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Impact of Tank Rehabilitation for Direct and Indirect Users— A Case Study in Vengal Tank, Tamil Nadu

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ABSTRACT: Tank irrigation is an old established practice in most of the semi-arid tropical parts of India. Since the monsoon rainfall pours erratically in this region. Irrigation tanks serves to store and regulate the flow of water for agricultural use. In southern part of India, they are primarily used for the production of rice. Since major and medium irrigation projects needs huge investment, cost, long gestation period, heavy maintenance cost and ecological problem. There is a need to utilize the existing tanks by undertaking necessary repairs to them and evolving proper management system. This will facilitate the optimum utilization of the available rain water for sustainable agriculture development in semi-arid tracks of the country. Several factors such as increase in urbanization, encroachments, changes in land ownership pattern, absentee landlordism, development of well irrigation in tank command area, changes in cropping pattern in favor of cash crop and occupational diversification from agricultural to non-agricultural activities leads to improper maintenance of tanks causes many of the tanks dysfunctional. Later it was realized to rehabilitate the existing tank system and maintain them properly to obtain continued benefits from them than allowing them to degenerate and create new sources at exorbitantly high cost. In the initial years of tank rehabilitation the focus was to maximize the agricultural production per unit of water supplied to the farmers but later the main emphasis has been shifted towards the livelihood approaches through community based tank rehabilitation with involvement of multi-stake holders which includes small, marginal farmers, landless group, women and other vulnerable groups. The present study attempts to explain the impact of tank rehabilitation exclusively in peri-urban areas with the special objective of to understand the impact of water productivity and the livelihood options for direct and indirect uses before and after tank rehabilitation.

The present study attempts to explain the impact of tanks rehabilitation exclusively in peri-urban areas with the specific objective:

- To understand both the direct and indirect impact of productivity of water and the livelihood options after rehabilitation of tanks.

As to understand the above a total of 10 per cent respondents (irrespective of their land ownership) were selected from Vengal village in Tamil Nadu State of India and the extent of use of tank was studied. The samples were analyzed and the results abstracted were highly responsive interims of a rise in internal rate of net return, yield increases/acre, increase in yield due to silt application, incremental net return per hectare, increase in yield of dug and dug cum bore wells, increase in yield of bore wells, net yield/ ha and enhanced livelihood options by and large.

INTRODUCTION

Tanks and rehabilitation of tanks are exclusive to the tropical history. The apprehension of the impact of tanks in general is of recent interest for the developing countries like India and in specific to South India. In the initial years of tank rehabilitation, the focus was to maximize the agricultural production per unit of water supplied to the farmers' field through improved tank system and by adopting better water management practice. Though, the endeavor was worthwhile, it never paid the expected direct results. To revolutionize the outcome of rehabilitation, in recent times the main emphasis has been shifted towards the livelihood approaches through community-based tank rehabilitation with involvement of multiple stakeholders, which includes small, marginal farmers, landless group, women and other vulnerable groups.

OBJECTIVES

To understand both the direct and indirect impact of productivity of Land and water and the livelihood options after rehabilitation of tanks.

METHODOLOGY

Selection of Study Area

The Vengal village is situated in Thiruvallur district in the northern part of Tamil Nadu. Before abolition of

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Zamandari act in 1952, the Vengal village was under the control of Zamindars. Vengal has a population of 5523 constituting of 2786 males and 2737 females. The area under Vengal command is 178.045.5 ha and there are 252 members in Water users Association. It is a rainfed tank which is fully depending on it own catchment's for water. Tank capacity is 1.11 mm^3.

Samples

A total of 10 per cent respondents from farming households have been selected from Vengal village and the extent of use of tank were studied. Also landless people were grouped on the basis of their livelihood activities.

Techniques of data collection

Year of consideration for post and pre rehabilitation period is 1993–94 and 2005–06 respectively. As the first step, a pilot survey was taken up and on the basis of it a detailed questionnaire was prepared. Focus group discussion was done with indirect tank users. Then, the collected data were analysed using SPSS (Statistical package of Social Science).

Sources of Data

The extent of the use of tank has been understood from both observation and questionnaire. As to understand the impact of tank rehabilitation the socio-economic variables that has major impact on the locals of the area such as production, income, nourishment (through fisheries development), gainful employment, seasonal migration, quality of life, livestock and milk production were abstracted. Besides, the effect of other factors such as socio-cultural aspects of rural communities, irrigation, drinking water for people and livestock and for recharging ground water was observed. And other resource derivations like fuel wood and timber, fodder, silt, water for rearing fish, animals and bio-diversity complex for flora and fauna were also focused for the study.

DIRECT IMPACT OF TANK REHABILITATION

Efficiency in Productivity of Water Before and After Rehabilitation of Vengal tank

Water Acquisition

The outcome of tank rehabilitation could be apprehended with the following documented results. Before rehabilitation the supply channel was full of vegetation and the cross section of the channel was not uniform. So farmers required to remove the vegetation and made proper sectioning of the channel to facilitate smooth inflow into the tank. After rehabilitation supply channel is improved in terms of water acquisition.

Water Storage

Tank bund was strengthened and brought to standards by providing the maximum required free board. Sluice number three was in a damaged condition. RF (Rear front) weir was also in a damaged condition with the disturbed Apron, broken coping concrete and with cracked abutments through which leakage was possible. In the after rehabilitation phase the damages were rectified.

Water Distribution

The earthen field channels were having mild bottom width lots of undulations that caused heavy silting up and stagnation problems in the channels. But after rehabilitation phase the main distributory channels are lined. And hence the conveyance, field channel, field application and irrigation efficiency got increased to 16.36%, 12.49%, 0.81%, and 19.28% respectively. Not only that, the percentage of loss of flow in study tank also reduced to 2.39%.

Table 1: Details of Increased Efficiency in Vengal Tank

Sl. No	*Particulars*	*Pre Project (%)*	*Post Project (%)*	*Test Length (M)*
1.	Conveyance efficiency	59.64	74.17	100
2.	Field channel efficiency	83.67	90.96	100
3.	Irrigation efficiency	39.88	52.29	100
4.	Time of Travel	5.85 min	3.28 min	100

Table 2: Crop Yield and Efficiencies Related to Water Use

Sl. No	*Description*	*Pre Project*	*Post Project*
1.	Crop yield average kg/ha	3980	4100
2.	Water use efficiency kg/ha cm	22	23.97
3.	Relative water supply *	1.51	1.42
4.	Rainfall during the crop calendar year (mm)	1256.40	1087.80

Increase in Relative water supply is 0.09. Up to RWS value of 1.12, the WUE increases and reaches the maximum value of 27.20 kg/ha cm.

WATER MARKETING

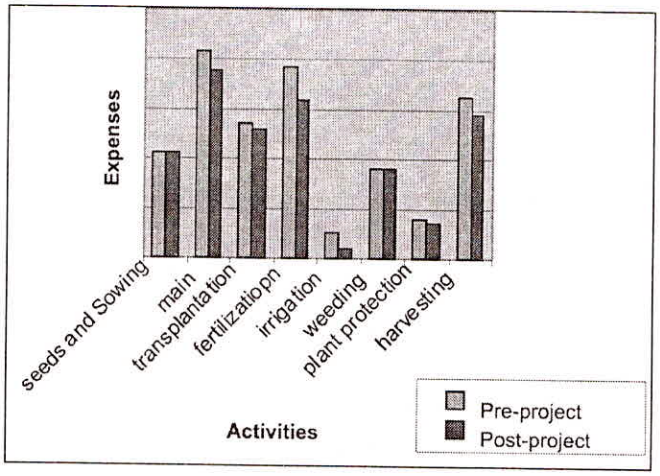
Vengal, the village is located in peri-urban area of Chennai city has high recharge especially after rehabilitation of tanks which has raised the income of the local people by giving them a ransom to resolve

the problem of the drinking water of the nearby cities. There is a practice of water marketing taking place here as the well owners sell water to the one who do not own well for irrigation, which would be paid back either as cash or as kind. Tanks located in urban and peri-urban areas once used to irrigate private lands, can now be used as drinking water storage tanks to nearby towns or as a percolation ponds (Sakthivadivel and Sreenivasan).

Table 3: Comparison of Expenses and Revenue in Vengal Tank

Sl. No	*Expenses*	*Pre Project (Rs)*	*%*	*Post Project (Rs)*	*%*
1.	Seeds and sowing	1276	12.56	1376	10.61
2.	Main land preparation	1788	17.6	2662	20.48
3.	Transplantation	988.64	9.73	1208	9.29
4.	Manuring	1367	13.46	1546	11.9
5.	Fertilization	1699	16.73	2602	20.02
6.	Irrigation	151	1.49	350	2.69
7.	Weeding	932	9.18	950	7.31
8.	Plant protection	274	2.7	361	2.78
9.	Harvesting	1625.88	16.55	1939	14.92
Total		10160	100	13000	100
Yield(kg/ha)		4113		4149	
Gross revenue (Rs)		18509		23867	
Net return (Rs)		8348		10867	

Graph 1: Expenses for Various Stages of Cultivation in Pre and Post Rehabilitation Period



Socio-Economic Conditions

Tanks in the Indian context are inextricably linked to the socio-cultural aspects of rural communities especially and are considered an indispensable infrastructure of each and every village for sustaining the socio ecological balance. The tank system, which have been developed ingeniously over a period of several centuries have provided insulation from recurring droughts and floods and vagaries of monsoon, and provided the much needed livelihood avenue to the marginal and poor people living in the fragile semi-arid tropics. The importance of tanks is being realised more and more, as the continued use of ground water and other large-scale water resources system is proving to be costly and inadequate to meet the increasing demands. It has been suggested by the researcher that a 'Water Bond' should be introduced to increase the responsibility of the farmer in system management (Gulati A *et al.*, 1994).

Potential Socio-Economic Benefits of Rehabilitation

- Improved production and higher income.
- Improved nourishment (through fisheries development).
- Increased opportunity for gainful employment.
- Reduction in seasonal migration by landless and poor households.
- Increased family income.
- Improved quality of life.
- Improved interaction and cordial relationship among different communities.
- Improved livestock and milk production.
- Increased availability of water in terms of storage days for livestock and humans.

Lack of farm inputs, seasonal migration and damage of crops by stray animals, where women and children travel long distances in search of fodder, fuel, wood and water all together contribute the decrease in production (Shanmugam and kanagavalli, 2004). Apart from hours spent in fetching water from different private wells women also experiences abuse treatment of well owners. They have to put up with, as there are no other options. This trend can be reversed through rehabilitation of tanks.

Drinking water problem is solved in Vengal village through drilling bore in tank bed itself. Water extracted is stored in 5 overhead tanks of 50,000 litres capacity helps to meet their drinking water demand. Moreover the excess water was used for kitchen garden like vegetables and orchids. Thereby women can get a small amount for their home needs and their nutritional value was also improved when they consumed it.

Due to the dugout pond work, the cattle are getting sufficient drinking water through out the year. Cattle drinking water source is created and was full with

water even in summer. Fodder cultivation on the farm pond bunds and near the plot of farm ponds in 13 acres were introduced. Additionally 160 liters of milk/day has been produced from the watershed area due to the project works. The villages of South India, which are mostly located on the banks of the tanks, enjoy the water from the tank for their use in livestock rearing, drinking and for domestic use. Historically, some marginal groups for grazing livestock, growing trees and for undertaking seasonal cultivation use the water-spread area. Even today the Thiruvellore district has one of the highest populations of livestock such as sheep and goats, which require vast area of grazing. Apart from the above, tank rehabilitation helps in growing more fodder. The most remarkable fact is that the women are the utmost beneficiaries of the above. Migration from this village has stopped in the last two seasons and it is reported that the people from the surrounding villages are coming to work as labourers to this village.

Box 1: Duck rearing in Vengal

This case elucidates the practice of rearing duck in Vengal village, Thiruvellore district Tamil Nadu. Nearly 15 families of Vettaikara Naiker community are involved in duck rearing as their main source of livelihood. They have minimum 160–350 ducks per household. They purchase ducks with the belief in Henotheism from the village called Ponmar for Rs. 7000 for 100 ducks at the rate of Rs. 70 per duck. According to Mannar a duck rearer, a duck attains adult stage and starts laying eggs just in one month. Duck rearing period as practiced in this village is normally from the month of November to April. The more the water availability in the tank, the more the availability of nutritious nosh for the ducks as farmers raise crops for two seasons. The ducks rearers thus make use of both tank and the harvested fields. During this period since the intake of ducks is good one duck could lay eggs for nearly 3–4 months continuously.

The market rate per egg is Rs. 2 And hence on an average the total amount one gets from eggs laid by 100 ducts in 3 months period is Rs. 18,000. While selling back the ducks they get only Rs. 5000 In total they get Rs. 23,000 gross income from hundred ducks in 6 months period. However, they spend around Rs. 700 on transportation from Vaigarai to Vengal. And if the feed is not sufficient they supplement it with 'paddy karukka' (least graded paddy), which costs around Rs. 2700 for six months period. They also spend Rs. 100 on health risk and as remuneration for village panchayat each rearer has to pay Rs. 300 for every 100 ducks at the rate of Rs. 3 per duck. And in some cases, if they take duck to the neighbouring villages for want of feed they should pay Rs.300 as panchayat fees for grazing. Altogether total expenditure for six months period for 100 ducks comes around Rs. 4100 Deducting the expenditure from income the net benefit from 100 duck for six months period is Rs. 18,900

For the remaining six months when the storage in the tank is very less, few prefer engaging themselves in other works for their livelihood while few continue the same duck rearing if they are able to meet the expenditure for duck-feed. Nevertheless for the few who continue duck rearing the low level of water in the tank reduces the intake of ducks that affect the number of eggs the ducks lay. Approximately only 50 out of 100 ducks lay eggs on an average of 45 days. So, their net income gets drastically reduced to Rs. 100 after deducting the expenditure. Though there is no gain during lean period as there would not be sufficient water in the tank, just because it is practiced by hereditary they are compelled to continue. In case if the same person engages in some other jobs like construction work for 150 days out of 180 days, maximum amount one could earn is Rs. 10, 500. So they feel that duck rearing is no more remunerative than going out for a wage labour and they also feel that unless the tank is rehabilitated the task of duck rearing may disappear out and out.

The significant aspects in this case study are gender equality, flexibility of work culture, and social settlement of the duck rearing families. It is remarkable that either the husband or wife in a household takes the duck to tank or fields. If one takes the ducks for grazing the other brings food and they exchange the roles irrespective of the gender. Thus the normal cultural barriers in doing household duties are broken and the flexibility in assigning works in the household promotes harmony. It is also apparent that in Vengal village all the duck rearing families live in a same street as they belong to a particular caste.

Box 2: Fishing in Vengal tank

The association wanted to take up an income generating activity for the maintenance of the tank and so fish rearing in the tank was taken up. Fish rearing is possible during the month March-April to May- June with available dead storage in tank near deepest sluice where sluice should be completely closed. Auction will be taken by the own villager by paying Rs.7000 to Panchayat which will be used for minor tank repair works, whereas panchayat will pay Rs.1500 to government. No initial investment will be spending for fish rearing, since fish originates by its own during runoff. Self control of villagers prevents theft and damage to fishes as a result no special expenses have to be allotted for safety. Normally types of fishes reared in somangalam tank are Viral, Keluthi, Kendai, Katla and Jelabi. Expect Friday (auspicious day for Hindu religion) all the 78 days he catch fishes and sell it. Since he has his own family labour the entire benefits solely goes to him. On an average every day he can sell 3 kg of viral for Rs. 150/kg, 4 kg of katla for Rs. 60/kg, 6 kg of Kendai for Rs. 60/kg, 6 kg of Keluthi for Rs. 20/kg. So gross income comes around Rs. 86000. Some times he may have to give fishes to friends, relatives and higher officials at free of cost which makes to reduce 5% of his gross income. So net gain for the period of 3 months is Rs. 80,000 i.e., 27000/month in post rehabilitation period. In pre-rehabilitation period since dead storage was available only 11/2 to 2 months his net income was only half the amount what he is getting now.

Benefits of Water Management

The immediately perceptible benefit is that an average gap of 20 ha land in tail end has been bridged. The Vengal Kuppam main channel length is 2500 m. This channel is lined up to 1950 meter. This made the irrigation possible to the tail end lands. Details of cropped area and gap before the execution of work, the storage was at full tank level (4.115 m) and the area irrigated was 155.92.5 ha. The gap was 22.10.0 ha even though there was copious rainfall in that year. After rehabilitation, the tank water level was only 3.875 m, the area irrigated was 169.51.0 ha and the gap was only 8.53.5 ha. This shows that after rehabilitation the gap was reduced considerably resulting in an increase of cropped area. The post and preperiod was taken into account for 100 m length of field channel. The time taken for the water to pass through the specified 100 m length was 6.15 minutes before tank rehabilitation and 3.28 m after rehabilitation. This reduces the travel time of water considerably. The tail end farmers felt that they received sufficient irrigation water to their fields leading to the increase of paddy production. Before the lining of field channel farmers put of mud bund (kondam) to divert water and often broke open by itself or by other farmers sometimes. This causes silting up in the channel. The slop of the channel was very mild. Silting up reduced it further and decreased the velocity. But now the shutters are locked by the farmer association and water is distributed evenly to all areas.

INDIRECT IMPACT OF TANK REHABILITATION

Ground Water Recharge

Increased storage and increased inflow has helped in better groundwater recharge. 160 wells in Vengal ayacut got recharged. This was not possible before rehabilitation. These wells before rehabilitation were able to supply 2–3 hrs a day during Dec–Jan and 2 hrs in summer during normal rainfall years. This is enough to cultivate around 2 ha from each well. But in post rehabilitation period supply hours has doubled. The water table in this area is also increased below ground level consistently in all the wells. There were around many wells in the vicinity (1 km radius is the ground water recharge area) of the tank's recharge. The tanks usually supply water for 3–5 months and farmers supplement it with groundwater. The recharge in the wells is a function of the tank (surface) water storage. This is a reason why the wells are over flowing when the tank is full and well has meager recharge when the tank is empty (Sakthivadivel and Srinivasan, 2004). Before rehabilitation, the farmers raised only one paddy crop through tank irrigation. But now they can go in for second crop with tank water in early stage and well in the later stage.

SUMMARY AND CONCLUSION

Tanks in the Indian context are inextricably linked to the socio-cultural aspects of rural communities especially and are considered an indispensable infrastructure of each and every village for sustaining the socio ecological

balance. The tank system, which have been developed ingeniously over a period of several centuries have provided insulation from recurring droughts and floods and vagaries of monsoon, and provided the much needed livelihood avenue to the marginal and poor people living in the fragile semi-arid tropics.

The importance of tanks is being realised more and more, as the continued use of ground water and other large-scale water resources system is proving to be costly and inadequate to meet the increasing demands. So, the tank ecosystems have to be conserved to provide a safety net to the livelihood of millions who depend on these systems. The conservation of tanks has to be done considering the multiple uses such as irrigation, drinking water for people and animals and for re-charging ground water. The tank systems also provide fuel wood and timber, fodder, silt, water for rearing fish, and animals and bio-diversity complex for flora and fauna.

In watershed programme, the management activities were maximizing the utilization of available precipitation and controlling surface run-off by adopting appropriate bio-engineering technologies, whereas in the case of tank system, the water available in the tank is utilized to the maximum extent so as to get maximum production with high percentage of cropping intensity through which decisions were made for letting out water to the field, raising crops on the basis of availability of water in the tank, taking up second crop where ever soil moisture was available.

The tank system has to be evaluated with various parameters or indicators which would inform or indicate the crucial constraints of the system such as its performance before and after the project implementation, systems and weakness, system usefulness and deficiencies, system operations and difficulties and system maintenance and involvement of farmers. The selected indicators were:

- Irrigation efficiency
- Conveyance efficiency
- Application efficiency
- Water use efficiency
- Equity in water supply
- Ground water use in Ayacut
- Crop yield (productivity)
- Awareness and adoption level of improved agriculture
- Time lag in agricultural operations and
- Farmers Association—A status analysis.

Thus it could be substantiated from the following observed indicators on the impact on the Vengal village tank rehabilitation.

- Irrigation efficiency 22%, Conveyance efficiency 28%, Field channel efficiency 23%, Field application efficiency 0.91% has been increased during post project period.
- Internal rate of net return before rehabilitation 1.73 and after 1.27%
- Yield increases/acre: 25–40%
- Increase in yield due to silt application: 5–12%
- Incremental net return per hectare: Rs. 1700
- Increase in yield of dug and dug cum bore wells: 72%
- Increase in yield of bore wells: 30–40%
- Net yield/ ha increases: 20–30% and,
- Enhanced livelihood options by and large.

In Tamil Nadu, there is on the average, one tank for every 3.3 sq.km. of geographical area. In some areas, they are densely located and in others not. Maintenance of these tanks through governmental agencies becomes a gigantic task, when aggregated. Since it is not possible and also not necessary to create a new tank, at least it is now essential to revive the old system of maintenance of tank through voluntary group effort at beneficiary level.

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