6.0 ECONOMIC EVALUATION OF INVESTMENT IN KCBTMP

6.1 Methodology

In order to rehabilitate the tank systems and restore the storage capacities a large investment has been made by the Government of Karnataka, with the assistance provided by the World Bank. The major investment is on tank civil works, the details of which have been presented in an earlier chapter. The details of benefits / out comes of such investment in terms of increased storage, improved on-farm water use efficiency and the consequent increase in area irrigated, cropping intensity, productivity of crops and agricultural production in general have been presented in the previous chapters. An attempt is made in this chapter to examine the economic viability of investment, measured in terms of economic returns, by using popular methods of evaluation like Net Present Value (NPV), Benefit - Cost Ratio (BC Ratio). Taking the investment (actual amount spent upto April, 2008) in sample tanks (187) and amortizing it (annualizing) for 15 years (project life assumed), with a discount rate of 10 percent, the economic rate of return has been estimated. Before the economic analyses per se presented, a brief overview of the investment and benefits accrued has been discussed in what follows.

6.2 Data Analysis

The data for 187 sample tanks have been collected, by using the relevant structured schedules, on various components of tank improvement and aggregated. The benefits as realized by the beneficiaries have been averaged and presented (Table 6.1).

(a) The survey data indicates that on an average Rs.6,83,678 has been invested per tank. The benefits generated through different sources works out to Rs.6,90,578 per tank. Incremental benefits from agricultural

Table 6.1

production accounts for major chunk of the benefits (More than 98 percent). The next major source of benefits is from fisheries; (about one percent). All other sources are negligible. It requires minimum threshold period for optimum benefits to flow from the tank improvement.

(b) The investment per MI sample tank works out to Rs.9,73,139 and ZP sample tank Rs.5,56,761. The benefits per MI tank are Rs.12,19,345 and per ZP tank it is Rs.4,57,394. The major benefits from both types of tanks are from incremental output from agriculture only. Keeping this as backdrop the economic analysis has been carried out, the details of which are presented in what follows.

6.3 Cost – Benefit Analysis

6.3.1 Benefits

The cost-benefit analysis is one of the popular tools used for investment appraisal of development projects. The KCBTMP is implemented in six agro-climatic zones in Karnataka. The costs and benefits of the project in these zones are presented. The time period for the analysis is 15 years and the discount rate used is 10 percent.

The **benefits stream** of the project includes:

1. In crease in the agricultural production: The agricultural production in the sample tanks before and after the project was collected. The incremental production from kharif, rabi and summer crops has been derived from deducting the values of base period from the present period and included in the analysis. The production of all the crops grown in the sample tanks in all the three seasons has been included.

2. Additional benefits generated in the sample tanks, like auction of fish, water tax, sale of silt for brick making and agricultural purposes, sale of jungle cutting in the tank bund, sale of grass and other usufruct rights in the tank bed, etc; have been included.

3. Indirect benefits from time saved in fetching water etc; were also included. The estimated values of these benefits are included in the analysis.

6.3.2 Costs

The analysis includes the direct investment costs for each sample tank across the zones, both MI and ZP tanks; they include direct engineering costs as well as non-engineering costs incurred for tanks improvement, including water distribution system.

The appraisal measures used are net present value (NPV) and Benefit-cost Ratio (B-C ratio), which are derived using the formula mentioned below:

$$NPV = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)t} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Where Bt= Benefits in year t; Ct= cost in year t;

t= 1,2,3……n;

n= number of years

i= discount rate

$$BCR = \frac{\sum_{t=1}^{n} \frac{Bt}{(1+}}{\sum_{t=1}^{n} \frac{I}{(1+i)t}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

In the present context n=15 years

i=10 percent

- The economic viability of investment in tank de-silting and rehabilitation has been evaluated using the popular methods of evaluating project worth, viz., Net Present Value (NPV), Benefit Cost Ratio (B:C ratio), Internal Rate of Return (IRR) and pay back period. These measures of project worth are employed when the investment is made at one point in time and the returns stream is obtained over a period of years. Since time exercises an influence on the value, it is adjusted for time using a suitable discount rate which reflects the time value of money, in other words the rate at which money loses value due to time.

- The discount rate is crucial in calculation of these measures and usually a rate is selected to reflect the cost of capital, i.e, the rate at which capital is borrowed in the market. However, in the case of development projects such as this a slightly lower rate of discount is selected as the indirect or the social benefits which are not quantified if the benefit stream is high, hence a discount rate of 10 percent has been chosen for this study.

- The costs and the benefits have been worked out for each tank both project tanks and the control tanks and the incremental net returns of the project tanks over the control tanks only have been considered as the returns stream for each tank. The subsidiary incomes like fisheries, water tax, sale of silt, brick making, sale of wood and other fruit products were also estimated and included as benefits from the project. These returns were combined and compared with the cost of desiltation and rehabilitation of each tank and the cost and returns streams have thus been arrived at. The returns have been assumed constant from the second year onwards till the 15^{th} year, under the tacit assumption that any escalation in costs will be offset by an increase in the returns. The life of the rehabilitation work has been assumed to be 15 years which was arrived at based on experience and discussions held with experts.

- The results of the discounted cash flow techniques are presented in table 6.2. Perusal of the table reveals that the investment in tank rehabilitation is extremely viable and the benefits more than outweigh the costs by several fold. For the state as a whole the Internal rate of return was estimated at 29 percent which was higher in Minor irrigation tanks at 39.62 percent and 20.90 percent in Zilla Parishid tanks.

- A comparison of rates of return to investment in tank rehabilitation across the zones shows that in Eastern Dry Zone (EDZ) and Northern Dry Zone (NDZ) the highest rates of return were over 30 percent in both these zones. However the rates look a bit low in the North Eastern Transitional Zone at around 11- 12 percent. This could be due to the tanks not filling up adequately during the preceding monsoons.

- The net present value for various tanks has also been presented in Table 6.2. All tanks investments have yielded positive net present values. The total investment in all the tanks put together amounts to Rs. 12.78 million. This investment yields a net present value of Rs. 138.02 million which testifies to the high net worth of the investment. All the investment in the various tanks showed a healthy Benefit Cost Ratio. For the state as a whole it was 2.41 and 2.32 and 1.82 for Minor Irrigation and Zilla Parishad tanks respectively.

Table 6.2: Measures of the Economic Viability of investment in Tank Irrigation in selected zones of Karnataka.

Zone	Type of Tanks	Net Present Value (Rs. million)	B:C Ratio	Internal Rate of return (%)
CDZ	Overall	17.73	1.79	20.50
	MI	4.36	2.04	23.96
	ZP	1.20	1.21	11.82
EDZ	Overall	23.04	2.65	32.07
	MI	0.69	1.20	11.66
	ZP	13.18	1.50	16.21
NDZ	Overall	30.64	3.31	40.55
	MI	1.95	1.30	13.19
	ZP	0.28	1.17	11.16
NEDZ	Overall	3.81	1.67	18.80
	MI	1.99	2.13	25.16
	ZP	1.81	1.49	16.04
NETZ	Overall	0.17	1.14	10.72
	MI	0.17	1.14	10.72
	ZP	-	-	-
NTZ	Overall	3.06	1.29	13.14
	MI	8.31	3.24	39.62
	ZP	3.74	1.62	18.09
Total	Overall	38.02	2.41	28.84
	MI	56.10	2.32	27.75
	ZP	43.16	1.82	20.90

6.4 An attempt was also made to **evaluate the economic viability of tanks which are full** vis-à-vis tanks which are not due to paucity of rains. This will help better understanding of the future scenario of project benefits. The investments and the returns of such tanks have been segregated and the incremental net returns over tanks which have not filled up has been used to evaluate the investment in such tanks. The results are presented in Table 6.3.

Table 6.3: Economic viability of tanks which have received full storage during the reference period.

Zone	Type of Tanks	Net Present Value (Rs million)	B:C Ratio	Internal Rate of return (%)	Economic rates of returns
CDZ	Overall	1.95	1.60	17.79	-
	MI	1.14	2.67	32.32	20.0
	ZP	0.56	2.37	28.36	16.0
EDZ	Overall	33.40	7.70	44.97	-
	MI	3.37	2.97	36.11	29.0
	ZP	13.94	5.38	46.36	18.0
NDZ	Overall	3.34	1.90	21.96	-
	MI	2.89	1.86	21.43	22.0
	ZP	0.45	2.28	27.13	19.0
NEDZ	Overall	0.76	1.62	18.09	-
	MI	0.00	-	-	23.0
	ZP	0.76	1.62	18.09	23.0
NETZ	Overall	1.61	1.51	16.47	-
	MI	2.77	1.87	32.37	22.0
	ZP	-	-	-	34.0
NTZ	Overall	6.56	2.59	31.19	-
	MI	5.32	3.13	38.23	22.0
	ZP	1.24	1.79	20.46	19.0
Total	Overall	5.34	2.38	46.30	-
	MI	6.00	3.98	48.89	-
	ZP	10.79	2.57	31.01	-

Note: Economic rates of returns are from project appraisal document (PAD)

- Perusal of the table reveals that the tanks which had received full storage had an incremental rate of return of 46.31 percent which was 48 percent in Minor Irrigation tanks and about 31 percent in tanks under the Zilla Parishad. Similar returns were obtained in investments made in EDZ. Obviously the returns to investment is higher, when all tanks were considered together.

- From these results, it is clear that tanks which have been rehabilitated and have filled up during the season had yielded very significant returns to the investments made. This is due to the increase in irrigation intensity as well as the greater coverage in the command. This was true of tanks under the ZP as well as the Minor Irrigation department. The effect is two fold, one the farmers secure a higher yield and second they take up enterprises which are highly remunerative like vegetables, pulses, sunflower, etc; albeit a little risky when there is no good amount of water in the tank. One word of caution while interpreting these results, since the rates of returns look very high, is that gross returns have been considered, consequently fixed costs like land rent and depreciation on machinery have not been considered explicitly. If these are included in the cost the returns may get moderated a bit.