tank development program under two schemes funded by the state government and the World Bank. The JSYS is registered under the state's Society Registration Act. The organization is chaired by the Chief Minister and headed by an Indian Administrative Services (IAS) officer to carry out the community-based tank restoration program. This program is being implemented with the assistance of a Rs6.7 billion World Bank funding. Works are taken up in 2,000 tanks located in 34 taluks of 9 drought-prone districts of the state. The program is implemented with the involvement of NGOs and other local bodies (Doraiswamy, 2001). The scheme benefits even those users associations that are not registered under the Cooperative Act. This is contrary to the amendment to the Karnataka Irrigation Act, 2000. Another scheme called *Raitha Kayaka Kere* is a state-funded program in which one tank from each *hobli* (block) is taken up for development purposes.

Per the provision in the Karnataka Irrigation Act of 1965, the state, in the interest of the general public,

can take over those water bodies that are not well maintained by local institutions. Yet, the parameters set by the state to assess the performance of tanks is unclear.

6.2.2 Thindal Experiment and Pasanakottams in Tamil Nadu

The AED of Tamil Nadu made attempts in the Lower Bhavani Project (LBP) area to form farmers' organizations with a 3-tier system as follows:

- 1) FA at sluice/outlet level
- 2) Farmers' council (*pasanakottams*) for a minor/branch/distributory
- 3) Farmers' federation for the irrigation systems

The first experiment was made in Thindal distributory of LBP. One irrigation community organizer with a diploma in civil engineering or degree in agricultural engineering is to be stationed in the village. He meets the farmers and motivates them to form an association. Once the association is formed, the other tiers are elected from among the office bearers of the lower tiers. With a view to support these associations, a management subsidy of Rs100/ha for first 2 years and Rs75/ha for the third year was given (Gol, Command area development grant). Both these models use an institutional organizer, which was adapted from the National Irrigation Administration of the Philippines.

6.2.3 Saliperi Experiment and Irrigation Trust in Tamil Nadu

The Irrigation Management Training Institute (IMTI) in its Saliperi Experiment relied on the volunteers from the village as the catalysts. Under the guidance and help from the faculty of IMTI, these volunteers were able to motivate the farmers to form an association. The most important feature is that these farmers also gave Rs100/acre as contribution and created an irrigation trust. IMTI provided a matching grant. The entire trust fund is kept as a

fixed deposit and only the interest is drawn every year to do kudimaramath works. The distinguishing features of this model are:

1. There are no external organizers to form the association.
2. The village is the basic unit for association, but higher tier organizations will be hydraulic-based (channel, river, etc.).
3. The farmers and the government provide an equal amount to create a trust and interest from the deposit alone is utilized.
4. This amount can be spent only for irrigation-related works.

6.2.4 National Water Management Project

In 1984, Gol and World Bank agreed to explore the potential for water management project in selected states. Gol decided to initiate detailed preparation in three states (Andhra Pradesh, Tamil Nadu, and Karnataka). If the concept was successful, other states were to be included at a subsequent stage. The premise under NWMP was that substantial benefits could be obtained in existing irrigation systems through a more *reliable, predictable, and equitable* water delivery system. Its essential feature was preparing an operation plan. Limited funds up to Rs2,500/ha were provided for scheme improvements.

An important component of this project was the scheme level irrigation committee (SLIC) with engineers of PWD, representatives of agricultural department, and farmer leaders as members. The SLIC would make management decisions as regards systems operation. Another important element was the introduction of a structured network that allowed variable and controlled discharges at a higher limit of the distribution canal. The Government planned to pull back its control to distributory head level. The farmers would still continue at 8 ha limit. The ungated structured network would be in between the two limits. The optimism of the World Bank about

this project could be seen from the words of a senior staff member D.J.W.Berkoff, "If the concepts of the NWMP are found relevant and valid and its strategy successful, irrigation policies can be expected to undergo a change as a result of improved performance of the NWMP schemes."

6.2.5 Participatory Irrigation Management

Andhra Pradesh

The Andhra Pradesh Management of Irrigation Systems Act 1997 (Act 11 of 1997) is one of the most revolutionary legislations made by any government in the country. It is perhaps the first of its kind to be enacted in the country with a view to bring about irrigation management by farmers in all irrigation systems of the state of Andhra Pradesh, through the participation of farmers who are stakeholders. The Act provides a framework for WUAs to be constituted with well-defined jurisdictions, role, and functions of farmers' organizations and the irrigation agency.

Salient features

1. The Act is applicable to all the irrigation schemes major, medium, and minor, except those vested under the PRIs and all minor water bodies in the SC areas of Andhra Pradesh.
2. Every irrigation project would be divided into convenient areas of operations and committee constituted at the project level, the distributory committee at the distributory level, and the water users' associations at the primary level. The delineation of the areas of operation would be done on a hydraulic basis.

All district collectors who head the district administration have identified the irrigation systems in their respective districts and delineated the jurisdiction of WUAs command-wise. To ensure equity, the

jurisdiction of WUAs has been subdivided into 4–10 territorial constituencies. Very detailed regulations have been drawn up regarding election of officers and the administration and operation of WUAs. These regulations include the following provisions:

- a. All members within the jurisdiction of the WUA shall elect a president.
- b. All members within the territorial constituency of a WUA shall elect a member of the managing committee.
- c. Elections of the President and members of the managing committee of the farmers' organization shall be conducted by the district collector under the overall supervision of the CADA Commissioner who is the election authority for the purpose.
- d. Elections shall be by secret ballot. District collectors shall notify polling stations for the purpose of conducting elections through election personnel appointed for the purpose.
- e. The district collector shall prepare and publish the voters' list. All members who are landholders in the notified area of an irrigation system as per record of rights shall be members with voting rights. A person who is above 18 years of age on the date of the notification is eligible to vote.
- f. Only members with voting rights can contest the post of president and members of the managing committee of a WUA.
- g. Regardless of the landholding, a person shall have one vote for a WUA.
- h. Where a person has land in more than one territorial constituency of a WUA, he shall exercise his option to be treated as a voter in one constituency only.
- i. Where a person has land in different WUAs he shall have a vote in that WUA.
- j. Government has decided to sanction Rs50,000 in the form of works in cases where president and members of the managing committee are unanimously elected.

- k. In the case of the distributory committee, the presidents of the WUAs within the jurisdiction of the distributory committee shall elect a president and members of the managing committee, not exceeding five members. The date shall be notified by the collector.

A significant provision of this Act is the power to recall members. The president or members of the managing committee or distributory committee may be recalled on the request by one third of the voters and voting by a simple majority of the members present.

Tamil Nadu

The government enacted the Tamil Nadu Farmers' Management of Irrigation Systems Act, 2000, to pave way for the turnover. However, the formal rules to the Act were made in 2002 and the election process was initiated in November 2003. The Act contains the same provisions of the Andhra Pradesh Act. Under this Act, the WRO of PWD had organized and conducted elections in major river systems in Tamil Nadu. The Act had not been applied for tank irrigation. The major lacuna is that both acts aim to transfer the irrigation systems that are under the control of PWD to the farmers. But most of the tanks are with the panchayat and rural development departments. Hence the government has not attempted to form WUAs in these tanks.

Orissa

Orissa enacted the Pani Panchayat Act on 8 June 2002 through a gazette notification. However, it has not yet framed rules under the Act for guidance and has not notified the date it will come into force.

6.3 NGO-sponsored Institutions

Many NGOs in India are working with rural people in small tank commands, promoting participatory management of tanks. They follow different methods of organizing farmers and develop

institutions in the villages for sustainable management of tank irrigation. Their approach is different from government-sponsored institutions. They adopt the good aspects of traditional institutions and create formal organizations as followed by the Government.

6.3.1 Grama Vikas

GV is an organization in Karnataka for women, children, and environment development. The NGO carries out a child development project, a women empowerment project and a natural resource development and management project. They organize women SHGs. The SHGs in turn carry out tank rehabilitation works funded by donor agencies like NOVIB, Netherlands. The SHGs are responsible for desilting and repair works. The desilted earth is used as fertilizer. As the GV does not provide technical support, the executed works are not of high standard.

6.3.2 Institute for Youth Development

IYD is an NGO working in Karnataka since 1978 with an emphasis on organizing and promoting youth participation in development. IYD is engaged in participatory tank rehabilitation. The objective is to rehabilitate all natural resources and CPRs with the evolution and reestablishment of traditional decision making and management mechanisms at the village level and to create a regenerative, self-supporting agro-eco system. The women in the village are grouped and formed into SHGs and they are empowered with income-generating activities. A cooperative society is formed to look after the entire tank from watershed to command area. They are also taking up activities to augment their financial resources. Farmers have to contribute 30% of the cost of rehabilitation and IYD will ensure 70% from donor agencies like CAPART. Their contribution can be both in cash and in manual labor.

The strength of the IYD model is the capacity building of local leadership. There is no fixed time frame

for rehabilitation and the works are carried out in stages. This ensures continued and sustained interest in development activities among the villagers and IYD. The weakness is the lack of technical support on works.

6.3.3 Palmyra

Palmyra, an NGO in Pondicherry, has initiated a tank rehabilitation project with assistance from the India-Canada Environment Facility (ICEF). Considerable effort is extended in capacity building before taking up the rehabilitation work. A team of Palmyra staff facilitates organization of WUAs through motivation and training. After the WUA is organized, farmers plan the rehabilitation works. A unique feature of this model is the flexibility in deciding the rehabilitation works and speedy release of funds. Palmyra/ICEF will make available 70% of the total cost required for the tank rehabilitation work, whereas the ayacutdars put in a 30% contribution. The work that needs to be done will be prioritized by farmers, keeping in mind the contributions collected. These will be deposited in a joint bank account for which a member each from Palmyra and WUA will be the joint signatories. Palmyra also promotes women SHGs.

6.3.4 DHAN Foundation

DHAN Foundation believes that the lack of local institutions to run, manage, and govern the tank systems is one of the major reasons for its decline. Therefore, the program has a major component to build social organizations aimed at conserving and developing tanks. These are nested organizations with clearly defined roles and responsibilities. The 3-layered organizations are formed respectively at the tank, tank cascade, and district levels. They work together in a mode of serving their members' interest in best possible ways.

- *Tank FAs*: Farmers having land under the command area and other interested groups

in the village are enrolled as members. They look after maintenance of the tank systems and their management, including water distribution.

- *Tank cascade associations (TCAs)*: TCAs are formed with members of the tank FAs across the cascade. They undertake development works such as cleaning and excavation of feeder channels and repairs to diversion weirs/regulators on feeder channels.
- *Tank farmers' federations (TFFs)*: TFFs are formed at the district level with tank FAs as members.

Once the tanks are identified and selected, the TAs are formed at the village level. The members of these associations are involved in planning tank rehabilitation works through PRA and interaction with stakeholders. The office bearers are elected by the members and they are responsible for mobilizing local contributions, planning and implementing, and O&M of the systems. To have a wider impact across locations, TCAs are formed from among the TAs. Tank federations are formed at the district level where all TAs in the respective districts get enrolled as members

The tank federation is a legal entity as it gets registered under the Societies Act. The members of the federation are represented by individual TAs. There exists a nested relationship among the various TAs, TCAs, and TFFs. DHAN Foundation perceives that these arrangements empower the organizations to conserve and maintain tank irrigation systems during the years to come in a sustained manner. The movement, known as the *vayalagam* (farmers' association) movement, is conceived as an offshoot for advocacy efforts of tank farmers and their associations at various levels. The activities are essentially targeted to mobilize the participation of tank farmers from different states in the country by getting together and strengthening themselves to better speak out on issues pertaining to the conservation of small-scale water bodies like tanks, ooranies, etc.

7 PROTOCOL FOR TANK REHABILITATION

7.1 Hydrological Endowment and Selection of Tanks for Rehabilitation

The farmers under the tank command may or may not have wells. The wells enable the farmers. to start their agricultural operations before the start of the monsoon rain and inflows into tank.

As soon as the monsoon rain starts, they do land preparation and transplantation with well water. During this time, there is very little water storage in the tank. When the monsoon progresses, the transplanted rice fields effectively use the rainfall for their consumptive use with supplementary irrigation from wells as and when there is a large gap between rains. By the time the tank gets partly or fully filled and water is released for irrigation, much of the land irrigated by wells is at an advanced stage of crop growth needing only one or two waterings from the tank to make the crop mature. They also go for a second crop if water is still left in the tank and/or the wells have sufficient water. On the other hand, farmers who do not own wells wait for the tank to get filled to a certain level before they start their nurseries and start land preparation and transplantation. In this process, they lose effective use of a considerable fraction of rainwater and mostly depend upon the tank water to meet their crop water requirements. Because of the delayed start of cultivation, their cropping season extends much beyond the rainy season. Figure 3 substantiates the statement made above.

If for any reason the tank storage is not sufficient, then these farmers either buy water from the neighboring well owners for 1–2 waterings or, if they need more waterings, they allow the crop to wither because buying well water becomes costly. Factors such as uncertainty involved in starting the agricultural operation, inadequate storage realized in the tank, delay in starting the season at the appropriate time, and inequity involved in distributing tank water between head enders and tail enders bring down the yield level between farmers who own a well and those who do not. The income and profit for well-owning farmers is sufficiently attractive, but not so for those who do not own one, and especially those who can only grow paddy during the rainy season. As such, marginal and poor farmers in this type of hydrological environment give the land on lease or leave it fallow in lieu of wage labor, which is more remunerative than to irrigate their own land. This kind of switchover becomes all the more attractive in tanks that are nearer to cities and towns. The net result is that irrigated agriculture without wells in tank command is neither remunerative nor sustainable.

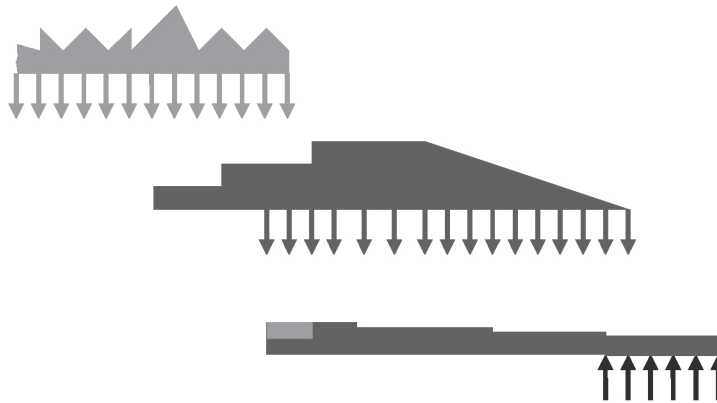
The fact that tanks and wells should be used in conjunction along with rainfall under tank command to be productive leads us to conclude that we need a different strategy for selecting tank rehabilitation components. As a first step in this direction, the present classification of tanks based on tank command area has to be changed and selection of

tank rehabilitation components should be based on hydrological endowment to suit the conjunctive use. The hydrological endowment of a tank depends primarily on two factors: its capability to supply water to as many months as possible and having a good aquifer under the tank command to hold and release the recharged water. Based on this concept, one way of classifying the tanks is given in Table 7.

All types of tanks—whether PWD, panchayat, system or nonsystem, cascade or individual—can be put under one of the six categories. The least productive tank is the one that holds storage for less than 4 months and has very little groundwater potential. Here, augmentation of supply to tanks, selection of proper cropping pattern to match the available water, water conservation, and water

Figure 3. Agronomic Practices

Case 1: Blue Water Agriculture: Tank and Well



Case 2: Green and Blue Water Agriculture: Rain, Tank, and Well

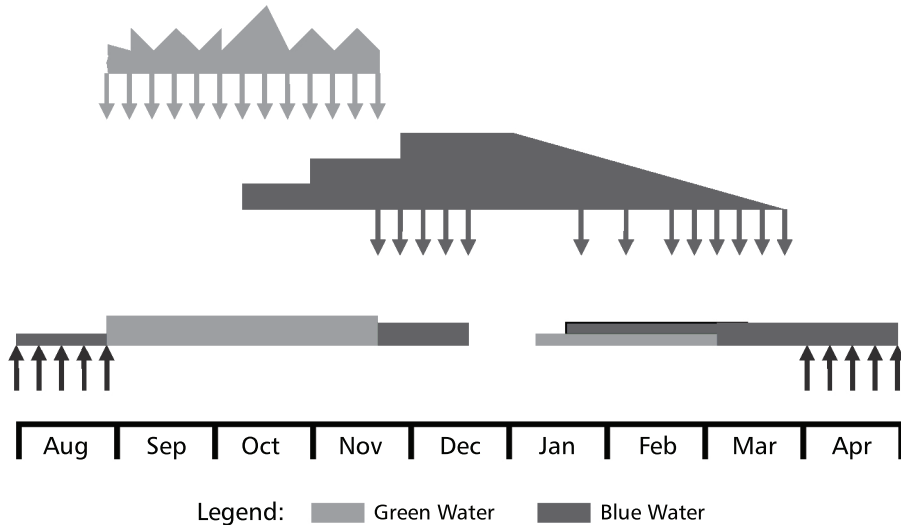


Table 7. Typology for Tank Classification

Aquifer Capacity	Number of Months of Tank Storage		
	Less than 4 months	4–8 months	Greater than 8 months
Good			Highly Productive
Poor	Least Productive		

management assume importance. Adoption of modern irrigation technology such as drip and sprinkler and supply management are important. In the case of highly productive tanks, increasing the land and water productivity through better water and demand management assume significance. Recharging the aquifer is important. The remaining four classes come in between these two extremes. This classification requires that the tank water and well water be treated as a common resource to be dealt by the local tank users' institution. Hydrological classification of tanks allows one to choose the proper tank for rehabilitation and rehabilitation components as opposed to classification based on extent of area irrigated such as PWD tanks and panchayat tanks.

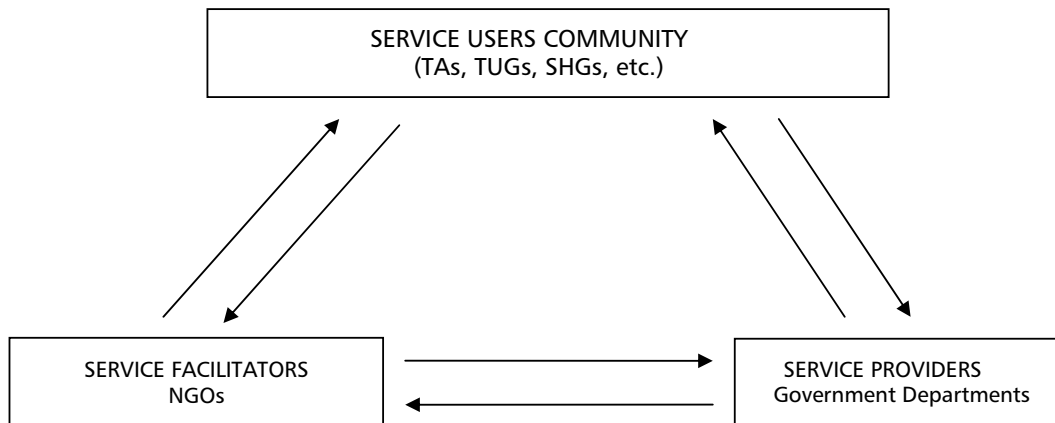
7.2 Institutional Framework

Tank rehabilitation is a process consisting of institution building, implementation, and maintenance and management. The process of rehabilitation must be right to achieve the desired end result and the objectives of rehabilitation. Among the three phases, the implementation phase gets the maximum time and budget (more than 95%) while institution building gets the least (less than 5%); maintenance and management phase did not get any time and fund.

The tank level organizations promoted in Tamil Nadu are the WUAs, implying that the farmers are the main users. The corresponding organization is the TA in Pondicherry and the TUG in Karnataka. The TUG includes tank water users and persons in the tank area including catchment, water spread area, bunds, and ayacut. In view of the multiple uses of tanks and their appurtenant structures, all members of the village community, including the landless, must become members of TUG. Involvement of two members from a household (one man and one woman) in the TUG, as practiced in Pondicherry, is a good proposition since many men migrate out for work while women stay back to tend to the family, livestock, and agriculture.

The Panchayat Raj Act confers rights to water, drinking water, and water bodies with the *gram panchayat*. The electorate for both comprise the entire village. Hence, the TUG could be made a subcommittee of the *gram sabha* (persons registered in the electoral rolls of a village) and the revenue from usufructs of the tank and water spread area (fish auction, trees, firewood, and silt) can be shared at an acceptable ratio by the panchayat and TUG (as in Kedar and other tanks in Tamil Nadu).

Figure 4. A Framework for Tank Level Organization



Note: Service users include not only ayacutdars but all landholders, landless, artisans, and women who all use in one way or another the tank water and tank area.

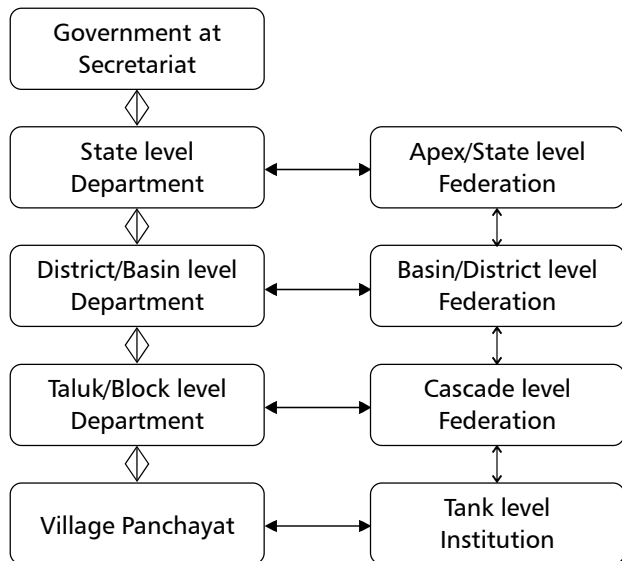
With this background, the suggested framework for a tank level organization involves three limbs: service users, service providers, and service facilitators. All the three need to interact, cooperate, and work together to sustain tank irrigation (see Figure 4).

There is a general agreement among villagers that tank and appurtenant works including usufructs from tanks should be under the TUG who is the local custodian of the tank and capable of managing and maintaining the tank on a day-to-day basis. Many village communities with whom we have discussed are willing to take the tank on a long-term lease (say, 20–25 years). They feel that the tank must be managed as a commercial entity. For this, they would like to appoint a common irrigator on a full-time basis and an accountant on a part-time basis to be in charge of tank administration and management. These two will work with either tank user's association or with the local village institution. They also feel that clear-cut rules for assigning tasks and responsibility and sharing usufructs rights must be framed and discussed in the general body meeting. These rules must be strictly enforced with penalty for not obeying the rules.

The village-level TUGs are the lowest in the hierarchy. There will be a federation at the cascade level, basin/district level, and an apex body at the state level. Collection of revenues, carrying out repairs, and receiving funds from government is undertaken by the tank level organization. The linkages of the proposed institutions with government departments are shown in Figure 5.

A number of government agencies such as panchayat, PWD, Revenue, Fisheries, and Forest departments are involved in tank-related affairs. Each one is involved in some aspects of tank management and maintenance without the knowledge of others or each one is in charge of some responsibility of tank management. For carrying out any repair work or to use and manage the usufructs

Figure 5. Hierarchical Linkages Between Government Institutions and TUGs



in the tank, the TUG has to interact and get permission from a number of departments, which is cumbersome and the transaction cost involved is very high. One way to circumvent this is to lease the tank water spread area and the tank to the TUG on a long-term basis and vest with them the responsibility of upkeep. From the government side, a plethora of agencies are interfering with tank management; this should be dispensed with and one single agency such as PWD or the Rural Development Department must be made the nodal agency in charge of the tank system.

7.3 Planning Rehabilitation Components

When the tank rehabilitation started in 1987, it was a top-down approach in planning and execution. The Government followed a "benevolent paternalistic approach" and executed with preconceived ideas. Moreover, the object was to increase agricultural production; the thrust was in tank and field channel improvements and lining. Gradually, the shift in spending moved toward catchment treatment, institutional strengthening, and livelihood provision. But the farmers have different expectations.

During field visits and interaction with the tank users, it was found that the users preferred the following:

Priority	Work	Respon- dents (%)
1	Cleaning feeder channel	22
2	Tank desilting	20
3	Tank bund improvement	17
4	On-farm development work	17
5	Sluice repairs	13
6	Repairs to surplus weir	10
7	Cleaning surplus course	1

In most tanks, farmers want cleaning of feeder channel to be taken up as the first priority. Many expressed they could undertake all the works if water is brought and retained in the tank. As the sustainability of rehabilitation depends on the availability of water to the tank, this preference is to be the first in future projects. The next most wanted work is desilting the tank. Thus, the works for augmentation and storage of water are most important.

Rehabilitation should comprise foreshore plantations; creation of dead storage for community and livestock use; improvement to supply channels, tank structure, command, water spread, and catchment areas; and provision of community wells to serve the marginal and small farmers who cannot sink their own individual wells. The entire economic activities of the community are decided by whether the tank gets filled or not. After making suitable provision of augmenting supply and increasing storage capacity, the focus should be on providing livelihood to all, including the landless, during off season and during droughts.

Each tank is unique in terms of its physical, hydrological, institutional, socio-economic, and cultural parameters. As a result, tank rehabilitation components and requirements for its effective functioning differ to a great extent from tank to tank. Adopting uniform norms and following a blue print

approach leads to wastage of money and dead investment. For example, there is no great benefit in rehabilitating and increasing the width of a surplus weir which did not surplus over the last 10 years and is not likely to surplus in the years to come. Local people who have been using the tank for years are the best judges on what is to be rehabilitated and how that can be done to get the maximum benefit out of it. Components to be rehabilitated, budget for different components, and timing of completion must be flexible enough to meet the requirement of the tank users. Rehabilitation components aiding augmentation of tank water and improved storage of water to cater to the needs of the summer season and to recharge the groundwater should be given preference over others.

7.4 Investment Criteria and Financial Allocations

The present investment strategy is lopsided, heavily loaded toward physical rehabilitation, and very little toward institutional development and maintenance and management. It is recommended that rehabilitation budget be allocated in the ratio of 10%, 75%, and 15% to institutional development, physical works, and maintenance, respectively. A one-time investment of 15% for maintenance and management will be allocated from the rehabilitation funds and this amount will be deposited in a bank. The interest accrued out of this fund can be used only for maintenance and management. To draw the interest from the bank, the TUG must provide a matching grant in terms of cash or labor.

The institutional component should be implemented through a well-trained NGO and continue to provide assistance for at least 5 years from the start of the rehabilitation work. Adequate funds must be provided for linking the TUG to market and knowledge centers for improving gross tank product of rehabilitated projects through capacity building and training. The physical component should be implemented by the TUG, which should be made

responsible for decision making regarding components for rehabilitation, implementation, and maintenance and management.

The rehabilitation funding norm is based on Rs/ha of command area. This criterion was formulated when the focus of rehabilitation was on tank and on-farm development works. The provisions made in the past for catchment's treatment, feeder channel cleaning, and increasing the storage capacity of the tank was grossly inadequate, as the budget for these items were then decided by the extent of command area. The focus of rehabilitation in the future is going to be more on water acquisition. Hence, it should be based on Rs/ha of catchment area for works in the catchment including feeder channel improvement; for tank storage improvements, it should be based on Rs/ha of water spread area; and for the command area, it should be based on Rs/ha of command area.

Providing livelihood to all including the landless during off season and during the dry periods should form part of rehabilitation. Some options recommended are:

- Allow the landless/SHG to plant fruit-bearing trees or cultivate herbs, flowers, or vegetable around the tank. The planter should guard the plants and the revenue from usufructs will be shared at 20% to the TUG and 80% to the planter.
- Allow the removal of soil for brick making by leasing earmarked areas in the tank bed. The TUG can charge a nominal fee for each cart load.
- Allow fish rearing to group of landless or fishermen in the village.
- Allow SHGs to grow and cut fodder grasses from the tank bund.
- Dig a community well to be owned and operated by the TUG to encourage conjunctive use.

The budget provided for physical rehabilitation will have two levels—a base level that can be drawn without any matching contribution from the TUG

and a supplementary level for which the TUG's contribution is a must and a higher level of contribution from the TUG that will fetch more government grant for physical rehabilitation of tank work. The base level budget should be used to remove encroachment, provide requisite dead storage through desilting, and provide livelihood options for the landless and marginal farmers.

7.5 Execution of Work by WUAs and SHGs

The Government and funding agencies have reservations about the capability of FAs in carrying out the rehabilitation works and completing the work on time and with quality. But many NGOs and JSYS experiments in Karnataka and limited experiments carried out in Tamil Nadu by CWR under the Ford Foundation and EEC funding have proved beyond doubt that the farmers are capable of executing quality work. Hence the TUG should implement rehabilitation. If the contract system is to be followed, a contractor from the village/block and recommended by TUG should be entrusted and the TUG should supervise the work.

Local people who have been using the tank for years are the best judges on what is to be rehabilitated and how that can be done to get the maximum benefit out of it. They need to be consulted on decisions which they themselves are to implement. The components to be rehabilitated, the budget for different components, and timing of completion must be flexible enough to meet the requirements of the tank users. The farmers' share of the cost of rehabilitation either in cash or labor and savings from execution of work are to be put together to create a corpus fund.

7.5.1 SHGs and Tank Rehabilitation

The formation of SHGs at the hamlet and village levels is fast spreading throughout southern states of India. As a main activity, these SHGs have developed the saving habit among group members and

mobilized a considerable amount of savings which they loan to their own members. In many other villages, the loans are used for various income-generating activities like purchase of cattle, seeds, and pesticides; starting small businesses like fish sale; purchase of agricultural equipment; and funding children's education, marriage. The exposure and entrepreneurial training has empowered members of the SHGs in several ways.

The potential of SHGs should not be confined to microfinancing and income-generating activities; they must be given a greater role in tank rehabilitation activities. A mere 30% representation of women in the TUGs results in nonparticipating backbenchers in tank activities. But when the SHGs are made part of the TUGs, they are articulate and take keen interest in the activities of the TUG. By this real empowerment of women will take place. The SHGs should be entrusted with tank rehabilitation works as done by GV.

In Karnataka and Pondicherry, capacity building of SHGs and vulnerable groups is a built-in component of the tank rehabilitation project. Intensive training inputs are given for the sustainability and efficient functioning of the TUG and improvement of their livelihood aspects.

7.6 Monitoring and Evaluation

A regulatory body for small water holding structures including tanks is to be established at the district level to provide needed assistance to maintain and manage these structures and to monitor and safeguard these structures from encroachment, pollution, and misuse. The members from this regulatory body may be selected from the TUG, NGOs, and service-providing government departments.

7.6.1 During Rehabilitation Work

The TUG must implement the program in a transparent manner providing representation from all

sections in the village. Successful implementation of the tank rehabilitation program depends on the involvement of all stakeholders.

As a first activity, a PRA in the village has to be carried out with the TUG. The villagers may be divided into groups, with each group being assigned a task like the mapping and history of the village, transecting the watershed of the tank, and assessing the tank proper and command areas. After the PRA exercise, an estimate and an action plan are to be prepared. Once the estimate is sanctioned, the TUG should convene a meeting of all villagers and explain the various provisions of the estimate and sanctioned costs. All details including the plans and estimate should be displayed in a common place in the village.

If the work contract is awarded to the TUG, the TUG should be able to muster the manpower and materials at appropriate times. The activities carried out each day must be discussed in a meeting of the village held every day. The day's work should be reviewed and the villagers are informed of the receipt and expense account. The following day's work plan, arrangements such as assessment of needs for tractors, skilled and unskilled labor force, etc., and the responsibility to mobilize requirements are to be shared among the members of TUG. The sanctioned amount, the details of expenditure incurred, and the balance are to be displayed on a notice board.

Any bottleneck, or changes required in the plan have to be discussed with officials and suitable action should be taken. In addition to day-to-day review of the work progress, gaps, and steps to address the gaps in the subsequent days, weekly and monthly meetings are also to be held with resource persons to seek guidance for the entire implementation period.

7.6.2 After Rehabilitation

Performance evaluation to assess the sustainability level of a tank rehabilitation is not simple. Sustain-

ability depends on quality of works carried out, the levels of maintenance, the institutions that maintain, the financial strength of the institutions, and the livelihood options provided through tank for poor and women.

7.6.3 Performance Indicators

A set of indicators were developed from among several variables identified to have some bearing on tank rehabilitation performance. The following six indicators that contain finer components of several variables are scored for each tank:

- (i) physical sustainability
- (ii) institutional sustainability
- (iii) resource conservation and use sustainability
- (iv) financial sustainability
- (v) livelihood providing sustainability

(i) *Physical Sustainability*

The physical sustainability of rehabilitation works depends on the quality of works and their durability. Here the institution plays an important role regarding maintenance. If the farmers had been involved in the planning and their preferences were executed, the villagers would have more interest in maintaining them. Hence, the maximum score was assigned to the tanks where the allocation of funds and implementation of works done according to farmers' preferences and components like institutional strengthening were provided adequately. If the works are carried out by the WUA, a full score is assigned. The present condition will indicate how the farmers are maintaining it.

(ii) *Institutional Sustainability*

The important functions of any irrigation institution are: Water acquisition, water allocation and distribution, maintenance, decision making, enforcement of decisions, and conflict resolution. An organization must be vibrant to perform these tasks and that alone

will make it function in a sustainable way. Hence, the institutional sustainability is measured by the leadership, structure, and composition of the TUG; absence of conflicts; rules and tools for O&M; and the mechanism for effective implementation of the rules. The institution's relationship with the village panchayat and other WUAs and their ability to mobilize resources from its members will also play an important role. Hence, these points are considered while evaluating the institution's sustainability.

(iii) *Resource Conservation and Use Sustainability*

Adequate water availability is the most important factor for sustainable tank maintenance efforts. Tanks get water from rain, jungle streams, river diversion channels, or from upstream tanks. Hence, the periodic cleaning and upkeep of feeder channels and the cordial relationship with the tank users in the upstream are vital in getting water to the tank. Once water is received it must be shared by all without any conflict. The development of wells and the conjunctive use of tank water and groundwater are also considered to evaluate the sustainability of resource conservation and use.

(iv) *Financial Sustainability*

Augmenting financial resources is an important activity in the sustainable functioning of any institution. The most durable institutions have a strong backup of finance in the form of bank deposits and assets like building. The successful institutions adopt new and innovative methods of fund mobilization. The revenue collected is not only sufficient to manage the affairs of the institution but also used for village development activities. The villagers willingly contribute and defaults are rare. All these factors are considered and values assigned to evaluate financial sustainability.

(v) *Livelihood Providing Sustainability*

The tank is the center of economic activity of a

village. It is not only used for irrigation but has many other uses like fish rearing, cattle, and domestic use. The tank bed and poromboke are used for vegetable cultivation, tree cultivation, fuelwood cultivation, and cattle grazing. The livelihood providing sustainability is assessed by the WUA's concern toward the poor and women by providing livelihood options through tank rehabilitation like allocation of water from the tank during scarcity to marginal farmers, permitting them to fish in the tank, and permitting the landless and SHGs to cultivate tank *poromboke* (government land) and bunds. Income-generating activities like awarding contract works to SHGs and keeping dead storage for drinking water are other livelihood-providing options.

Each parameter is sub-divided into components as follows:

Physical Sustainability

- allocation of funds and implementation of works
- who carried out the work
- present status of rehabilitated works and durability
- contribution by tank users
- repairs carried out and structures replaced by tank users after rehabilitation

Institutional Sustainability

- leadership and composition of office bearers
- caste/class homogeneity and conflict
- rules and regulations
- mechanism for implementing rules
- linkage with panchayat and other WUAs
- ability to mobilize resource from members

Resource Conservation and Use sustainability

- supply channel cleaning
- linkage with upstream and downstream
- development of groundwater
- water distribution
- O&M
- adequate water availability

Financial Sustainability

- deposits in the bank
- assets like buildings, etc.
- *shramdhan* (voluntary labor contribution)
- income from usufructs
- mobilization of government funds
- any other income

Livelihood Providing Sustainability

- allocation of water from tank during scarcity
- allowing fishing in tank by the poor and landless
- right to cultivate tank *poromboke* and use other usufructs (e.g., trees, fuelwood, silt, brick-making clay)
- tank bed cultivation
- tank bund usufruct and plantation
- contracting income-generating activity to SHG
- dead storage for drinking water

7.6.4 Scoring Process and Overall Sustainability

A subjective score in the five-point scale (1–5) is used for valuation of the indicators, with 1 for poor, 2 for fair, 3 for average, 4 for good, and 5 for very good. The rating was based on field visits and discussions with various stakeholders. Then, the simple average of these five parameters was calculated to arrive at the rating of overall sustainability. These indicators were applied to 40 rehabilitated tanks in Tamil Nadu to evaluate their performances (Gomathinayagam, 2005).

7.7 Training and Capacity Building

In the tank rehabilitation projects, there was a component for the training and capacity building of tank users. They are generally carried out at the state-level Water and Land Management Institute (WALMI) with a general syllabus on water management. In

many instances, the training has been conducted at the end of the project. They were not need-based. Training and capacity building of TUGs are more essential in tank rehabilitation programs for many reasons. As many new small distribution and control structures will be introduced in tank systems during rehabilitation, farmers must have the skills in O&M of such systems. They must be exposed to new water management practices. Normally, the trainings are confined to general features of tank irrigation and agronomic practices including soil water plant relationships. However, training is a continuous activity. The initial training programs should focus on forming TUGs and creating awareness on tank rehabilitation and on the planning process. The emphasis should be on making everyone in the village consider the tank as a common property resource of the village. Landholders must be made to understand that the tank water is to be shared by all users in the village. Everyone must also clearly understand the function of the tank as a source of groundwater recharge. There are now a large number of smallholding farmers in each village and an equal number of landless farm workers. The village communities lack proper training in leadership skills and conflict resolution tactics. Capacity building and conflict resolution must form part of the training program.

Where an NGO involved in tank rehabilitation, it is entrusted with institution building including formation of TUGs, and training and capacity building of stakeholders. In many instances, the NGO selected does not have the requisite qualification and/or experience.

7.8 Recommendations

- Capacity building has to start before planning rehabilitation.
- All stakeholders including SHGs and landless have to be involved in training activities.
- The first part of training, which comprises awareness creation, formation and strengthening of TUGs, introducing income-generating activities among SHGs, and involving them in tank rehabilitation work can be entrusted to an NGO.
- The second part of capacity building and training—comprising creation of effective leadership skills and commitment among TUGs, management of TUG affairs, conflict resolution, resource mobilization, O&M of tank systems, water management, agronomic practices, and linking with market—can be accomplished by a trained community organizer or a training institute like WALMI or IMTI.
- The training programs have to be tank-specific and should be conducted at the village/block with more time for “hands on experience.”
- After the rehabilitation, the TUGs must have a continuing training program on expanding their activities to federation levels, coordination with other TUGs and government agencies, and maintenance activities.
- As the capacity building has to be continued even after rehabilitation in a periodic manner, specialized institutions like the WALMI, universities, and NGOs may be entrusted with capacity building.

8 SUGGESTIONS FOR IMPROVING GOI GUIDELINES FOR TANK REJUVENATION

GoI guidelines (unofficially obtained), along with district level implementation structure for rejuvenating tanks, is given in Annex II. Based on a review of these guidelines, some salient suggestions are:

1. The boundaries of the tank system have to be resurveyed and demarcated, and the encroachment, if any, has to be cleared before taking up tank restoration works.
2. The local community should be organized into TUGs and motivated to plan and undertake the implementation of the tank restoration program. If the O&M of the renovated tanks are to be undertaken by the local people's institutions, they should be further facilitated to take the restoration works also without involving any contractors. If the active SHGs in the village are capable of undertaking repair works, they should be involved.
3. Experienced NGOs have to be selected for capacity building and facilitating TUGs to undertake the planning, implementation, and O&M activities. Other NGOs who have not had adequate experience should also be given appropriate training.
4. The TUGs should share a minimum 15% of the tank restoration cost (either in cash or in the form of labor). This amount will form part of the corpus fund for the O&M activities to be undertaken. Usufruct rights from the tank complex will be shared by the concerned panchayat and the TUG on a 50:50 basis. The savings from the implementation works, if any, will also be plowed back as a corpus fund for the TUG in order to enable it to undertake O&M activities. All these three sources of income will enable the TUG to maintain the tank irrigation system in good repair over the years.
5. The project director, the concerned panchayat president, and the selected NGO shall form part of the district level implementation committee (DLIC). Similarly an experienced NGO shall also be in the state-level committee.
6. The cascade approach should be followed in restoring tanks if the full benefits of harvesting the runoff from a micro watershed and effective groundwater recharge are to be realized. All tanks in the cascade, small and large and irrespective of the size of their command area, have to be renovated by restoring the link canals between them on top priority.
7. The conveyance system including repairs to sluices, outlets, feeder canals, community wells, and micro irrigation facilities in the command area shall not exceed 50% of the total estimated cost.
8. A minimum dead storage of 1–1.5 ha is to be created in the tank bed to cater to the needs of fish culture and livestock. This will also serve to provide life irrigation to the standing crops.

9 COST OF THE PROJECT AND ANTICIPATED BENEFITS

During the last 3 decades, about 5,000 out of 80,000 tanks in Tamil Nadu, Karnataka, and Pondicherry were rehabilitated primarily with external assistance and supported by State funds. The investments in tank rehabilitation projects could be grouped under the following six items:

1. works to augment water to the tank
2. works to make the tank store more water and for a longer duration
3. works to ensure proper distribution of tank water and minimize transmission losses
4. works to strengthen the tank users' institution
5. administrative cost for rehabilitation

The investment made depended on the objective of the tank rehabilitation. Initially during first 2 decades, rehabilitation projects aimed to *"increase food production and rural income by achieving higher cropping intensity through improved water management and reduced losses."* The focus is clearly conserving storage and improving command area water use. Physical works like reconstruction of weirs and sluices, and lining of water distribution channels accounted for 71% of the investment. About 27% went to administrative cost to meet government expenditures. The government planned and decided on the works to be carried out in tanks. No consultation was made to find the users' views and needs. As the project progressed, the views of farmers were taken to ensure sustainability after rehabilitation works. Hence, the EEC stipulated that

a tank user's association for each tank should be a precondition to take up rehabilitation. So the investment on on-farm development works reduced to 57% and the institutional component increased to 14%. This component was mainly used to build an office for the TUG and provide training to farmers. In tanks where CWR, Anna University, was involved as the facilitator, the TUG carried out the construction also. At the end of the project the EEC and government of Tamil Nadu decided to experiment with entrusting planning and construction to FAs. NGOs who had worked in tanks were involved as facilitators; the farmers were required to contribute 10% of the cost of rehabilitation; the TUGs carried out the works. The investment pattern did not undergo any major change as the same objective was continued.

In the recent past, based on the experiences of NGOs and the lessons learned from various projects, the focus shifted from increasing agricultural production to improve livelihoods of the poor. Hence, the concentration shifted from command areas to catchment areas. Considering tanks as multiple use structures (for fisheries, drinking water, use for washer men, cattle, fodder cultivation, etc.) has changed the investment pattern and increased the per ha cost. The TUG with all the villagers as members shared the rehabilitation cost to the tune of 25%. This project brought back the tank as the common property of the village. Figure 6 graphically explains the increase in cost per ha in the tank rehabilitation projects. The cost increased from

Rs 11,500 in the EEC Tamil Nadu Project to Rs56,500 in the World Bank Karnataka (JSYS) Project. This also reflects the shift in objectives from command area development in the EEC project to augmenting water to tanks, increasing storage capacities, and creating livelihood options for the poor. Also, as the cost increased, the contribution by users also increased, as discussed earlier, dispelling the general belief that farmers will not contribute more than 5–10%.

The rehabilitation funding norm is based on rupees per ha of the command area. This criterion was formulated when the focus of rehabilitation was on tank and on-farm development works. The provisions made in the past for catchment's treatment, feeder channel cleaning, and increasing the storage capacity of the tank was grossly inadequate, as the budget for these items were then decided by the extent of command area. The focus of rehabilitation in the future will be more on water acquisition. Hence, it should be based on rupees per square kilometer (sq km) of catchment area for works in the catchment including feeder channel improve-

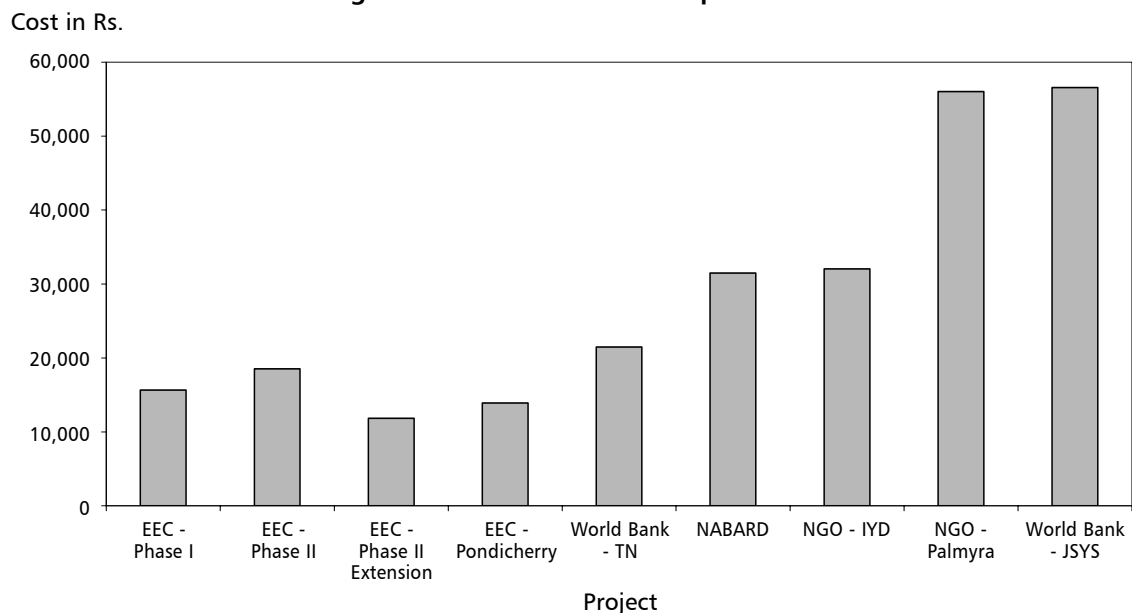
ment, for tank storage improvements it should be based on rupees per ha of water spread area; and for the command area, it should be based on rupees per ha of command area.

With the available average value of the catchment area, water spread area, and the command area of the above 875 tanks, the tentative cost per unit is as follows:

Catchment area	Rs20,000 per ha
Water spread area (improvements to tank bund, sluices, weirs, desilting)	Rs30,000 per sq km
Command area development	Rs5,000 per ha

The rehabilitation cost may be provided in the above unit rate basis. This cost will constitute 75% of the total project cost. The remaining 25% of the cost toward institution and maintenance and management is to be arrived and added to get the total project cost. The allocation in the total project cost is:

Figure 6. Rehabilitation Cost per Hectare



Note: EEC=European Economic Community, TN=Tamil Nadu, NGO=nongovernment organization, IYD=Institute for Youth Development, JSYS= Jala Samvardhane Yojna Sangha.

Institutional development	10%
Physical rehabilitation	75%
Maintenance and management	15%

Using this allocation for typical tanks, the cost per ha of the command area works out to Rs34,000 (Annex IV). This unit rate can be adopted for project formulation.

9.1 Cost-benefit Comparison

Three tanks that were rehabilitated with command areas ranging 40–200 ha, with waterspread areas 15–180 ha, and catchment areas 4.5–9.6 sq km were analyzed. The landholders and total population are:

Village	Landholders	Population
Somangalam	250	2,120
Samudram	176	2,000
Kasireddipatti	63	852
Mean	163	1,657

The mean percentage share of the rehabilitation cost actually spent is compared with the recommended pattern of investment, given in Table 8.

Table 8. Percentage Share in Project Cost

Component	Past Allocation	Recommended Allocation
Catchment area	0.02	0.05
Water spread area	0.19	0.48
Command area	0.67	0.15
Institution	0.03	0.14
Administrative cost	0.09	0.09

9.2 Benefits

When agricultural production alone is the objective for rehabilitation, the mean per capita income of the village from agriculture produce (including by-product and wage earned by the landless) will be Rs1,144.35 (see Table 9).

Table 9. Income Accrual after Tank Rehabilitation

Income from Agriculture	Income (Rs)	Per capita Income (Rs)
Income from agriculture production	701,401.65	423.040
Wages earned in rehabilitation work	617,515.99	372.440
Wages earned as agriculture labor	1,195,172.24	720.850
Total income dependant on agriculture	2,514,089.88	1,516.339
From Livestock (dairy)	3,600.00	2.171
From duck rearing	20,000.00	12.063
From fish culture	613,575.00	370.069
From fuelwood cutting	2,833.33	1.709
Total income livelihood options	640,008.33	386.012
Total tank gross income	3,154,098.22	1,903.120

When livelihood and agricultural production are the objectives for rehabilitation, the mean per capita income of the village increases to Rs1,903.12. This shows a phenomenal increase of 66%. The details of analysis are given in Annex IV.

10 RECOMMENDED INSTITUTIONAL, POLICY, AND LEGAL CHANGES

10.1 Institutional Changes

The tank level organizations promoted in many states restrict the membership to landowners only. As tanks are to be brought back as a CPR, the TUG has to include the users of not only tank water but also the tank area from catchment, water spread area, bunds, and command area. In view of the multiple use of the tank and its appurtenant structure, all in the village community, including the landless must become members of the TUG. Involvement of two members from a household (one man and one woman) in the TUG as practised in Pondicherry is a better proposition. This enables a representative from each household to attend the TUG meetings, as many men migrate out for work while women stay in the village level to take care of the family, livestock, and agriculture.

The Panchayat Raj Act confers rights to water, drinking water, and water bodies with the gram panchayat. The TUG, like the members and president of the gram panchayat, is elected by all the households in the village. Hence, it is suggested that the TUG be made a subcommittee of the gram sabha. With this background the suggested framework for a tank level organization involves three limbs—service users, service providers, and service facilitators. All the three must interact, cooperate, and work together to sustain tank irrigation (see Figure 2, chapter 5). The village-level TUGs are the lowest level in the hierarchy. There will be a

federation at the cascade level, basin/district level, and an apex body at the state level. Collecting revenues, carrying out repairs, and receiving funds from government will be done only by the tank level organizations. The linkages of these organizations with government departments are shown in Figure 3, chapter 6.

From the government side, a plethora of agencies such as panchayats, PWD, Revenue, Fisheries, Forest and other departments interfere with tank management without the knowledge of each other. This should be dispensed with and one single agency such as PWD or Rural Development Department must be made the nodal agency in charge of the tank system.

10.2 Panchayats and Water Bodies

The Madras Village Panchayat Act 1920, later repealed by the Madras Local Boards Amendment Act of 1930 and the Madras Village Panchayats Act 1950, provided for the involvement of panchayats in irrigation works. It did not actually happen because of the stringent conditions imposed by the government for the transfer of irrigation sources to the panchayat and inadequate devolution of funds and powers to the panchayats. Later the Madras Panchayat Act 1958, specifically sections 83, 84 and 85, provided for the transfer of irrigation sources to the panchayat union council and village panchayats. The provisions are as follows:

83. Any property or income including any fishery right which by custom belongs to, or has been administered for the common benefit of the inhabitants of the village or town, or of the holders in common of village land, generally or of the holders of lands of a particular description or of the holders of lands under a particular source of irrigation shall, if so declared by the Government, vest in the Panchayats and be administered by it for the benefit of the inhabitants or holders aforesaid.

84. (1) All public water courses, springs, reservoirs, tanks, cisterns, fountains, wells, stand-pipes and other water works (including those used by the public to such an extent as to give a prescriptive right to their use) whether existing at the commencement of this Act or afterwards made, laid or erected, and whether made, laid or erected at the cost of the Panchayats or otherwise and also any adjacent land (not being private property) appertaining thereto, shall vest in the Panchayats and be subject to its control: Provided that nothing contained in this subsection shall apply to any work which is, or is connected with a work of irrigation or to any adjacent land appertaining to any such work. (2) The government may, by notification, define or limit such control or may assume the administration of any public source of water supply and public land adjacent and appertaining thereto after consulting the Panchayats and giving due regard to its objections, if any.

85. (1) Subject to such conditions and control as may be prescribed, the government may transfer to any Panchayat or to any Panchayats union council the protection and maintenance of any irrigation work, the management of turns of irrigation, or the regulation of distribution of water from any irrigation work to the fields depending on it.

(2) The Panchayats or the Panchayat union council shall have power, subject to such restrictions and control as may be prescribed, to execute kudimaramath in respect of any irrigation source in the village or town and to levy such fee and on such basis for the purposes thereof as may be prescribed:

Provided that nothing contained in this section shall be deemed to relieve the village community or any of its members of its or his liability under the (Tamil Nadu) Compulsory Labor Act, 1858, in respect of any irrigation source in the village or town, in case the Panchayats make default in executing the kudimaramath in respect of that irrigation source.

(3) Where the maintenance of any irrigation work is transferred under this section the fishery rights of government in such work shall be transferred to and be vested in the Panchayats or the Panchayat union council, as the case may be, subject to such terms and conditions including terms and conditions regarding the utilization of the income, as may be specified by the Government.

After the 73rd Amendment to the Constitution of India, the Tamil Nadu Legislative Assembly passed the Panchayat Raj Act 1994. Sections 83 and 85 of the 1958 Act have been retained as such in sections 132 and 133, respectively, of the Tamil Nadu Panchayats Act 1994.

Section 84 of the 1958 Act, which vests the water works in village panchayats, has not been incorporated in the 1994 Act for reasons not known. Actually it is this section that enables the village panchayats to own and exercise control over the water courses, springs, reservoirs, tanks, ooranies, etc. lying within the panchayat area. The failure to incorporate section 84 of the 1958 Act in the 1994 Act is a serious omission.

The powers under Section 85 (Section 133 of the 1994 Act) were delegated to the collectors. The

tanks were actually transferred to the panchayat unions and not to village panchayats. Small irrigation tanks with an ayacut of 10 acres and less were not transferred to the panchayats or panchayat unions. The PWD retained tanks forming part of river irrigation systems and tanks having an ayacut of more than 100 acres. The conditions of transfer of tanks were laid down in GO No. 711 LA dt 16.04.1960.

10.2.1 Fishing Rights

When the irrigation tanks are transferred to the panchayat unions for maintenance, the panchayat unions will have the right to fishery in those tanks under section 84 of the Tamil Nadu Panchayat Act 1958. But as pointed out earlier, no such section in the 1994 Act corresponds to section 84. However, the government has issued rules under its power to regulate the water sources by the village panchayats to maintain and regulate them similar to that of ooranies, fountains, tanks, springs, reservoirs, etc. lying in the village panchayat area. Wherever fish *patta* (deed) has been granted to individuals or institutions, the panchayat union will have no right to the fishery until the *patta* is cancelled. Fishery right will accrue to the panchayats under Section 83 of the 1958 Act (Section 132 of the 1994 Act). If by custom, such right belongs to the inhabitants of the village from a particular source of irrigation and if the collectors make a declaration that such right vests with the panchayat, the income from the fishery will then be used to benefit the inhabitants. It is very important that the declaration to this effect has to be issued by the collector. Until such a declaration is issued, the panchayat will not have any right. Earlier instructions regarding fishery rights have been completely modified after the issue of statutory rules by the government in GO (RT) No. 169 RD Dept, dt 16.08.1999. Under this rule, the panchayat union commissioner is authorized to auction the fishery right in all tanks vested with the panchayat union and all PWD tanks other than the provincial sources in the panchayat union area. Panchayats will auction the fishery rights in all water

bodies vested with them. The important point to be noted is that the fishery right in tanks can be granted only by public auction and not by any other means. The Madras High Court recently held that Section 83 of the 1958 Act (Section 132 of the 1994 Act) clearly contemplates a declaration by the government. There has to be a declaration by the government for vesting the community property or income to the panchayats. There is no automatic vesting under Section 83 without the declaration by government (delegated to the collector).

By the Tamil Nadu Land Encroachment Act, 1905, the government assumed full ownership and control over the water bodies. In 1949, the government enacted the Tamil Nadu Irrigation Tanks (Improvements) Act. This Act empowered the Government to increase the capacity of the tanks, whether they are government or private tanks. Suit against such actions was also barred under Section 4 of the Act.

10.2.2 Usufruct Rights

Use of the usufruct revenues by villagers is always objected to by government authorities, mainly the Revenue Department and not by the Irrigation Department (PWD) or the local panchayats. In the past, the villagers were enjoying the right to rear fish and grow trees in the bunds and in the water spread area of the tank. Individuals mostly plant trees such as tamarind and they enjoy these revenues by paying 2 C *patta* charges. The Revenue Department collects a tax based on the type of tree and recognizes the right of individuals who planted and guarded them, and allow them to make revenue from them. However, such a practice is not seen if all villagers join together for generating revenue from the tank bed. Currently, the panchayats are given such powers to raise such usufructs by planting or otherwise; however, they are not capable of doing anything in the tank beds. The practice of cutting juliflora (a wild growth) is illegal as far as the law is concerned and thereby the Revenue Department makes its "enforcement".

From the above, the following points that need policy changes and legal support emanate:

- The government has full ownership and control over the water bodies.
- The government is empowered to increase the capacity of the tanks, whether they are government tanks or private tanks.
- Suit against such actions were also barred under section 4 of the Act. Thus either the *panchayat* or PWD can claim right over tanks.
- The Revenue Department intervenes and appropriates the usufructs and bars the villagers to repair or use the waste lands in the tank area. Armed with Mines and Minerals Act, in several cases the Revenue authorities prevented the removal of silt from the tank bed.

Recommendation

It is recommended to lease the tank water spread area and the tank to the TUG on a long-term basis and vest it the responsibility of upkeep. They may be permitted to plant trees, rear fish, or generate income in any other manner. A condition may be stipulated that a part of the revenue thus generated is to be shared in an agreed proportion with the *panchayat*. This requires a policy change and suitable amendments to *panchayat* acts.

10.3 Policy on Investment Pattern

The present investment strategy is skewed toward physical rehabilitation and very little is provided toward institutional development, and maintenance and management. An examination of the various estimates of tank rehabilitations in Tamil Nadu reveals the following:

Total number of estimates of rehabilitated tanks analyzed: 875

Total provision made toward	Rs (lakhs)	%
Catchment area treatment	919.00	7

Storage area improvement	5,975.50	45
Command area development	4,259.04	32
Institutional development	338.96	3
Administrative cost	1,810.50	14

The rehabilitation funding norm is based on rupees per ha of command area. This criterion was formulated when the focus of rehabilitation was on tank and on-farm development works. The provisions made in the past for catchment's treatment, feeder channel cleaning, and increasing the storage capacity of the tank were grossly inadequate, as the budget for these items were then decided by the extent of command area. The focus of rehabilitation in the future is to be more on water acquisition. Hence, it should be based on rupees per sq km of catchment area for works in the catchment including feeder channel improvement; for tank storage improvements, it should be based on rupees per ha of water spread area; and for the command area, it should be based on rupees per ha of command area. With the available average value of catchment area, water spread area, and command area of the above 875 tanks, the tentative cost per unit is arrived as below:

Catchment area	Rs20,000 per ha
Water spread area (improvements to tank bund, sluices, weirs, desilting)	Rs30,000 per sq km
Command area development	Rs5,000 per ha

The rehabilitation cost may be provided in the above unit rate basis. This cost will constitute 75% of the total project cost. The remaining 25% of the cost toward institution and maintenance and management is to be arrived and added to get the total project cost. The allocation in the total project cost is:

Institutional development	10%
Physical rehabilitation	75%
Maintenance and management	15%

Using this allocation for typical tanks, the cost per ha of the command area works out to Rs34,000 (Annex IV). This unit rate can be adopted for project formulation. A one-time investment of 15% for maintenance and management will be allocated from the rehabilitation funds and this amount will be deposited in a bank. The interest accrued out of this fund can only be used for maintenance and management. To draw the interest from the bank, the TUG must provide a matching grant in terms of cash or labor.

The budget provided for physical rehabilitation will have two levels—a base level that can be drawn without any matching contribution from the TUG and a supplementary level for which the TUG's contribution is a must; and a higher level of contribution from the TUG will fetch more government grant for physical rehabilitation of tank work. The base level budget should be used to remove encroachment, and provide requisite dead storage through desilting and livelihood options for landless and marginal farmers.

10.4 Policy on Execution of Work

10.4.1 Role of the TUG

The government and funding agencies have reservations on the capability of FAs in carrying out rehabilitation works and in completing the work on time and with quality. But many NGOs and JSYS experiments in Karnataka and limited experiments carried out in Tamil Nadu by the CWR under the Ford Foundation and EEC funding have proved beyond doubt that the farmers are capable of executing quality work. Hence, the rehabilitation should be implemented by the TUG. If contract system is to be followed, a contractor from the village/block and recommended by the TUG should be entrusted. The TUG should supervise the work.

Local people who have been using the tank for years are the best judges on what is to be rehabilitated and how it can be done to get the maximum ben-

efit. They need to be consulted and must be allowed to make decisions, which must be implemented by them, with their contribution to rehabilitation through cost sharing. Components to be rehabilitated, and budget for different components and timing of completion must be flexible enough to meet the requirement of the tank users. The farmers' share of the cost of rehabilitation either in cash or labor and savings from execution of work is to be put together to create a corpus fund.

10.4.2. Role of SHGs

Formation of SHGs at the hamlet and village levels is fast spreading throughout the southern states of India. The training and exposures enabled the members of SHGs to articulate in meetings and have empowered them with confidence both financially and venturing into new enterprises. The potential of SHGs should not be confined only to microfinancing and income-generating activities; they must also be given a greater role in tank rehabilitation activities. A mere 30% representation of women in the TUGs results in nonparticipating backbenchers in tank activities. But when the SHGs are made part of the TUGs, they articulate and take keen interest in the latter's activities. By this, real empowerment of women will take place. The SHGs should be entrusted with tank rehabilitation works as done by GVs in Karnataka and Pondicherry. Capacity building of SHGs and vulnerable groups is a built-in component of the tank rehabilitation project. Intensive training inputs are given for the sustainability and efficient functioning of TUGs and to improve their livelihood.

10.5 Equity and Poverty Alleviation Considerations

Tank rehabilitation had been aimed to increase agricultural production. The benefit had gone to the landholders mainly and landless agricultural laborers marginally as wages. On the whole, per capita income was Rs1,144 considering the popu-

lation. If the tank rehabilitation is planned as a poverty alleviation program along with agricultural production, everyone in the village gets benefited one way or other. The per capita income in this case is Rs1,903 showing an increase of 66%.

In view of the increased benefits and from equity consideration, improving the livelihood of the rural community through increasing the gross tank product should be the objective of future tank rehabilitation and rejuvenation projects.

10.6 Summary of Recommendations for Orissa and Tamil Nadu States

Issue	Tamil Nadu	Orissa
Objectives	In Tamil Nadu, tank rehabilitation objectives have moved from merely increasing agricultural productivity to improving livelihood opportunities through tank rehabilitation.	In Orissa, the major focus of tank rehabilitation until now is in increasing the agricultural productivity through on-farm water distribution and tank repairs.
1. Selection of tanks for rehabilitation	The selection of tanks should be based on its hydrological endowment. Depending upon the hydrological endowment, rehabilitation components have to be decided. As far as possible, all tanks in a cascade need to be considered for rehabilitation.	For selecting tanks for rehabilitation, the objectives of rehabilitation are to be spelt out clearly. Then criteria can be formulated for tank selection to meet the objectives.
2. Institutional arrangements		
i. Tank level institution	Tank-level organization involves 3 limbs— service users, service providers, and service facilitators . Service users, who constitute the members of TUGs, include not only <i>ayacutdars</i> but all landholders, landless, artisans, and women who all use tank water and tank area. All must interact, cooperate, and work together to sustain tank irrigation.	Tank-level organization involves 3 limbs— service users, service providers, and service facilitators . There are 2 types of tanks—one mainly used for agriculture and the other, for fishing. Service users, who constitute the members of TUGs, will depend upon the predominant users. All must interact, cooperate, and work together to sustain tank irrigation. Involving service facilitators such as NGOs is a must for the success of the project.
ii. TUG and panchayati raj institution	TUGs can be made subcommittees of the <i>gram sabha</i> and the revenue from usufructs of the tank and water spread area (fish auction, trees, firewood and silt) can be shared at an acceptable ratio by the <i>panchayat</i> and TUG.	Presently, WUAs under the EC project are exempted from Pani Panchayat and Irrigation Acts. They can collect tax and use it for O&M activities. This has to be regularized.

Issue	Tamil Nadu	Orissa
		TUGs can be made subcommittees of the <i>gram sabha</i> and the revenue from usufructs of the tank and water spread area (fish auction, trees, firewood and silt) can be shared at an acceptable ratio by the <i>panchayat</i> and TUG.
iii. Linkages with government departments	Village-level TUGs are the lowest in hierarchy. There will be a federation at the cascade level, basin/district level, and an apex body at the state level.	Village-level TUGs are the lowest in hierarchy. There will be a federation at the cascade level, basin/district level, and an apex body at the state level.
iv. Responsible government departments and TUG	One single agency such as PWD or Rural Development Department must be made the nodal agency in charge of the tank system. Lease the tank water spread area and the tank to the TUG on a long-term basis and vest with them the responsibility of upkeep. Collecting revenue, carrying out repairs, and receiving funds from government will be only by the tank level organization.	One single agency such as PWD or Rural Development Department must be made the nodal agency in charge of the tank system. Two sets of farmers' organizations, PP and WUA, exist. In the interest of the State and sustainability, both have either to be merged or vested with similar powers in tax collection. PP may be vested with the power of collection of revenue and carrying out repairs and receiving funds from government.
3. Components of rehabilitation	Rehabilitation should comprise catchment treatment, foreshore plantations, creation of dead storage for community and livestock use, improvement to supply channels, improvement to tank structure, on-farm development works, and provision of community wells. The focus should also be on providing livelihood to all including the landless during off season and during drought.	Rehabilitation focus should be on distribution of water and water management through on-farm development. Focus should also be on providing livelihood to all including the landless during off season and during drought.
4. Investment criteria and financial allocations	The rehabilitation budget should be allocated in the ratio of 10%, 75%, and 15% to institutional development, physical works and maintenance, respectively. A one-time investment of 15% for maintenance and management activity will be allocated from the rehabilitation funds and this amount will be deposited in a bank. The interest	The rehabilitation budget should be allocated in the ratio of 10%, 75%, and 15% to institutional development, physical works and maintenance, respectively. A one-time investment of 15% for maintenance and management activity will be allocated from the rehabilitation funds and this amount will be deposited in a bank. The interest

Issue	Tamil Nadu	Orissa
	accrued out of this fund can be used only for maintenance and management. To draw the interest from the bank, the TUG must provide a matching grant in terms of cash or labor.	accrued out of this fund can be used only for maintenance and management. To draw the interest from the bank, the TUG must provide a matching grant in terms of cash or labor.
5. Who should execute the work	The rehabilitation should be implemented by the TUG. If the contract system is to be followed, a contractor from the village/block and recommended by the TUG should be entrusted. The TUG should supervise the work.	The rehabilitation should be implemented by the TUG. If the contract system is to be followed, a contractor from the village/block and recommended by the TUG should be entrusted. The TUG should supervise the work.
6. Role of SHGs and empowerment of women	The SHGs are to be made part of the TUGs. This ensures real empowerment of women. The SHGs should be entrusted with tank rehabilitation works. Capacity building of SHGs and vulnerable groups is a built-in component of the tank rehabilitation project. Intensive training inputs are to be given for the sustainability and efficient functioning of the TUG and to improve their livelihood.	The SHGs are to be made part of the TUGs. This ensures real empowerment of women. The SHGs should be entrusted with tank rehabilitation works. Capacity building of SHGs and vulnerable groups is a built-in component of the tank rehabilitation project. Intensive training inputs are to be given for the sustainability and efficient functioning of the TUG and to improve their livelihood.
7. Monitoring	The TUG should monitor the work when it is being carried out by contractors. If any of the works need changes to ensure planned operation and distribution of water, they have to be carried out and turned over to the TUGs. After the completion of rehabilitation, there should be a period of joint management where the department officials closely help the TUG in O&M activities. There should be a subcommittee in the TUG to do social audit of the water distribution to ensure equity among the users.	The TUG should monitor the work when it is being carried out by contractors. If any of the works need changes to ensure planned operation and distribution of water, they have to be carried out and turned over to the TUGs. After the completion of rehabilitation, there should be a period of joint management where the department officials closely help the TUG in O&M activities. There should be a subcommittee in the TUG to do social audit of the water distribution to ensure equity among the users.
8. Training and capacity building	Capacity building has to start before planning rehabilitation. All stakeholders including SHGs and the landless have to be involved in the training activities. The first part of training com-	Capacity building has to start before planning rehabilitation. All stakeholders including SHGs and the landless have to be involved in the training activities. The first part of training com-

Issue	Tamil Nadu	Orissa
	<p>prised of awareness creation, formation, and strengthening of TUGs and introducing income-generating activities among SHGs, and involving them in tank rehabilitation work can be entrusted to an NGO. The second part of capacity building and training comprised creation of effective leadership skills and commitment among TUGs, management of TUG affairs, conflict resolution, resource mobilization, O&M of tank systems, water management and agronomic practices, and linking with market can be accomplished by a trained community organizer or a training institute like WALMI and IMTI. The training programs have to be tank-specific to be conducted at the village/block with more time on hands-on experience. After the rehabilitation, the TUGs must have a continuing training program on expanding their activities to federation levels, coordination with other TUGs and government agencies, and maintenance activities. As the capacity building has to be continued even after rehabilitation in a periodic manner, specialized institutions, like WALMIs, universities, and NGOs may be entrusted with capacity building.</p>	<p>prised of awareness creation, formation, and strengthening of TUGs and introducing income-generating activities among SHGs, and involving them in tank rehabilitation work can be entrusted to an NGO. The second part of capacity building and training comprised creation of effective leadership skills and commitment among TUGs, management of TUG affairs, conflict resolution, resource mobilization, O&M of tank systems, water management and agronomic practices, and linking with market can be accomplished by a trained community organizer or a training institute like WALMI and IMTI. The training programs have to be tank-specific to be conducted at the village/block with more time on hands-on experience. After the rehabilitation, the TUGs must have a continuing training program on expanding their activities to federation levels, coordination with other TUGs and government agencies, and maintenance activities. As the capacity building has to be continued even after rehabilitation in a periodic manner, specialized institutions, like WALMIs, universities, and NGOs may be entrusted with capacity building.</p>

Note: EC=European Community, Gol=Government of India, IMTI=Irrigation Management Training Institute, IWMI=International Water Management Institute, MI=minor irrigation, NGO=nongovernment organization, O&M=operation and maintenance, PRI=panchayat raj institutions, PWD=Public Works Department, TUG=tank users' group, WALMI=Water and Land Management Institute, WUA=water users' association

Annex I

Tamil Nadu and Orissa Study*

1. Introduction

Several initiatives were undertaken during the past few decades in the rehabilitation of a number of schemes in different states of India either with state funds or external donor assistance from the World Bank, European Union, etc. This study focuses on Tamil Nadu and Orissa. Tamil Nadu had a long tradition of tank irrigation systems which had been neglected over time. However, recently a large number of minor irrigation schemes were rehabilitated. Orissa suffers from the flood and drought syndrome and is a very poor state. Despite being endowed with adequate water resources, 48% of the population falls below the poverty line in the rural areas. Based on detailed survey of 50 selected schemes in different agro-climatic zones of each state, the study examines the methodology adopted in rehabilitating the schemes, various sources of funding, existing institutional arrangements for operations and management (O&M), and makes specific recommendations on institutional arrangements and cost effective methods of rehabilitation. The schemes were selected such that they are in clusters in a sub-basin of a river system and the hydrological linkage and water balance are considered while determining water availability and uses.

2 Literature Survey

The few cases of tank management by traditional systems are scattered in Rajasthan, Andhra Pradesh, Karnataka, and Tamil Nadu. In Tuticorin, the Peikulam minor tank and a tank in Dindigal have traditional systems that have survived over 100 years. Mosse (2003) concludes that considerable caution is necessary in extending lessons from indigenous traditional systems to other tank systems

while establishing new institutional systems. The existence of traditions of collective action may not therefore predict the success of new formal assets holding organization-demanding procedure for public accountability or financial management. Successful cooperation does not imply collective responsibility for managing wider resources for tank systems. Not only is fund management avoided in the indigenous systems but also villagers conspicuously avoid investment in tanks as a common productive resource. The moral claims on common resources for expenditure on temples, festivals, and other culturally defined public goods are high. This penalizes collective investment for production and militates against collective entrepreneurial activities. The point is that resource mobilization is linked to investment in system maintenance or income generation in culturally specific ways. Indigenous institutions are characterized by transactions, which emphasized this social identity, position, and status of actors. They are not between free and independent appropriators. The organization of new democratic societies based on the principles that all individuals irrespective of identity have equal rights often is in contradiction with the very logic of social relation in indigenous systems. Given that rules of resources used are the product of social relationship, new rules isolated from old interests are unlikely to achieve authoritative enforcement simply because they were publicly agreed.

Existing systems of water use are supported by structures of authority and not democratic decision making. They often serve symbolically to express and reproduce this authority and the accompanying gender and caste exclusions. Attempts to establish alternative democratic and accountable institutions often result in: the co-option of new institutions by

* This section draws on the study report prepared by B.S. Bhavanishankar.

local leaders or the reproduction of existing structures inside new organizations; the dismissal or side lining of new organizational forms; or the undermining and disruption of new organizations through local resistance. As documented cases illustrate, there is often more at stake in their control and they are therefore more often the subject of prolonged dispute.

Institutional innovation in tank systems takes place in the context of change, where resource flows expressing existing authority are breaking down and where new, more democratic arrangements are sought. Indeed, external interventions promoting new associations based on principles of equity and democracy often precipitate such crisis in local authority as well as provide sources of support for subordinate groups and offer new institutional solutions. Social processes disrupting authoritative structures may encourage new forms of enlightened, accountable and disinterested leadership compatible with new patterns of resource use. However, it is often the decline and erosion of indigenous forms of collective action which actually makes the appearance of new forms of association possible. Contrary to common assumption, successful cooperative institutions are not the expression of enduring institutions of village self-government but a sign of the replacement of indigenous authoritative control.

Tank management has not historically been an autonomous affair. In the new water users' associations (WUAs) and irrigation management transfer, also, the role of external agencies is important and frequently overlooked. External development interventions of all kinds offer material and symbolic resources for use in the ongoing renegotiation of social relations. In this sense new institutions, tank societies and others serve political purposes, being used, especially by subordinate groups, to acquire resources (from programs or NGOs), to lobby and forge external links as much as for the management of village resources. The best and most reflective of recent tank development efforts go beyond the idea of tradition and begin to

examine the dynamic and contested meanings of community underlying resource use in Tamil Nadu today; and then strategically support subordinate groups to enhance access to, and control of water resources, taking operational clues from ongoing struggles, knowledge, and strategies rather than constructing steady-state models of cooperation.

3. Methodology

To facilitate data collection from the field at the selected tank locations in the interior, through visits and interviews with the local people, a team comprising an engineer and a sociologist was formed for each state. About 10% of the tanks were studied in-depth for engineering information. The questionnaire sought to cover information on engineering, economics, social, and institutional aspects regarding the tank and tank users. The assessment of the present situation was done through group discussions with beneficiaries of the tanks. The research assistants (RAs) stayed in the field to collect data, conduct interviews, and observe agricultural and irrigation practices in the command area. The current practice of water distribution among users, the decision-making process, the role of women, and the revenue payment performance among different set of users was analyzed to assess the capacity to manage the system by the community. This field study highlights the need to bring about major institutional restructuring if tank systems have to be self-sustaining with equity and access to water for all sections of society including weaker sections like dalits, scheduled castes and scheduled tribes (SCs/STs), and women.

4. Tamil Nadu

Almost 90% of the tanks in the state are in tank chains/cascade, therefore, selection of tanks was done by chain approach. Also based on the agro-climatic distribution of tanks in the state, tank chains were chosen from the two major agro-climatic zones. Seven tank chains, five from southern zone

Table A1. Selected Tank Chains

Chain	Total	Sample	Agro-climatic Zone	Projects
1. Alisoor	12	7	Northeastern	Partial rehabilitation (EC, WB, MP, and FW programs)
2. Uthiramerur	27	5	Northeastern	Partial rehabilitation (EC and WB funded)
3. Nanjure	20	19	Southern	Chain rehabilitation (EC, FW, and MP funds)
4. Kolpidi	9	3	Southern	Partly rehabilitated (MP and FW program)
5. Kilavaneri	9	8	Southern	Partial rehabilitation (EC, WB, FW, and MP funds)
6. Villur	18	9	Southern	Chain rehabilitation (EC and MP funds)
7. Vallakulam	7	3	Southern	Chain rehabilitation (EC funds)
Total	102	54		

Note: EC=European Community, WB=World Bank, MP=Member of Parliament, FW=Food for Work.

(representing 45% of tanks in the state) and two from the northeastern zone (representing 23% of tanks in the state) were selected. The total number of tanks in these seven chains total to 102. Of these 54 sample tanks located in the head, middle, and tail locations of the chains were selected (Table A1).

The average actual irrigated area of the 54 sample tanks during the last 4 years (2000/1 through to 2003–04) was about 69% at 1,822 hectares (ha) as against the registered command of 2,643 ha. In these 4 years the actual irrigated area varied from 1,663 ha during 2002–03 to 2,018 ha during 2000–01, which more or less followed the annual rainfall pattern.

4.1 Farming

Rice (paddy) is invariably cultivated either wholly (37 tanks) or partly (17 tanks) in sample tank commands during the main tank season. The other major crops cultivated are sugarcane (13 tanks), cotton (2 tanks), and one tank each with banana, betel vine and groundnut. Second season rice was cultivated in about 26 tanks either wholly or in part of the command with supplemental well irrigation. The other major crops cultivated during the second season are cotton, sorghum, groundnut, pearl millet and fox tail millet.

4.2 Water Management

Field-to-field irrigation as well as channel-to-field irrigation coexist in almost all tank commands. In a

few cases the main channels have been lined (wholly or selectively).

4.3 Tank Rehabilitation Programs

Tank rehabilitation programs have a long history and perhaps date back to the time of formation of tanks themselves. The centralization of the tank administration in the last 2 centuries by the British colonial administration led to severe consequences—alienating the local community from taking up collective efforts toward the maintenance of tanks. The investments on the preservation of tanks also steadily declined, resulting in the deterioration of the tank systems. Later after independence, the continued intervention of State in managing common property resources (CPRs) has further diluted and in most cases has erased the concept of community participation. There have been several efforts taken up by the government (State and Center), nongovernmental and donor agencies to rehabilitate tanks. Given below are some major and notable programs after independence in Tamil Nadu.

- Special Minor Irrigation Programme (1950–1980)
- Desilting-cum Reclamation Programme
- Accelerated Minor Irrigation Programme
- Tank Restoration Schemes
- Maintenance and Repair of Irrigation Tank by Highways and Rural Works Department

Table A2. Summary of Tank-Related Problems Identified in the Study Tanks

Component	Category	Constraint
Tank System Facilities		
Tank	Catchment treatment	Soil erosion induced reduction in tank storage and tendency for silting up at intake points
	Tank bund	Insufficient top width and freeboard due to soil erosion of top level; leakage
Intake and outlet structure	Intake works	Water leakage due to damaged structures; broken water control facilities such as plugs and barrels; broken and damaged front and rear inlets and outlets
	Waste weirs	Insufficient length; damaged leaky body wall and eroded rear protective works
Supply works	Supply channel	Reduction of design discharge as a result of silting of channel; deterioration of stone masonry channel; insufficient flow velocity due to weed growth; leakage
Irrigation System		
Distribution network		Slow movement due to obstruction by vegetation growth; heavy seepage loss; salt injury in inundated command areas due to channel leakage
O&M		Occurrence of nonirrigated area due to insufficient water control structures
Irrigation management		Continuous over-drawing without relevance to actual need; unofficial restoring subordinating equity to vested interests; small size plot-to-plot irrigation

- State Tank Irrigation Project (1995-96)
- Tank Rehabilitation Programme – Food for Work Programme
- Tank Rehabilitation – MP/MLA Funds
- Member of Parliament Local Area Development Scheme
- Members of Legislative Assembly Constituency Development Scheme
- Rehabilitation and Modernisation Projects (funded projects)
- Tank Modernisation Programme – European Commission (EC)-assisted, in phases
- Tank Rehabilitation Project – World Bank-assisted Water Resources Consolidation Project
- Tank Rehabilitation Programme – National Bank for Agriculture and Rural Development (NABARD)
- Tank Rehabilitation Programme – Housing

Urban and Development Corporation (HUDCO)

4.4 Lessons from Past Efforts

The past efforts in tank rehabilitation through externally assisted tank projects could not completely reverse the process of tank degradation. There seemed to no realistic and sustainable model of tank conservation and management that has practically demonstrated to be successful. Of 39,000 tanks in the state of Tamil Nadu about 1,350 tanks have been “rehabilitated” with an outlay of Rs315 crores over the last 20 years. Most of these modernization investments were funded by external agencies such as EC and the World Bank.

Although tanks and their problems and potentials across agro-climatic and socio-economic regions

of the state are unique, one can see uniformity in approach in the rehabilitation projects. In most of these rehabilitated tanks the institutions established as a part of the project have become defunct together with poor maintenance of physical structures. The first major drawback of the past tank modernization projects was the failure to view the tanks from the livelihood perspectives of the people. In spite of the uncertainty in tank filling and the need for supplementary role of well irrigation, there was a lack of attention to provide the poor farmers with access to groundwater through group or community wells. There was no linkage between tank rehabilitation programs and other resource conservation programs such as watershed development, community wells, forestry, and wasteland development and the poverty alleviation programs such as micro finance, food-for-work, and drought relief works. Rehabilitation of physical structures such as field channels and sluices has been overemphasized and but it does not appear that serious efforts were made to ensure the active participation of farmers in decision-making, removal and prevention of encroachments, and turnover of benefits from tank usufructs to the village community.

Secondary stakeholders such as fishermen, agricultural labor households, pastoralists and nonagricultural households were not included in the tank community and hence could not stand against vested interests and encroachers. What appears to be emerging is a vicious cycle in tanks: externally assisted rehabilitation of tank structures—no/inadequate attention to sustainable institutions—poor maintenance—deterioration—further dependence on externally assisted rehabilitation. There were limited efforts in earlier projects to strengthen WUAs and help make them financially viable. The projects abruptly ended with the completion of physical execution. In none of the earlier projects such support existed after the project was completed with a one-time matching grant of Rs250 per ha. This amount was too meager considering the cost of rehabilitation.

5. Orissa

There are traditional tank systems in the western and southern part of Orissa, which were under the Madras Presidency during British Rule. Nearly 40% of the total minor irrigation (MI) schemes are located in this region. Even after the independence these minor irrigation projects (MIPs) were maintained by the Rural Engineering Department, which was formed in the year 1962 and later in 1980 the Minor Irrigation Organization was established for the schemes with ayacut of 40–2,000 ha.

The estimated net command area (NCA) under MI schemes ending June 2003 is 558,508 ha, which is about 21% of the total NCA of the state. Of the 3,696 MI schemes, 2,200 are classified as fully operational, 740 as partially derelict, and 582 as completely derelict. 174 MI schemes are under construction. The area of these defunct or partially defunct schemes amounted to 159,032 ha, which is about 28% of the NCA of all MI schemes. There are 983 diversion weir MI schemes and the rest 73% are storage reservoir schemes.

The net area irrigated by tanks (including the schemes maintained by the Panchayat Raj Department) in Orissa in 1950–1951 was about 546,000 ha, which was about 54% of the total net irrigated area in the state. From 1955 to 1956, it started declining over time in absolute figures and not in terms of proportion to the total net irrigated area. In 2000–2001, the net area irrigated by tanks in the state was 305,000 ha, which was about 14% of the total net area irrigated.

5.1 Selected Schemes

Since the schemes are scattered and chain types do not exist, the individual schemes were selected by considering other factors such as backwardness, drought effect, and rehabilitation requirements. The details of selected schemes are in Table A3.

Table A3. Selected MI Schemes

No. of Schemes	Sub-basin	Agro-climatic Zone	District
21	Tel, Ong and Suktel sub-basins of Mahanadi river basin	Western Central Table Land	Bolangir
21	Baitarani river basin	North Central Plateau	Keonjhar
5	Brahmani river basin	Mid-Central Table Land	Dhenkanal

Of 47 schemes, 6 belong to Panchayat Raj Department and the rest are under Minor Irrigation Department. Seven of them are diversion weirs and the remaining are reservoir schemes. As per MI classification, 25 schemes are supposed to have developed full potential, whereas 19 of them are partly derelict and 2 of them completely derelict. The total command area is 7,043 ha and the average per scheme is 150 ha.

The average actual kharif irrigated area during the 3 years is 104 ha, which is just 63% of the certified kharif area. However, only in 10 schemes, the actual kharif irrigated area is less than 50% of the certified kharif command and in 23 schemes it is more than 80%.

Only 11 schemes have rabi irrigated area with an average area of 17 ha. The total rabi irrigated area is just 2.7% of the total kharif certified area, whereas the designed rabi irrigated area is 11% of the total kharif designed area. However, the average actual rabi irrigated area for the last 3 years is even less than 50% of the rabi certified area. It clearly indicates that the schemes are lagging in rabi irrigation although the potential exists.

5.2 Physical System

The systems constructed before independence are not according to design standard and hence there are incidences of overtopping and breaches like in Kemposara MIP of Keonjhar district. Only 17 schemes have strong bunds and up to standard size and shape and, an equal number of

schemes have weak bunds and not up to standard. Two out of the remaining 14 schemes are up to standard size and shape but weak with seepage. In 12 schemes the bund is not up to standard but they are strong enough with little rehabilitation requirements. Only 14 schemes have good and forested catchment whereas the rest are vulnerable to erosion. Encroachment in the foreshore area and water-spread area is visible in the selected districts. Encroachment problems in the water spread area are severe in only 4 schemes and moderately in 7 schemes whereas the siltation problem is severe in 25 schemes, which needs catchment treatment works inevitably in all the schemes. General observation is that considerable dead storage is available in most of the schemes even though the farmers reported that siltation has occurred in all the schemes either slightly or moderately or even heavily. However, as per the farmers' version, the siltation rate is alarming due to catchment conditions. The siltation is heavy in all the schemes in Keonjhar district due to various reasons such as mines, cultivation in the catchment and immediate foreshore area, and deforestation. The combined problems of siltation and encroachment are as follows:

- The head regulators/sluices are not functioning properly in almost all the schemes and so the leakages are heavy, which reduces the storage for the rabi system. Profuse leakage is observed in 17 schemes and the condition of the shutters is poor in another 15 schemes, whereas the shutters are not all available in 2 schemes.

- All schemes have proper weir arrangement either of broad crested/flush/ogee/chute spillway. However, the condition of the weir is good in eight schemes only and they are in average condition in 15 schemes, whereas in 24 schemes they are in poor condition. This also adds up to the cost required for head works.
- Schemes of pre-independence period do not have proper canal systems. The structures in 41 schemes need either major repair or complete renovation. Only 5 schemes have good distribution network due to recent rehabilitation under the EC assisted Project. In EC assisted project, head works are neglected and in a bad condition. There is inequitable distribution of water and water does not reach to the tail ends in many areas.

5.3 Environmental issues

The water body/reservoir is also used for bathing, washing and fishing purposes. Pisciculture is in practice only in very few schemes. In the schemes closer to the urban areas farmers are not interested in agriculture and formation of pani panchayats (PPs). They lease land to tenants for cultivation (e.g., Mandua Badadera MIP and Barbil MIP).

A considerable number of schemes in Keonjhar district is affected by the iron ore mines. For example siltation is higher in Suakathi, Jalajagara and Patabila MIPs due to the mining in the catchment area and people are not interested in cultivation due to demand for labor in the mines as in Basantpur, Panchananpur, and Balita MIPs.

5.4 O&M

O&M are generally with the department except the schemes where the O&M of conveyance is handed over to WUAs or PPs. As per eleventh Finance Commission, the government of Orissa norm for

O&M provision for minor irrigation schemes is Rs225 per ha and staff salaries consume most of this budget.

5.5 Farming

Paddy yield on average is 2.1 tons per ha during kharif season in the study area. The average profit margin per ha of kharif paddy per ha was Rs3,775 during 2000–2001 and marginally increased to Rs4,250 per ha during 2003–2004. Tenancy cultivation exists in 38 schemes where the average area under tenancy is 38% for an average rent of Rs1,375 per acre. The payment is mostly in kind or crop produce. Tenancy cultivation is greater when the schemes are closer to the townships or where the industries have come up, as in Keonjhar district.

5.6 Water Management

Field-to-field irrigation is followed in all the schemes and there are no field channel arrangements. The issue is addressed in some EC-assisted MIPs. Water distribution in 31 schemes is being taken up by all farmers. In the village without any proper scheduling and in 8 schemes they have appointed a waterman to distribute water. The waterman receives Rs60 per day for the days of water distribution. Only in 12 schemes general village meetings are held to decide the water distribution pattern out. Of these, in 8 schemes the PP/WUAs take decisions. The average water storage that is available for rabi irrigation at the end of October is about 30% of the capacity. Only in 16 of the 47 schemes, storage is more than 30% and is 70% in only one scheme. This storage is normally used for bathing and washing, which is in practice in all reservoir schemes. Fishing is practiced in 22 schemes. The other important use of the storage is for livestock drinking.

5.7 Conflicts

Conflicts over water use exist in 33 out of 47 schemes and it is mostly between head end and

tail end farmers within the command and chak (outlet) levels. In 24 schemes, there are conflicts between big and small farmers in the villages the users, and in 2 schemes there are conflicts regarding fishing and agriculture. There are court cases related to water in 2 schemes and unsettled disputes in 2 other schemes.

5.8 Rehabilitation

The major and minor maintenance works are being taken up by the Minor Irrigation Department based on the budget allocation (approximately Rs220 per ha of command area) and through contract system. The role of farmers in these works is limited. The budget provision is also insufficient to keep the system at full capacity.

None of the projects in the MI sector undertakes scheme rehabilitation holistically. The EC project is attempting to rehabilitate the distribution system and transfer the irrigation management to WUAs after providing adequate training on all aspects, with specific emphasis on O&M. However the head works are not being rehabilitated according to the design standard under the EC project. In the EC-assisted project, WUAs implement rehabilitation works in the distribution network after prioritizing the essential and secondary requirements. It appears likely that the financially strong and influential farmers are in control and there has been no advance on the rehabilitation work by the government.

The MI sector also receives funds from NABARD and Gol for completing ongoing schemes, taking up new schemes, bringing in additional command area, and formation of PPs. The Minor Irrigation Department obtained Rs20 crores from Gol to rehabilitate schemes in Ganjam and Gajapathy districts through PPs, using an approach similar to the EC project. As per the estimation of primary requirements by field engineers, about Rs28,000 per ha is required to make the system functional to capacity. However, the estimates vary widely from Rs5,000 to Rs70,000. The cost-sharing level between head

works and distribution network is 44:56. The detailed study undertaken in 5 schemes have also shown wide variations in rehabilitation costs (Table A4).

Table A4. Rehabilitation Costs

Scheme	Certified Command Area (ha)	Cost (Rs)	Cost (Rs) per ha
1. Kharidali*	144.0	2,804,000	19,475
2. Raikala	47.8	787,000	16,467
3. Kemposara	48.0	3,218,000	67,048
4. Loisinghasagar	119.7	3,800,000	31,746
5. Jhankarapali	108.9	2,350,000	21,579
Average			31,263

Note: * Cost of rehabilitation under EC Project is also included.

5.9 Current MI Projects

The government of Orissa, Gol, NABARD, and EC with an ultimate aim of increasing/utilizing the irrigation potential, currently supports MI sector for construction of new MIPs, completion of incomplete schemes, rehabilitation, formation of PPs, and employment generation. In only one scheme (Mandua Badadera) MIP farmers reported they undertake distribution network cleaning annually without external support. There is a mixed reaction from the farmers on the recent work taken up by the government. However, they agreed that the schemes benefit people although the work is not holistically and satisfactory.

5.10 Institutions – PPs/WUAs

In southern Orissa traditional systems work similar to those in bordering Andhra Pradesh as they belonged to the same province under British India. In the north and west, traditional management of tank systems follow the types in Madhya Pradesh and Bihar where the village panchayats controlled the tank systems and during the British rule, the irrigation panchayat system developed and managed the tank systems and remitted the water tax to the government while retaining a part as commission for running the panchayats.

Historically, there were no formal WUAs but all farmers participated in water distribution and O&M works. The chaukidar called in the farmers on the previous night, so that in the morning one person from each family would come. Disputes among the beneficiaries between tail end and upper end were resolved through the mukhia. Due to participation of farmers, equity, efficiency, and sustainability of water use was ensured. The farmers together decided the operation of the tanks to prevent wastage of water. Meetings were held at night usually at the temple and the farmers jointly decided to reduce the frequency of irrigation when the tank did not have sufficient water in deficient years of rainfall.

There are two types of farmers' organizations in Orissa: the PPs under Pani Panchayat Act and the WUAs under the EC-assisted MIPs. Under the EC-assisted project implemented in 50 schemes, WUAs are formed and registered under Societies Act 1860. Pani Panchayat Act was enacted in 2002. Engineers from the Water Resources Department are in-charge of forming the PPs. Whereas under EC project, community organizers have been recruited for institutional formation and further support. PPs have been formed in considerable number of schemes such as Biju Krushak Vikas Yozana (BKVY), NABARD Funds, etc. as follows:

Details	No. of Pani Panchayats	Area Covered (ha)
Minor irrigation	Nil	Nil
PPs formed	1,220	203,000
O&M transferred	770	120,000
Delineated by Super-intending Engineer	1,685	160,000
Lift irrigation	Nil	Nil
Handing over	6,867	157,000

Of the 47 selected study schemes, 18 schemes have PPs formed under the BKVY project and 5 WUAs formed under the EC-assisted project, out of which

2 schemes have been further handed over to WUAs for O&M. BKVY has contribution to rehabilitation works. The PP has to contribute 10–20% of the rehabilitation cost. However, in the EC-aided project, WUAs are not contributing toward rehabilitation. General farmers have little idea about the functions of PPs, which are usually managed by the big and affluent farmers. Awareness among farmers about MIPs and institutions is comparatively higher in the EC project due to the community organization program.

5.11 Gender Issues

Women's role is negligible in the selected schemes, comprising only 5% of total members in the PPs and 10% in the WUAs. Only in two cases, Aunli Irrigation Project and Baulasahi MIP, the management committee is dominated by women. However, in both cases women members are dependent on their male partners for decision-making. Women do not come forward to take on responsibilities due to traditional setups.

5.12 Social Issues

The number of SC/ST persons in Orissa is higher than Tamil Nadu and 9.5% of households in the selected schemes are landless, working as agricultural laborers. Except the schemes close to towns (e.g., Mandua, Badadera, Barbil, Sanabaril, and Khandra MIPs), migration is prevalent in all the schemes. However, this is less than 20% of the total village population. Migrants fall in the age group 20–40 years. Women migrate in 25% of the villages. Several farmers go for employment as daily labor in the towns within their district (to coal mines), state (to the National Aluminum Company or to the Paradeep, Cuttack, Bhubaneswar, and Talcher Thermal power plants), or to outside the state to West Bengal, Mumbai, and Surat. Migration takes place between November (immediately after the kharif harvest) and March (till the festival of holi). The migrants return to their villages just before

the onset of the monsoon. The wage rate earned is Rs50–100 per day. Those who work in industries earn more than the other daily labor in towns. The social cohesion in the villages is declining due to:

- Decrease in participation in common welfare
- Increase in open political affiliation
- Decrease in village meetings
- Decrease in interdependence among households
- Increase in inter and intra village conflict, and
- Decrease in village restrictions

However, there is exchange of labor in 79% of schemes, which is mainly during the harvesting seasons. The community coping mechanism exists only in 20 schemes where they do mainly take up canal cleaning works.

5.13 Nongovernment Organizations

The experience of the EC project is that initially the NGOs are involved in rehabilitation after a training period of about 4 months. However, since NGOs are not normally technically trained, they failed in satisfactorily carrying out rehabilitation works. Hence, it is felt that NGOs can be involved in the community organization part of the project but they need extensive training on project objectives and procedures before given responsibilities for rehabilitation work. The contract period should be 2–3 years for effective involvement of NGOs.

6. Key Recommendations for Rehabilitation of Minor Irrigation Schemes

The recommendations emerging from the survey are as follows:

1. The minor irrigation system is treated as one integral holistic unit comprising the

catchment, the water spread area, and engineering interventions to collect and distribute water through the conveyance system for uses, mainly in irrigation and other sectors. This applies primarily to schemes that are independent in themselves and have hydrological linkage with the sub-basin uses in a river system, such as several in Orissa and some in Tamil Nadu.

2. In Tamil Nadu where chain series of tanks are dominant, the integral holistic unit is the sub-basin of a river system, in which the WUAs are formed for each tank and federated at the sub-basin level, as an entity for O&M of the water harnessed in the sub-basin as a whole for various sectors of use. The sub-basin needs to have a hydrological linkage with the main river basin utilization such that there is no clash of interests among the different units and other schemes in the river basin. The federal body at the basin level will then endeavor to apportion water of the basin to the tank systems equitably.
3. The WUA or PP should be adequately empowered under a long time lease agreement with the government, to manage and operate independently with least interference or support from the government, particularly in attaining financial sustainability through the collection of all revenues accruing in the system such as water charges, sale of forest produce, revenue from pisciculture, revenue from mined materials in the catchment, etc., which is currently collected by the government.
4. The entire system should be turned over to the WUA/PP to generate adequate financial resources to manage the system including O&M on a sustainable basis. Participatory irrigation management should change to

- complete turnover with smooth transition under the lease.
5. All the collections should be in the bank account of the WUA/PP. In case of chain tanks, the federated body of the WUAs could keep account of collections and advise the individual association annually on the proper usage for O&M. They may collect a small portion for administrative expenses.
 6. Capacity building and awareness through training to the WUA/PPs should be established even before the rehabilitation starts. It should continue at least for a period of 5 years after full rehabilitation with technical support from the related government departments, to enable independent management of the system.
 7. The water allocation and distribution among the individual cultivators needs to be established by WUAs/PPs on volumetric basis so that efficiency in water use is generated. Volumetric rates could be fixed by the WUA if the tanks are not in a chain, and in consultation with the federation if there is a chain system. To facilitate measurement, the conveyance system should have simple measuring devices such as SWFs, v-notches in the distribution system, and replegle flumes in lined sections of water courses for measured supply to individual farmers.
 8. Conjunctive use of water needs to be developed in the command area either by individual farmers with their own wells or a community well owned by the WUA. Since water is a CPR, be it on the surface or underground, anybody who pumps water from the wells could be charged on an hourly basis by the WUA/PP so that wastage is minimized. To facilitate this system, the power supply could be subsidized to the farmers till such time the paying capacity is developed.
 9. Each WUA/PP should fix volumetric charges to match the requirement of O&M expenses including administration, plus a small surplus built in as a reserve, depending upon the value of agriculture produce in its system.
 10. The farmers' organization should have full freedom on decisions regarding cropping patterns but the agriculture department needs to give professional advice.
 11. There is a symbiotic linkage between panchayati raj institutions (PRIs) and the farmers' organizations since they require mutual support for physical and financial needs. To engender this relationship all the persons from the village community who have a stake in the water of the tank, need to be members of the WUA/PP, not merely the farmers who irrigate the lands, including fishermen and artisans. This will assure in cooperation between the two.
 12. Since a complete turnover is envisaged, structural changes in the irrigation department, fisheries department, revenue department and even the agricultural department may be necessary to right-size them in changed roles for modernized specialist functions.
 13. If there are financial savings to the government as most functions at the lower levels are taken over by the WUA/PP, funds can be set apart as reserve to revive sick WUAs/PPs in case of emergency or to supplement modernization of schemes.
 14. All the specialists of the related departments need to work as a team at the district level and the junior staff at the taluk level to monitor proper functioning of the WUA/PP, render

- advice as and when necessary, and report to the government if interventions are required.
15. Farmers who grow surplus agriculture produce from the irrigated commands for sale could be taxed on such sales by the WUA/PP. The PRI may assist in such collection sharing a part for such service.
 16. Poor and marginal farmers should not be charged on their produce for their basic livelihood. In effect, water for irrigation should be nearly free except a small cess or royalty proportionate to the volume of water consumed to prevent wastage and realize the value of water. This royalty could be credited to the government for having turned over the facilities to the WUA to meet administrative expenses.
 17. The specialists in the district and taluk will conduct periodic training for capacity building in the WUA/PP to empower them to operate and manage the system themselves. This training will be conducted as and when needed as refresher courses and also for the new generation of functionaries of the WUAs/PPs.
 18. Farmers and members should be allowed access to the fine silt from the tank bed, either to use it on the fields or for brick making in a regulated manner determined by the association whenever desilting works are carried out.
 19. Coarse-grained soil should be used on the downstream of the tank bund to make it wide enough for a cart track (minimum width 3 meters) to facilitate communication between the banks. This will help strengthen the bund thereby requiring less maintenance and also help in transportation of agricultural produce.
 20. Desilting of the dead storage must be done in all tank systems so that water is available practically throughout the year for cattle and for recharging the wells downstream to meet domestic needs during the drought period.
 21. Desilting of the live storage should be done if the tank surpluses in at least 5 of the past 10 years.
 22. As the ownership of the system for purpose of management is transferred to the WUA/PP, which is enlarged, including all the stakeholders of the village community, community pressure and social boycott should be encouraged to regain land from encroachers.
 23. WUA/PP should prepare an operation plan for each irrigation season depending upon the seasonal water availability and fix volumetric allocations to irrigation and other users. The volumetric allocation should be based on defined water rights for individuals, particularly farmers. These water rights will be adjusted each year depending upon the inflow to the tank.
 24. The WUA/PP should have a written constitution defining the rights and responsibilities. An executive body could be set up with one third representation by women, and one third representation from SCs/STs and vulnerable sections of the community. The president and secretary of the women's SHGs should be members of the executive body with voting powers.
 25. Water pollution in the tank can be prevented by barring direct access to individuals for washing, bathing, etc. A cistern needs to be built in the downstream of the bund at the head of the canal to facilitate ablutions

- outside the water spread. This could be connected to the sluice meant for irrigation.
26. To restore sanctity to water in the people, the PRI of the village could build places of worship suited to all communities in the vicinity of the tank and encourage religious and festival activities.
 27. As pollution due to defecation is noticed extensively in most of the tanks' vicinity close to the habitations, the PRI and WUA needs to provide adequate sanitation facilities away from the tanks. The government should earmark funds to the PRI/WUA exclusively along with the provision of potable water supply. The positive features of traditional systems noted in few locations needs to be incorporated wherever possible while forming new WUAs/PPs in other locations.
 28. The system of rice intensification (SRI) or the Madagascar method of growing paddy should be encouraged and developed in minor systems as it gives higher yields and consumes less water. MI schemes are amenable for refined control and supply suited to this method than the medium and major projects.
 29. Tank systems near urban centers should not be taken up for rehabilitation, as they are being encroached upon by the urban population and converted into layouts for housing.
 30. At least 10% of the cost of rehabilitation of the tank system either in cash or in kind or in parts of both, should be contributed by the WUA/PP to engender a financial stake in the work.
 31. The estimated amount of the rehabilitation work for a system should be deposited in the bank account of the WUA/PP and drawn by the association exclusively for that purpose. It could be in a joint account with a government representative as a party for such withdrawals and meant for payment of labor, materials, and bills of contractors engaged by the association. The engineering department needs to then assist in the execution of the rehabilitation work.
 32. At a later time when the WUA/PP is well established, women SHGs with the assistance of a sociologist provided by the zilla parishad could participate in decisions regarding allocation of volumetric per capita quota of water to the landless and others. The landless could trade their quota with the landed for equivalent agricultural produce or money and the rate could be decided by the WUA/PP.
 33. In each district headquarters, a farmers' training school needs to be established to provide periodic training and refresher courses of short duration in the nonagriculture season to keep them abreast of changing agricultural technology and efficient use of water. The WALMI in each state could take up this responsibility with field demonstrations.
- ### 6.1 *Special recommendations for Tamil Nadu*
1. In several tanks, cultivation has been going to tenants but they have no say in the WUA. It is recommended that if the tenant has continuously been cultivating on the land for 10 years or more, he could be allowed transfer rights in the books and the owner could be given compensation by the government. Part of the compensation can be realized in installments in specified number of years starting from the first year

of transfer so the tenant can retain all the produce to enhance its capacity. This recommendation is made to ensure the health of the association and that of the tank system if the actual cultivators are the members with stake in the tank.

2. The water table is depleting fast due to the uncontrolled proliferation of tube wells in the vicinity of the tanks, breaking the chain of hydrologic flow from tank to tank and reducing the surface flow to the tanks. It is recommended that tube well irrigation be discouraged by gradually withdrawing power supply for this purpose in stages, and ultimately banning tube wells for irrigation (but allowing them for drinking water purposes). Irrigation from open wells with centrifugal pumps should be substituted in and outside the commands wherever groundwater can be tapped.

6.2 *Special Recommendations for Orissa*

1. Although the State is richly endowed in water resources, due to poor management

both at macro and micro levels, there is drought and flood syndrome with inequity of access. The western part has drought and the groundwater potential is not adequately exploited. It is recommended that encouragement for farmers should be given through subsidized rates to tap groundwater until such time they are able to pay the normal charges.

2. Paddy is grown mostly in kharif season although there is good scope to develop rabi paddy in large areas. In many tanks, water is available and not utilized fully. It is known that rabi gives higher yields than kharif. In addition, the kharif paddy calendar could be advanced with nurseries, to make use of the longer sunshine hours and obtain higher yields.
3. The primitive broadcasting method of growing paddy should be changed to transplantation methods adopting the SRI or the Madagascar method of growing paddy for higher yields. Full advantage of the facilities of the Central Rice Research Institute at Cuttack needs to be taken.

Annex II

Guidelines of the Ministry of Water Resources for Tank Rejuvenation

1. Background

- 1.1 Water is the lifeline of civilization. The biggest crisis that the world will face in the 21st century will be the crisis of water. Water is indeed a renewable resource but, in any given year, it is not inexhaustible. The crisis of water has affected the lives of millions of our fellow citizens. In some cities, whole households keep awake to receive one or two buckets of water well past midnight. In rural areas, the girl child is often pulled out of school in order to fetch water.
- 1.2 Through the ages, Indian agriculture has been sustained by natural and man-made water bodies such as lakes, tanks, ponds and similar structures. It has been estimated that there are about five lakh water bodies/tanks used for irrigation. Many of them have fallen into disuse and are in urgent need of repairs. These water bodies have been a part and parcel of minor irrigation in the country under which even today two thirds of irrigated agriculture is covered in our country. Such minor irrigation schemes generally suffer from problem of loss of storage due to silting of the tanks, poor maintenance and management, encroachment, etc. Damage to various structures, inadequate surplussing arrangements, and silting are some reasons for deteriorating conditions in the irrigation system. It is necessary to restore the storage capacity of water bodies with the purpose of recovering their lost irrigation potential.
- 1.3 The Union Finance Minister, in his Budget Speech 2004–05, proposed a scheme to repair, renovate and restore all water bodies that are directly linked to agriculture. It was proposed that in the current year, pilot projects would be taken up in one or two districts to be selected in each of the five regions of the country.
- 1.4 The scheme “National Project for Repair, Renovation and Restoration of Water Bodies directly linked to Agriculture” has been prepared to take up pilot projects in states for implementation by the State Governments for which funds will be released to the states. Criteria and issues to be considered for preparing these guidelines were discussed in meeting with representatives of some states and concerned Central Ministries.

2. Objective

- 2.1 This is a pilot scheme for repair, renovation and restoration of water bodies directly linked to agriculture, to be taken up during the remaining period of X Plan. The objectives of the scheme are: (a) to restore and augment storage capacities of water bodies, and (b) to recover and extend their lost irrigation potential. Once the pilot scheme is completed and validated, it will form the basis for launching of the “National Water Resources Development Project” at much larger scale and spread to be completed in 7–10 years.

3. Scheme Design

- 3.1 The scheme envisages the States to take up the activities for project formulation in the manner generally prescribed as follows:
- 3.1.1 Projects in one or two districts each in the states are to be taken up under the scheme.

If some states do not come up with a viable project proposal, the funds may be utilized for taking up priority projects of other states.

- 3.1.2 The States shall take up restoration of water bodies having original irrigation-culturable command area of 40 ha up to 2,000 ha, to revive, augment, and utilize their storage and irrigation potential. Water bodies having original irrigation culturable command area of less than 40 ha are to be covered under other ongoing schemes/existing schemes.
- 3.1.3 For the above purpose, the States may also undertake repair of related structures like check dams, weirs, bunds, and water conveyance systems. The detailed project report (DPR) from the states shall ensure that not more 50% of a given project cost is earmarked for ancillary works for conveyance system.
- 3.1.4 The DPR shall not include works for incomplete minor irrigation schemes or schemes completed within the last 10 years.
- 3.1.5 DPRs should clearly indicate the targeted benefits, both in physical and financial terms, relative to proposed costs.
- 3.1.6 The pilot project should be based on sound techno economic considerations so that the viability of the project is established and value addition for the proposed investment is achieved.
- 3.1.7 The states shall accord priority to the areas which are arid, semi-arid, drought prone, backward, and tribal-dominated while selecting the districts. Prioritization of water bodies are to be done by the respective states.
- 3.1.8 No proposals for funding establishment costs will be made under the scheme.

- 3.1.9 The projects are to be completed within a period of 2 years.

4. Preparation of Detailed Project Reports

- 4.1 The DPRs to be prepared by states should address the following considerations:
- 4.2 **Selection of project:** Project should be selected from consideration of priority, need for repair and restoration for providing benefits. The main thrust of the project should be for augmenting storage capacity of the tanks/water bodies for recovering the lost irrigation potential. The States shall take up restoration of water bodies having original irrigation culturable command area of 40 ha up to 2,000 ha, to revive, augment, and utilize their storage and irrigation potential.

Details shall be given in regard to the background, present status of the project with reasons for deteriorating conditions of the project and alternatives, if any, which have substituted/modified the original project objectives, social/economic considerations and future plan. Arid/drought prone areas, backward/weaker sections and particularly tribal dominated areas will be given due consideration while preparing the project proposal and this should be appropriately brought out in the DPR.

- 4.1.2 **Type of project:** The type of project should be clearly brought out. Relevant information, e.g., general topographical details, and description of components of the project such as renovation of minor irrigation tanks, check dam, weir, surface flow/lift, renovation of field channels, etc. shall be brought out. Other considerations like recharging of groundwater, water utilization for other purposes are to be brought out appropriately. Measures

for water utilization efficiency, e.g., lining of canals, etc. should be considered and adopted in the project proposal. Work on repair of related structures like check dams, weirs, bunds, and water conveyance systems should be clearly brought out.

4.1.3 Command Area: The total command likely to be irrigated from the project vis-à-vis the original and lost storage, intensity of irrigation, etc. should be brought out. This chapter should contain details relating to status of the existing conveyance system giving *inter alia* details of existing deficiencies, which are hindering water use, status of maintenance, availability of funds for O&M, participation of water users' associations, etc. in the O&M activities, details of potential created and utilized and that targeted under the project.

4.1.4 Project planning and design: In the project formulation the following points should be considered among other issues involved.

4.1.4.1 Data availability and hydrological studies: General water availability giving hydrological conditions of the area, physiography covering climate, the source of availability of water, rainfall data including hydrological studies for water availability, and quantum of water available vis-à-vis proposed storage capacity, should be considered. Sources of irrigation available in the command area vis-à-vis the requirement should be analyzed.

4.1.4.2 Design criteria and viability: Design criteria shall be elaborated and viability justified highlighting the basic requirements and importance related to the project. The targeted benefit from the project implementation bringing out quantitative assessment, incremental area brought under irrigation and other aspects will have to be clearly brought out.

4.1.4.3 Issues on convergence of the project with related activities under other schemes should be achieved and this aspect should be brought out clearly.

4.1.4.4 People's Participation, capacity building and survey for collection of baseline data:

A provision up to 10% of project cost will be kept for related capacity building and people's participation and surveys for collection of baseline data for impact assessment and evaluation. Detailed surveys are to be undertaken in each district to establish baseline data at the village level and also at the tank level for performance parameters considered appropriate. Parameters like agricultural production and productivity, fisheries production and productivity, fodder production and productivity, livestock production and productivity, status of irrigation intensity, area irrigated, and volume of water stored in the tank will be taken up for the purpose as applicable for the particular water bodies under the project.

Detailed surveys in the district will be taken up simultaneously with project implementation.

4.1.4.5 Catchment description: A brief description of the catchments, i.e., plain, undulating, hilly including forests, etc. shall be given with the following information.

- a. Catchment area map of the project showing all upstream works affecting the flow into the reservoirs
- b. Full command area maps showing all details of canals, branches, distributaries, minors and outlets
 1. Privately owned water bodies are not to be considered for funding

- i. *Social/ecological consideration*: Socio-economic status covering data on population, the type of population affected by the project and the likely social, environmental and ecological impact of the area is to be considered and commented upon.
 - ii. *Community involvement for project implementation and handing over of project to community on completion of project*: Active community participation is necessary to ensure optimum utilization of assets and facilities created under the proposed scheme and, to sustain the scheme on a long-term basis. DPRs from the states will, therefore, include plan for involvement of panchayati raj institutions (PRIs) and the community—especially water users associations (WUAs)—to build, operate, monitor, and maintain the assets and facilities. DPRs should specify the plan for handing over the revived facility for O&M, monitoring, and maintenance to community organizations such as WUAs or PRIs.
 - iii. *O&M of the facilities created under the Project*: The O&M responsibility is proposed to be of the beneficiary community. An appropriate institutional framework is required to ensure viability and sustainability. Appropriate institutional framework for the purpose should be evolved simultaneously during project implementation from intense deliberation of related issues at different levels.
 - iv. *Cost aspect*: The components of estimated cost of the project to be taken up as pilot project and phasing of cost, i.e., cost to be incurred during the current year and subsequent years, should be projected. All works proposed for execution should be classified, leading to total assessment of the works. The detailed estimate of the project needs to be given. Their phasing and plan for taking up these activities should be spelt out. The phasing should cover both physical and financial aspect.
2. For preparation of DPR, there will be a limit of approximately Rs30,000/per ha of the culturable command area of the project. Individual components of a project have to adhere to command area development cost norms of Ministry of Water Resources (MoWR).
 3. In terms of additional irrigation potential restored under the project, an upper limit of approximately Rs80,000/per ha will be followed.
 4. The DPR should clearly indicate the targeted benefits, both in physical and financial terms, relative to proposed costs. Cost-benefit ratio of the projects in DPRs will generally conform to planning commission norms. Analysis like the economic rate of return may also be included.
 5. No proposals for funding establishment costs will be made under the scheme.
- Monitoring and evaluation*
1. Water bodies serve the interest of local communities. It is imperative that a graded and bottom-up approach is established for progressive monitoring and evaluation of the revived water bodies at the local-district-state-central level. The DPRs will spell out this monitoring mechanism at these levels.

2. The states may also provide for such other periodic evaluation of the project as necessary, to be specified in DPRs, to draw suitable lessons to take the scheme forward with better efficiency.
3. Salient features: Salient features of the project proposal, e.g., specific project component details, cost, time of completion of project etc. should be provided in the DPR.

5. Clearance of DPR from State Authority

- 5.1 Projects need to be cleared from the State Technical Advisory Committee or an equivalent arrangement per procedure in vogue in a State, to select districts and, to approve the DPR for the project works for the selected districts under the Scheme. The environmental clearance and forest clearance from the State government departments have also to be obtained as per procedure in vogue. The project preparation should adhere to the guidelines of the Planning Commission also.

6. Manner of Approval of DPRs

- 6.1 Central Water Commission (CWC) will be responsible for examination of DPRs received from the States, and for recommending those for approval by the MoWR.
- 6.2 For that purpose, the States shall submit DPRs—duly approved by their TAC or equivalent arrangement—to the concerned regional office of the CWC.
- 6.3 The concerned regional office of CWC—in association with the concerned regional office of the Central Groundwater Board (CGWB) and their counterparts in the States where necessary—will examine DPRs and send their findings to CWC (headquarters).

6.4 CWC will forward DPRs with their considered views and recommendation to MoWR for approval.

6.5 To select DPRs for funding, a committee under the chairmanship of Additional Secretary, MoWR, will consider the DPRs recommended by CWC. This committee includes representatives of Ministry of Agriculture, Ministry of Rural Development and officers from Ministry of Water Resources.

6.6 Techno-economic appraisal by CWC:

6.6.1 The Techno-economic appraisal for the proposed projects by CWC will include, inter alia, the following aspects:

- (a) Scrutiny of the cost-benefit aspects analyzed in the DPR submitted by the State.
- (b) Scrutiny of water availability study vis-à-vis proposed storage capacity.
- (c) Scrutiny of soundness/viability of basic planning and alternatives studied.
- (d) Considerations on groundwater regime and management/development related to the project proposal.

7. Postproject sustainability

Post project sustainability is an important factor for minor irrigation projects.

7.1 Measures and consideration for ensuring post project sustainability need to be clearly brought out in the DPRs. This chapter would also highlight the existing set up for operations and maintenance and delivery arrangements up to farmers. Holding and other on-farm development (OFD) works.

7.2 Legal status of provisions of regulatory Acts, administrative measures, methodology of

achieving farmers' participation and realizing of water charges, etc., are to be detailed out along with proposal for rationalization of water charges.

8. Implementation Arrangement/ Implementing Agency:

The project is planned for implementation on priority as per the present institutional arrangements, available in the respective state with strengthening of community participation. The projects are generally technical input based for extending irrigation facility. Implementation arrangements also have to cater for appropriate consideration on this aspect.

District-level Implementation Committee

There will be a district-level implementation committee (DLIC) to decide all issues on implementation management, supervision and effectiveness of the pilot project including post project sustainability. This committee will be chaired by the District Collector and the Vice Chairman of the DLIC will be from a reputed NGO to be nominated by MoWR, Gol. The Committee will include representatives from WUAs, NGOs, village panchayats, women, SCs/STs and the landless. The DLIC will also provide a platform for working out active community participation in implementation, supervision and monitoring of the projects. A typical structure of DLIC is at Annex III.

Executive engineer of the nodal department in the state in charge for project implementation will function as member secretary for the DLIC. Member secretary shall ensure utilization of the existing infrastructure with him for administrative support for day-to-day functioning.

The functions of the DLIC will be as follows:

- (a) Finalizing actual implementation strategy and management for effective implementation.

- (b) Selection of private sector agencies and/or NGOs, local community and deciding implementation issues such as extent of involvement of contractor for execution of work.
- (c) Deciding mode of procurement of construction materials/goods and approve construction activity and works from time to time.
- (d) Approving project plan for sensitizing the panchayati raj functionaries, WUAs, related government officials, local opinion makers and politicians and the community regarding the merits and modalities of the community-managed program of the project.
- (e) Deciding on formation of local level implementation committee at WUA/panchayat level.
- (f) Approving awareness campaign, participation and HRD training activities.
- (g) To supervise quality in works and procurement.
- (h) Monitoring, supervision and signing off on all completed works including all construction activity.
- (i) Interaction with state and Gol as required.

The WUA will include all stakeholders associated with the tank system such as women, SCs/STs, landless and other vulnerable groups and not only command area farmers.

Arrangement at State level

This is a state sector scheme. The nodal department in the state government will have the overall responsibility for planning, implementation, supervision and monitoring of the project.

The state would have an apex committee headed

by Secretary/Principal Secretary in-charge of minor irrigation/water resource/irrigation department in the particular state. The apex committee will provide policy direction, approve the annual plan and also review and monitor implementation of the project. This committee will decide strategy at the state level and consider broad issues like convergence of the project with the other projects in the area and appropriate coordination between different departments. The committee will also address issues like long-term O&M arrangements through community organization like WUA/PRI, maintenance fund for the purpose and facilitate interaction at various levels. The concerned chief engineer will be the member secretary of the committee.

An executive committee shall be constituted by the apex committee and shall be headed by the chief engineer of the concerned department. This committee will consider and identify project related issues for handling the same and report to the apex committee for assisting the apex committee in the due discharge of its functions.

9. Financial Arrangement

The funding pattern of the scheme will be in the ratio of 75:25 (center:state). The central funding will be in form of grant to the states. A budget provision for the total amount of the project for both Central plus State share is to be kept in the state plan for the year. A pre-condition of sanctioning annual central funds to the states will be that they have made suitable provision of funds, including both central and states share, in the state budget.

The DLIC shall maintain a separate bank account for implementation of the project in the district. State will transfer the funds along with the State's share to the dedicated bank account for the project.

The first two installments of central share shall be released on approval of DPR at half yearly interval.

The third central installment will be released on receipt of utilization certificate and the expenditure statement of the first installment (including the state's corresponding share). The subsequent installments would likewise be released after receipt of utilization certificates for the penultimate installment. State should send Utilization Certificate to Gol for release of installment in the prescribed performance. The utilization certificate must be prepared strictly on the basis of the receipts and payment accounts. The audited account for project works from the state is to be substituted to the Gol as per usual procedure.

10. Monitoring and Mid-Term Review

10.1 Monitoring of minor irrigation projects is a state subject.

10.2 Monitoring of the scheme is to be done by the states with appropriate set up in the State in the concerned department. The monitoring agency has to be independent of the construction agency.

10.3 Project graded and bottom-up monitoring mechanism is to be established for progressive monitoring and evaluation of the revived water bodies at the local-district-State-Central level.

10.4 State level committee as mentioned in para 8.4.2 will be in-charge of monitoring and evaluation of the program at state Level and thereby bring about a qualitative improvement in the implementation of the program. The state monitoring committee may incorporate a CWC representative from their corresponding regional offices. Besides, the states may also provide such other periodic evaluation of the projects mentioned in para 4.1.9.2.

10.5 An appropriate system of monitoring of the projects will be taken up through CWC and

CGWB in the states consisting of on-site examination of works and off-site analysis of states' monitoring reports. Such mid-course evaluations as necessary of the scheme during the plan period would also be taken up through CWC and CGWB.

11. Project Evaluation

- 11.1 MoWR and the respective state may appoint an independent institution to carry out evaluations of the project.
- 11.2 Services of the NABARD could be utilized for independent evaluation studies on the scheme toward validation of the pilot project with suitable inference.

12. Postproject Sustainability and Maintenance:

- 12.1 Resource for postproject maintenance will consist of water charges/user charges and beneficiary contribution apart from the

government funds for major repairs in particular circumstances. The O&M resource requirement for the project on completion will have to be worked out by the concerned State during implementation period of the scheme.

13. Completion Report Containing Main Findings on Implementation of the Project: Recommendations for Future Projects

- 13.1 On completion of the project, a project completion report is to be prepared by the nodal department and submitted to MoWR. The report should take into account the views of the DLIC. The report should contain important observations on design and implementation of the project as regards its effectiveness. It should also focus on critical aspects of the scheme such as community involvement, O&M, and development of tank management system for assessment purposes to enable suitable decision for the future scheme.

Annex III

Structure of District-Level Implementation Committee



Annex IV

Worksheet for Cost-benefit Analysis of Tank Rehabilitation

Details	Unit	Somangalam	Samudram	Kasireddipatti	Mean
1. Catchment area	sq. km	5.86	9.63	4.56	6.68
2. Water spread area	ha	80.00	179.00	13.70	90.90
3. Command area	ha	191.47	109.23	38.03	112.91
4. Rehabilitation Cost (Past)					
Catchment area	Rs lakhs	0.46	1.00	0.00	0.49
Water spread area	Rs lakhs	9.60	1.98	1.11	4.23
Command area	Rs lakhs	26.20	16.11	2.25	14.85
Institution	Rs lakhs	1.20	1.00	0.00	0.73
Administrative cost	Rs lakhs	2.54	2.75	0.44	1.91
Total	Rs lakhs	40.01	22.84	3.80	22.22
Cost per ha	Rs lakhs	0.21	0.21	0.10	0.17
5. Recommended rehabilitation cost					
Catchment area	Rs lakhs	1.76	2.89	1.37	2.00
Water spread area	Rs lakhs	16.00	35.80	2.74	18.18
Command area	Rs lakhs	9.57	5.45	1.90	5.64
Institution	Rs lakhs	5.47	8.83	1.20	5.17
O&M	Rs lakhs	3.64	5.89	0.80	3.44
Total	Rs lakhs	36.44	58.86	8.01	34.44
10% as administrative cost	Rs lakhs	3.64	5.89	0.80	3.44
Total project cost	Rs lakhs	40.09	64.74	8.81	37.88
Cost per ha	Rs lakhs	0.21	0.59	0.23	0.34
6. Demographic details					
Population	number	2,120.00	2,000.00	852.00	1,657.33
Landholders	number	250.00	176.00	63.00	163.00
7. Benefits					
Yield	kg/ha	4,120.12	4,240.24	4,892.58	4,417.64
Gross income at 5.2/kg	Rs	21,424.61	22,049.23	25,441.42	22,971.75
By-products	Rs	2,000.00	2,100.00	2,400.00	2,166.67
Expenses	Rs	17,500.00	18,000.00	20,000.00	18,500.00
Net income	Rs/ha	5,924.61	6,149.23	7,841.42	6,638.42
Net agricultural tank income	Rs	1,134,385.77	671,649.34	298,169.84	701,401.65
Wages (at Rs60 per day)	Rs	2,026,803.52	1,156,200.00	402,513.21	1,195,172.24
Total income from agriculture	Rs	3,161,189.28	1,827,849.34	700,683.05	1,896,573.89
8. Income p/c from agriculture	Rs	1,491.13	913.92	822.40	1,144.35
9. Benefits as per recommended protocol including livelihood and watershed approach					
i. Net agricultural tank income	Rs lakhs	1,134,385.77	671,649.34	298,169.84	701,401.65
Employment/Generation					
In rehabilitation works	person days	14,959.99	8,534.00	2,970.98	8,821.66
ii. Wages (at Rs70 per day)	Rs	1,047,199.35	597,380.00	207,968.64	617,515.99
/In agriculture	person days	33,780.06	19,270.00	6,708.55	19,919.54
iii. Wages (at Rs60 per day)	Rs	2,026,803.52	1,156,200.00	402,513.21	1,195,172.24
iv. Total wages (ii+iii)	Rs	3,074,002.86	1,753,580.00	610,481.84	1,812,688.24
10. Agri dependent income	Rs (i+ii+iii)	4,208,388.63	2,425,229.34	908,651.69	2,514,089.89
a. Livestock(Dairy)	Rs	3,600.00	3,600.00	3,600.00	3,600.00
b. Duck rearing	Rs	20,000.00	20,000.00	20,000.00	20,000.00
Yield of fish	kg/ha	270.00	270.00	270.00	270.00
Price of fish	Rs/ha	25.00	25.00	25.00	25.00
c. Income from fish culture	Rs	540,000.00	1,208,250.00	92,475.00	613,575.00
d. Fuel wood	Rs	2,500.00	5,000.00	1,000.00	2,833.33
11. Associated income	Rs (a+b+c+d)	566,100.00	1,236,850.00	117,075.00	640,008.33
12. Total gross tank income	Rs (10+11)	4,774,488.63	3,662,079.34	1,025,726.69	3,154,098.22
13. Income per capita	Rs	2,252.12	1,831.04	1,203.90	1,903.12
14. % increase in per capita income		0.51	1.00	0.46	0.66

GLOSSARY

<i>ahar-pyne</i>	a system of irrigation prevalent in south Bihar; ahars are rectangular catchment basins and pynes are channels built to utilize the water flowing from the seasonal streams	<i>kudimaramath</i>	voluntary community labor
<i>anicuts</i>	check dams; small or medium dams built across rivers to divert water into irrigation channels	<i>lakh</i>	100,000
<i>ayacut</i>	command area of the irrigation system corresponding either to a tank or a branch of canal of roughly 50 hectares	<i>mukhia</i>	village headman
<i>ayacutdar</i>	farmers in the ayacut	<i>oorani</i>	farm pond
<i>chaukidar</i>	watchmen	<i>panchayat</i>	village's body of elected representatives
<i>crore</i>	100 lakhs, or 10 million	<i>pangu</i>	traditional system for sharing the work for cleaning and maintenance of the irrigation infrastructure; every landowner in the command area of a particular tank is responsible for cleaning and repairing one section of the bund or canals allocated to him/her
<i>ghat</i>	used in reference to the steep mountainous ranges of India	<i>pani panchayat</i>	water users' association
<i>gram</i>	village	<i>patta</i>	deed
<i>gram sabha</i>	body consisting of persons registered in the electoral rolls of a village or a group of villages which elect a panchayat	<i>poromboke</i>	barren land
<i>karai</i>	regime of water allocation in some Indian villages, under which each farmer is entitled to a fixed time share of water delivery; however, this discriminates against farmers at the tail end since water losses due to conveyance and filtration mount as water approaches the tail end	<i>rabi</i>	season during winter months when agricultural activities take place only in irrigated areas
<i>karnam</i>	village accountant	<i>ryot</i>	tenant under ryotwari system
<i>khariif</i>	season during the south-west monsoon (July-October) when agricultural activities take place both in rain-fed areas and irrigated areas	<i>ryotwari</i>	Indian tax system introduced by the British in India in which farmers directly pay tax to the government
		<i>taluk</i>	block division within a district
		<i>thalaiyari</i>	village policeman
		<i>vayalgam</i>	farmers' association; the movement is conceived as an offshoot of advocacy efforts of tank farmers across states to mobilize joint participation on issues pertaining to the conservation of small-scale water bodies
		<i>zamindari</i>	land tenure system in which ryots pay land tax to zamindar or landlord

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