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Financial Feasibility on Rehabilitation of Tank Systems and its Impact on Farm Economy

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Abstract

The study focused to assess the economic viability of tank rehabilitation and benefits accrued to farmers after rehabilitation in the selected five community based tank systems in Haveri district of Karnataka. The gross total investment of Rs.92.41 lakh spent to undertake rehabilitation works which includes desiltation, excavation of irrigation canals, strengthening of bunds, etc. The extent of gross cropped area was increased by 21.94 per cent after rehabilitation with the cropping intensity increased from 177.78 to 209.03 per cent. The investment analysis has revealed a positive NPW, B:C ratio greater than unity and IRR was more than the opportunity cost of capital with a payback period of 4 to 5 years in all the five rehabilitated tanks indicated economic viability of tank rehabilitation.

1. Introduction

Irrigation tanks are small reservoirs impounding runoff water and they are largely concentrated in peninsular India. Tanks played a vital role in agricultural development in the dry regions of peninsula for centuries. These tanks are common property resources supporting the village economy in general and the livelihood of farming communities in particular. Tanks provide both surface and groundwater irrigation and serve water needs of rural households and livestock. They also impound silt by the process of sedimentation over time which can also be used to supplement nutrients and improve water holding capacity of soils. With the gradual withdrawal of silt application to farm lands, the encroachment and siltation of tank beds continued unabated drastically. This led to reduction of the storage capacity of many tanks. At present majority of the tanks are in need of desiltation, strengthening of bunds,

renovation of conveyer and distribution channels to use them effectively as a source of irrigation by village community. The Government of Karnataka initiated a programme of desiltation of tanks with huge capital investment on pilot basis parallel to the efforts of voluntary organizations in tank rehabilitation in a span of 6 years from 2002 to 2008 in some major tanks of drought prone districts of the state. An attempt to evaluate the impact of tank rehabilitation becomes imperative in order to document the benefits of such efforts on the production pattern of farmers and also to know economic feasibility of such investment on tank rehabilitation. Therefore this study is undertaken to assess the economics of tank rehabilitation efforts and the benefits both at the household and tank command levels with these specific objectives: To document the changes in the cropping pattern due to rehabilitation of tank systems; To assess the economic impact of rehabilitation on yield, income and on farm economy; To assess the investment feasibility of rehabilitation of tank systems.

2. Methodology

The present study was purposively undertaken in Haveri district of Karnataka, where majority of the tanks were rehabilitated, from the Haveri district, Hanagal taluk was selected as it has a large number of the community tanks which were rehabilitated, and hence, based on the highest command area five major tanks were selected they are, Hirekere (Balambeed), Hirekere (Adur), Doddakere (Akkihalur), Singapurakere (Singapura) and Doddakere (Hallibail). From each of these tank commands 25 farmers were selected randomly constituting a total of 125 farmers.

Secondary data regarding total command area of tanks, particulars of works taken up under rehabilitation, cost involved and associated benefits of rehabilitation were collected from the records of District Project Unit (DPU), Haveri district and Jala Samvardane Yojana Sangha (JSYS), Hanagal taluk. Primary data collected from the farmers related to socio-economic status, various aspects of agriculture like size of land holding, asset position, cropping pattern, input usage, crop yields, costs and returns and other related information both before and after rehabilitation in the selected tank command area was collected for the year 2010-11 through well structured and pre-tested schedule to realize the impact of tank rehabilitation. The primary data on various aspects of farming before rehabilitation (2005-06) were collected from the farmers on the memory recall basis. Data were analyzed using ratio measures, percentages, averages, budgeting technique and financial feasibility technique. Considering the enormous degree of encroachment of tank catchments, tank feeder channels and the water spread areas and considering the uniformity in rainfall and the number of rainy days over the last 15 years, the volume of rain water flow to tank in general has reduced. Since the volume of rain water has reduced, the tank siltation rate also reduced due to encroachment. Hence the life of desiltation effort is assumed as 20 years even though twenty year appears to be a long duration for the tank to accumulate the magnitude of silt necessary and that is enough to undertake yet another desiltation endeavor. A discount rate of 12 per cent was used, considering the logic that the longer the life period of a developmental activity, the smaller is the interest rate. Since tank

desiltation is a developmental and welfare measure, it cannot be strictly viewed as an economic activity with market oriented parameter of interest and prices. Assuming that the benefit of tank rehabilitation will accrue for 20 years, the investment on tank rehabilitation was amortised to obtain the annual share of the fixed cost.

3. Results and Discussion

3.1 Impact of tank rehabilitation on cropping pattern and intensity

The overall cropping pattern and cropping intensity of the selected tank commands were indicated in Table 1 and it was noticed that, the gross cropped area increased from 403.42 acres to 491.95 acres after rehabilitation. During kharif, the area under paddy cultivation increased from 126.15 acres to 182.45 acres (31.27 % to 37.09 %) and other crops were decreased due to area under paddy cultivation except green gram there was an increased area (3.77 to 9.90 acres) after rehabilitation. In rabi, gross cropped area was only 144.50 acres before rehabilitation and it was increased to 190.50 acres after rehabilitation. Rabi sorghum was predominantly grown during rabi with an area of 148.50 acres after rehabilitation and it was only 86.25 acres before rehabilitation. The area under fallow land decreased from 20.95 per cent to 9.38 per cent after rehabilitation.

Interestingly, the cropping option during summer season increased where, crops occupied only 7.93 per cent of the gross cropped area before rehabilitation and it was almost doubled to 13.44 per cent after rehabilitation as a result of increased availability of irrigation water. Among the crops, area under groundnut increased from 5.45 per cent to 8.64 per cent and black gram area increased from 0.74 per cent to 3.07 per cent of the gross cropped area after rehabilitation.

The impact of tank rehabilitation was observed in terms of change in the cropping intensity in the selected tank commands. The cropping intensity as a result increased from 177.78 per cent to 209.03 per cent after tank rehabilitation. Rajeshwari (2005), Gireesh *et.al*. (1996) also supported the findings of present study in respect of increased gross cropped area, cropping intensity as a result of double cropping as induced by increased irrigation through construction of farm ponds.

3.2 Impact of tank rehabilitation on productivity of major crops

It could be inferred that (Table 2) the percentage increase in per acre crop yields were found to be considerably higher after rehabilitation when compared to productivities before tank rehabilitation. The highest increase (36.15%) in per acre yield was noticed in case of paddy, rabi sorghum (35.29%), black gram (34.82%), and cowpea (32.39%). The increase in productivity in case of chilli, cotton, groundnut, green gram, and maize ranged between 23 to 28 per cent. The reason for such an increase could be attributed to increased availability of water for irrigation and which served the farmers to use it as a protective irrigation at critical stages of crop production especially during rabi and summer seasons.

3.3 Cost, incremental income of tank rehabilitation for sample farmers

The rehabilitation facilitated storage of surface water by increasing impounding capacity. Tanks of all the five villages had reasonable amount of water stored during monsoon after rehabilitation works. Increased crop production activities resulted in increased returns and net incremental returns (Tables 3). The comparison of total returns and annual net incremental income in all the selected tanks showed a significant increase after rehabilitation due to increased area under crops and also account of increase in per acre crop productivities when compared to before. The total returns from all crops increased from Rs. 5,82,658 to Rs. 13,93,961 which was about two and half times more than before rehabilitation. The total annual net incremental returns from crop production for all the sample farmers together in all the five tanks was Rs. 2,22,365. This clearly signified the impact of rehabilitation works undertaken in the respective tank commands through desiltation. These results were in conformity with the results of the study conducted by Gireesh *et. al.*(1996) and showed increased incremental income due to desiltation.

Cost and projected incremental benefits for the tank command after rehabilitation

The gross total investment of Rs.92.41 lakh spent to undertake rehabilitation works in five tank systems in Haveri district (Table 4). Of this total investment, allocation on different work components together in each tank system shared ranged from 20.00 per cent to 23.45 per cent for Balambeed, Adur, Akkialur, and Singapura tanks. Only about 13.00 per cent was allocated for Hallibail tank considering the smaller command area and work components to be executed. Average investment made for different work components put together ranged between Rs.17101/acre and Rs.28310/acre per tank depending on the extent of work and seriousness of the problem. The total annual incremental net returns from crops for the total command area in each tank system was computed by extrapolating the cropping pattern adopted by sample farmers to the whole of tank command. The overall total incremental net returns from crops from all five tank systems was Rs.23.54 lakh per annum from a total of 453.40 acres of irrigated command area. It worked out to be Rs.5193 per acre annually. A largest total incremental net returns was contributed (29.14%) by Balambeed tank command mainly because of largest size of the command area and also high cropping intensity (210 per cent) followed by Adur, Akkialur and Singapura which contributed around 20.00 per cent each. The incremental net return generated was lowest (10.96%) by farmers of Hallibail tank command due to its smaller size of irrigable command. Generally, variability in the contribution of incremental net returns to the total by each tank command mainly depended on nature of crops and extent of cropped area, cropping intensity, crop yields and the size of the command area under each tank.

3.3 Financial feasibility of investment on tank rehabilitation

Among the financial feasibility measures (Table 5) the NPV was found to be positive (ranged between 4.08 lakh to 9.87 lakh) in all the selected tank systems. This indicated discounted net returns were sufficient to cover initial, operation and maintenance costs on tank rehabilitation indicate the worthiness of the project. The B:C ratio’s worked

out for all the tank systems in the district were more than unity indicated worth of the project as every rupee invested resulted into more than one rupee returns. The internal rate of return (IRR) was found to be in the range from a high of 64 per cent and low 28 per cent, indicated a reasonably high earning capacity of the investment in rehabilitation of community based tank systems and was found to be greater than the opportunity cost of capital. The works undertaken in different tank systems were also able to recover the initial investment within a (pay back) period of 3 to 5 years time. Similar findings were reported in the study carried out by Gireesh *et.al.* (1996), Amarnath and Karthik (2006) with respect to investment on tank rehabilitation. Hence, the investment on tank rehabilitation was found to be financially feasible and economically viable. Such investment also leads to efficient use of land, water and other productive resources and enhance profitability to the farmers particularly among rural community.

3.4 Policy implications

1. Rehabilitation of community based village tanks increased the irrigation potential under its command by 24 per cent with a cropping intensity of more than 200 per cent. Along with this there was also a considerable increase in the crop yields (in the range from 28% to 36%) for different crops and farm income. Therefore, there is a need for covering non-rehabilitated tank systems which offer immense potential towards increasing the area under irrigation.
2. The Net Present Value (Rs.3 to 7.80 lakh), B:C ratio (more than one) and Internal Rate of Return (> 28%) and payback period (4 to 5 years) measures indicated financial feasibility and economic viability of rehabilitation investment of community based village tank systems. Therefore, in this direction there is need for increased allocation of budget by the State for under taking large-scale rehabilitation of community tanks.

Table 1: Impact of tank rehabilitation on overall cropping pattern and intensity among sample farmers in different tank commands

(Area in acres)

		Before rehabilitation (n=125)		**After rehabilitation (n=125)**	
Sl. No	**Season/ crop**	**Area**	**Proportion (%)**	**Area**	**Proportion (%)**
I	Kharif				
1	Paddy	126.15	31.27	182.45	37.09
2	Maize	71.00	17.60	16.50	3.35
3	Cotton	19.00	4.71	18.00	3.66
4	Green gram	3.77	0.93	9.90	2.01
5	Sugarcane	7.00	1.74	8.50	1.73
6	Fallow	2.10	0.52	1.30	0.26
	Total kharif	226.92	56.25	235.35	47.84
II	Rabi				

1	Sorghum	86.25	21.38	148.50	30.19
2	Sugarcane	7.00	1.74	8.50	1.73
3	Chilli	32.25	7.99	12.00	2.44
4	Cowpea	0.00	0.00	3.50	0.71
5	Cotton	19.00	4.71	18.00	3.66
6	Fallow	84.52	20.95	46.15	9.38
	Total rabi	144.50	35.82	190.50	38.72
III	Summer				
1	Groundnut	22.00	5.45	42.50	8.64
2	Black gram	3.00	0.74	15.10	3.07
3	Sugarcane	7.00	1.74	8.50	1.73
4	Fallow	197.02	48.84	170.55	34.67
	Total summer	32.00	7.93	66.10	13.44
	Gross cropped area	403.42	100.00	491.95	100.00
	Net cropped area	226.92		235.35	
	Cropping intensity (%)	177.78		209.03	

Note: Percentages to gross cropped area

Table 2: Impact of tank rehabilitation on productivity of major crops in sample tank commands

(qtl/ acre)

Crops	**Before Rehabilitation**	**After Rehabilitation**	**Change in Crop Yield Over before Rehabilitation**
Paddy	15.24	20.75	5.51(36.15)
Maize	15.38	19.54	3.86(25.09)
Cotton	5.32	6.84	1.52(28.57)
Sorghum	6.83	9.24	2.41(35.29)
Chilli	3.54	4.37	0.83(23.45)
Greengram	3.41	4.37	0.96(28.15)
Groundnut	4.12	5.24	1.12(27.18)
Black gram	2.24	3.02	0.78(34.82)
Cowpea	2.84	3.76	0.92(32.39)

Table 3: Incremental farm income after tank rehabilitation for the sample farmers of tank command

	Before rehabilitation						**After rehabilitation**						
Particulars	**Paddy**	**Rabi Sorghum**	**Maize**	**Groundnut**	**Other crops**	**Total**	**Paddy**	**Rabi Sorghum**	**Maize**	**Groundnut**	**Other crops**	**Total**	**Net Incremental income/ cost**

Area(acre)	25.23	17.25	14.20	4.40	12.80	73.88	36.49	29.70	3.30	8.50	13.40	91.39	
Yield(q)	384.90	121.28	160.10	18.28	56.81	741.36	703.26	251.71	48.70	46.61	60.05	1110.32	
Rate(Rs./q)	700.00	860.00	600.00	1750.00	750.00		970.00	1750.00	820.00	2238.00	950.00		
Total returns	290828.23	111160.42	102564.00	35501.56	42604.50	58258.70	730754.63	454284.61	39934.00	111945.60	57043.13	1393961.98	811303.27
Total cost	259416.34	104759.65	70180.00	31561.08	30729.60	49646.68	584747.02	348566.19	21750.00	82281.11	48240.00	108558 4.32	588937.64
Net incremental income													222365.64

*Due to aggregation problem the monetary value of the output is considered.

Table 4: Projected benefits and costs of tank rehabilitation.

Sl. No	Particulars	Balambeed	Adur	Akkialur	Singapura	Hallibail	Overall
1	Total investment (Rs.)	1846668 (19.98)	212043 7 (22.94)	2167153 (23.45)	193244 4 (20.91)	11747 04 (12.71)	9241406 (100)
2	Total command area(acre)	107.97 (23.81)	74.90 (16.51)	101.00 (22.27)	100.84 (22.24)	68.69 (15.14)	453.40 (100)
3	Investment per acre of command area (Rs.)	17103.53	28310.24	21456.96	19163.47	17101.53	103135.70
4	life of rehabilitation (years)	20	20	20	20	20	20
5	Amortised cost (AC) per year (Rs.)	216908.92	249065.72	254552.97	226984.14	137980.29	1085492
6	Annual O&M cost at Rs.60/acre (Rs.)	6478.20	4494	6060	6050.40	4121.40	27204
7	Water spread area (acres)	48.53	38.22	43.70	28.75	24.25	183.44
8	AC per acre water spread of tank (5/7)	4470.04	6516.63	5825.01	7895.10	5689.91	30396.70
9	AC per acre of command area (5/2)	2008.97	3325.31	2520.33	2250.93	2008.74	12114.28

10	Incremental net return from crops of total tank command area (Rs.)	686326.36 (29.14)	458973.49 (19.49)	473146.51 (20.09)	477897.49 (20.29)	258202.30 10.96)	2354546 (100)
11	Total cost (5+6) (Rs.)	223387.12	253559.72	260612.97	233034.54	142101.69	1112696
12	Net incremental income/tank (10-11) (Rs.)	462939.24	205413.76	212533.54	244862.96	116100.61	1241850
13	Net incremental income/acre of command area (Rs.)	4287.67	2742.51	2104.29	2428.23	1690.21	2739

Table 5: Financial feasibility of investment on rehabilitation of selected tank commands

Discounted cash flow measures of cost and returns	Balambeed Tank	Adur Tank	Akkialur Tank	Singapura Tank	Hallibail Tank
Net present value (Rs. Lakh)	9.87	3.96	5.64	5.94	4.08
Benefit-cost ratio	2.16	1.23	1.29	1.34	1.29
Internal rate of return	64	32	28	35	47
Pay-back period (years)	2.72	4.67	4.64	4.10	4.62

Note: A time period of 20 years was considered and discount rate of 12 per cent was used

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