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*Research Note*

## **An Economic Analysis of Tank Rehabilitation in Madurai District of Tamil Nadu**

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### **Abstract**

There has been a growing realization for rehabilitation and restoration of irrigation tanks with farmers' participation. The study has presented the costs and benefits of tank rehabilitation and financial feasibility of investment in tank rehabilitation. The total annual income has been found higher in the rehabilitated tanks than the non-rehabilitated tanks and amongst the rehabilitated tanks, panchayat tanks with community well has depicted the highest annual income. The investment analysis has revealed the net present worth to be positive, the B-C ratio to be more than 1.5 and the internal rate of return to be more than the opportunity cost of capital. This shows that all the three investments in tank rehabilitation are economically viable. The study has suggested that rehabilitation work should be undertaken in all the non-rehabilitated tanks also. Besides, efforts should be made to provide supplemental irrigation to crops and to improve the PWD tank management regime.

### **Introduction**

For centuries, tanks have been central to socio-ecology and irrigated agriculture in the states of Andhra Pradesh, Karnataka, Tamil Nadu and Chattisgarh. Tanks are, however, disappearing fast due to heavy siltation over time, poor organization and management, decline in compulsory labour contribution to the maintenance work, inadequate maintenance budgetary provisions by the government, meagre revenue from tank-based activities, growth of wells in tank command, and encroachments. Most of the tanks in Tamil Nadu have become degraded due to open access, weak institutional arrangements, poor structures and breakdown of the local authority system. In the recent years, there has been a growing realization for rehabilitation

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and restoration of irrigation tanks with farmers' participation. Some NGOs like 'DHAN' are also involved in motivating the people to participate in tank rehabilitation by making monetary and labour contributions and also facilitating government funding for this work. The present study has estimated the costs and benefits of tank rehabilitation and financial feasibility of investment in tank rehabilitation.

### The Study Site

Madurai, one of the districts in Tamil Nadu, has a large number of tanks and hence it was purposively selected for the study. Within the Madurai district, Kottampatti block was deliberately selected since this block has the maximum number of irrigation tanks — 56 large tanks and 842 small tanks. In the Kottampatti block, among the existing 56 PWD tanks, one rehabilitated tank was randomly selected. Among the 842 Panchayat tanks, three tanks, one tank rehabilitated with community well, one tank without community well and one tank without rehabilitation, were randomly selected. Thirty farmers were finally selected randomly from the command area of each tank situations. The total sample size consisted of 120 farmers.

### Income of Sample Farmers

The income details of sample farmers are presented in Table 1. The income of sample farmers was more in the rehabilitated than without rehabilitation tanks. PTC had the highest income of Rs 37674, followed by

**Table 1. Income of sample farmers**

		(Rs/yr/ha)			
S.No	Particulars	PTC	PWD	PT	PTW
1.	Crop income	18116 (48.08)	17371 (54.65)	12566 (45.04)	9066 (48.14)
2.	Off-farm income	558 (1.48)	340 (1.07)	318 (1.14)	431 (2.30)
3.	Non-farm income	19000 (50.44)	14080 (44.28)	15000 (53.82)	9333 (49.56)
4.	Total income	37674 (100.00)	31791 (100.00)	27875 (100.00)	18830 (100.00)

Note: Figures within the brackets are percentages of total income from all farms.

PTC = Panchayat Tank with Community Well

PWD = Public Works Department Tank

PT = Panchayat Tank

PTW = Panchayat Tank without Rehabilitation

**Table 2. Per hectare cost and income from crop enterprises**

(in Rs/ha)

S. No	Particulars	PTC	PWD	PT	PTW
1.	Gross income	30,706	25,176	22,046	18,888
2.	Variable cost	12,126	12,229	12,765	14,025
3.	Total cost	17,409	19,061	18,382	19,919
4.	Net income over variable cost	18,580	12,957	9281	4863
5.	Net income over total cost	13,296	6115	3664	-1030

PTC = Panchayat Tank with Community Well

PWD = Public Works Department Tank

PT = Panchayat Tank

PTW = Panchayat Tank without Rehabilitation

of Rs 31791 of PWD and Rs 27875 of PT. The highest income in PTC management regime was due to the highest crop income of Rs 18116, non-farm income of Rs 19000 and off-farm income of Rs 558 found in that situation. The highest crop income in PTC management regime was due to the highest cropping intensity of 117.83 per cent and the highest irrigation intensity of 117.43 per cent.

The crop income was 200 per cent more in the PTC regime, 190 per cent more in PWD and 140 per cent more in PT regimes as compared to that in PTW regime. Hence, the crop income was higher in the rehabilitated than non-rehabilitated tanks.

### Cost of and Income from Crop Enterprises

An analysis of cost and income of sample tanks would help to compare the net income in rehabilitated and non-rehabilitated tanks. It could be observed from Table 2 that the gross income, net income over the variable cost and net income over the total cost were more in the rehabilitated than non-rehabilitated tanks. Among the rehabilitated tanks, gross income was highest in PTC with Rs 30,706 per ha, followed by PWD and PT with Rs 25,176 per ha and Rs 22,046 per ha, respectively. The variable costs across the rehabilitated tanks were almost the same and these were lower than that in the non-rehabilitated tanks (Rs 14025 per ha). This showed that the input efficiency was higher in rehabilitated tank management than the non-rehabilitated tank management regime.

Among the rehabilitated tank management regimes, the total cost was highest in the PWD tank, which was due to the higher share of fixed costs.

**Table 3. Cost of rehabilitation of sample tanks**

S. No.	Particulars	PTC	PWD	PT
<b>1. Desilting of tank-bed</b>				
	(a) Volume of silt removed (m <sup>3</sup> )	16511.20	14797.10	8487.48
	(b) Cost of desilting (Rs)	267450 (70.38)	348000 (73.35)	115614 (56.63)
	(c) Cost per m <sup>3</sup> of silt removed (Rs)	16.19	23.51	13.62
	(d) Cost of bund strengthening (Rs)	89150 (23.46)	116000 (24.45)	38538 (18.88)
<b>2. Clearing supply channel</b>		20900	-	46300
	Cost involved (Rs)	(5.50)		(22.68)
<b>3. Jungle clearance</b>		2500	10500	3700
	Cost involved (Rs)	(0.66)	(2.20)	(1.81)
<b>4. Total cost of rehabilitation (in Rs)</b>		380000 (100.00)	474500 (100.00)	204152 (100.00)

Note: Figures within the parentheses denote percentages to the total

PTC = Panchayat Tank with Community Well

PWD = Public Works Department Tank

PT = Panchayat Tank

The net income over the variable as well as total costs revealed a similar pattern. The highest net income over the variable cost was in the PTC management regime, followed by the PWD and PT management regimes. The net income over the total cost was highest in PTC with Rs 13, 296 per ha, followed by PWD with Rs 6115 per ha and PT with Rs 3664 per ha. The non-rehabilitated tank management regime showed a poor situation with a negative net income over the total cost.

### **Cost of Rehabilitation of Sample Tanks**

DHAN, an NGO, started a movement in the Kottampatti block called 'Vayalagam' to rehabilitate and restore the rainfed tanks in the block. In this endeavour, a Tank Farmers Association (TFA) was formed at the tank level involving farmers in the tank command and other villagers. Thus, 102 tank associations were formed in the block and rehabilitation works were carried out in 42 tanks. The cost of rehabilitation is presented in Table 3.

### **Panchayat Tank with Community Well (PTC)**

The Vandagacholan Tank Farmers Association was formed in the year 1996 and rehabilitation works of tank were undertaken in two phases, during

1997 and 2003. During the first phase, the Association carried out desilting of tank under Employment Assurance Scheme of DRDA at a total cost of Rs 3,00,000, in which, the share of the Association was Rs 75,000. During the second phase, desilting of supply channel and tank-bed and jungle clearance in the tank-bed were carried out under Gramiya Thanniraivu Thittam (GTT) of DRDA at a cost of Rs 80,000 to which people contributed Rs 20,000 as their share. The volume of silt removed was 16511.20 m<sup>3</sup> and cost per m<sup>3</sup> of silt removed was Rs 15.44. The desiltation cost was 70 per cent of the total cost of rehabilitation.

### **Public Works Department Tank (PWD)**

The Pirandodi Tank Farmers Association was formed in the year 2000 and it was registered under the Societies Act 1967. The rehabilitation work was taken up in two phases, in 2000 and 2003. During the first phase, desilting of bed was done under the Nammaku Namme Thittam (NNT) scheme of DRDA. The cost of this work was Rs 2,00,000 to which peoples' contribution was Rs 50,000. During the second phase, desilting of bed and jungle clearance were attempted at a cost of Rs 2,74,500 to which, the peoples' contribution was Rs 54,900. The volume of silt removed was 14797.10 m<sup>3</sup> and cost of silt removed was Rs 23.51/m<sup>3</sup>. The desiltation cost formed 73 per cent of the total cost of rehabilitation.

### **Panchayat Tank (PT)**

In Nagamangalam tank, the association was formed in the year 2000. The rehabilitation work was taken up in two phases. First, in the year 2000, the tank was desilted under Nammaku Namme Thittam (NNT) scheme of DRDA at a cost of Rs 73,652 to which the peoples' contribution was Rs 18,750. During the second phase in 2003, desilting of tank-bed under Gramiya Thanniraivu Thittam (GTT) and clearing of supply channel under CAPART schemes were carried out with a total cost of Rs 1,30,500, of which the peoples' contribution was Rs 28,600. The volume of silt removed was 8487.48 m<sup>3</sup> and the cost per m<sup>3</sup> of silt removed was Rs 13.62. The desiltation cost formed 56 per cent of the total cost of rehabilitation.

The cost on silt excavation was minimum (Rs 13.62/m<sup>3</sup>) in the PT management regime, followed by PTC (Rs 15.44/m<sup>3</sup>) and PWD (Rs 23.51/m<sup>3</sup>) management regimes.

### **Investment Appraisal for Tank Rehabilitation**

Investment appraisal was carried out to find whether the tank rehabilitation was economically viable using the discounted cash flow

technique and the measures of Net Present Worth, Benefit-Cost Ratio and Internal Rate of Return for the investment on tank rehabilitation.

**Benefits:** The net income of each crop was extrapolated by estimating the trend price of each crop. From the extrapolated net income of different crops, the total annual benefits were worked out initially for the sample farmers and then for the tank ayacut area. Finally, the incremental net income was calculated by deducting the net income in each rehabilitated tank from the non-rehabilitated tank. In this method, the benefits and costs for years were adjusted for the year 2002-03 for all the three tanks.

**Costs:** The initial investment on tank rehabilitation in the first phase and the investment during the second phase along with the maintenance costs over the years for the three rehabilitated tanks were taken into account. The cost of rehabilitation of all the three tanks was also adjusted for the year 2002-03.

**Net Present Worth:** The net present worth is the difference between the present value of benefits accrued from rehabilitation and the present value of costs. A positive NPW implies the economic worthiness of the project, in generating returns in excess of all the costs, including the cost of rehabilitation. It was observed that the net present worth in all three rehabilitated tanks was positive with Rs 35,58,399, Rs 27,26,962 and Rs 10,77,664 in PTC, PWD and PT, respectively.

**Benefit-Cost Ratio:** The benefit-cost ratios for the investment in three tanks were: PTC, 6.93; PWD, 6.05; and PT, 5.82. Thus, the B-C ratio for all the three rehabilitated tanks was more than 1.5, prescribed for the irrigation projects. Hence, the investment on rehabilitation in all the three tanks was found to be economically viable.

**Internal Rate of Return :** The internal rate of return for the PTC was 26.96 per cent, for PWD was 39.10 per cent and for PT was 34.90 per cent. All the three investments yielded internal rates of return of more than the opportunity cost of capital of 10 per cent. Therefore, all the three investments were economically viable.

## Conclusions

The study has revealed that the total annual income is higher in the rehabilitated tanks than the non-rehabilitated tanks. Amongst the rehabilitated tanks, PTC has depicted the highest annual income of Rs 37,674. The net income over the variable costs and that over the total costs has been found

higher in the rehabilitated non-rehabilitated tanks. The variable costs have been almost the same across the rehabilitated tanks but are comparatively lower in the case of non-rehabilitated tanks. This shows that the input-efficiency is higher in rehabilitated than non-rehabilitated tank management regimes. The net income over the total cost is highest in PTC (Rs 13,296/ha), followed by PWD (Rs 6115/ha) and PT (Rs 3664/ha). The non-rehabilitated tank management has been found poor, with negative net income over the total cost.

The cost on silt excavation has been minimum (Rs 13.62/m<sup>3</sup>) in PT management regime, followed by PTC (Rs 15.44/m<sup>3</sup>) and PWD (Rs 23.51/m<sup>3</sup>) management regimes. The investment analysis has revealed the Net Present Worth to be positive, B-C ratios to be greater than 1.5 and the Internal Rates of Return to be more than the opportunity costs of capital in all the three rehabilitated tanks. Thus, all the three investments in tank rehabilitation have been found economically viable.

### Policy Implications

The tanks with rehabilitation have yielded far higher crop income than that in the tanks without rehabilitation with the adoption of commercial crops, and hence, rehabilitation work should be undertaken in all other non-rehabilitated tanks also.

Investment on tank rehabilitation with community well management regime has yielded a greater B-C ratio and much higher IRR compared with the tank without the provision of supplemental irrigation. So intensive efforts should be made to provide supplemental irrigation to crops as and when required for further improving the economic position of the farmers.

Even though investment on tank rehabilitation in the PWD tank management regime is economically viable, the performance of tank irrigation in terms of cropping intensity, irrigation intensity and net income are lower as compared to those in panchayat tank with community well management regime. Therefore, efforts should be made by the concerned authorities to improve the PWD tank management regime.

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