Chapter 14
Benefit – Cost Ratio

14.1   Benefits

The Nagarjunasagar-Somasila link canal is proposed to transfer the water from Nagarjunasagar to Somasila reservoir for use in Pennar and other basins south of Pennar and also provides water for enroute irrigation and domestic use. An attempt is made to work out the benefit-cost (B.C.) ratio on the basis of the annual benefits from enroute irrigation and water supply for domestic and industrial uses and the annual cost that is worked out as the apportioned cost of the water consumed enroute the link, including transmission loss, out of the total estimated cost of link project.

14.1.1   Direct benefits

Probable values of produce in post and pre-irrigation scenarios in the proposed enroute command area have been separately worked out to estimate the direct benefits from irrigation. These details help in visualising the likely improvement in the crop-wise yield in the post-irrigation scenario. Gross values of the benefits for the post-project and pre-project conditions are computed adopting the yields and prices of the commodities obtained from the Agricultural Department of the Government of Andhra Pradesh.

An area of 168017 ha has been identified in Prakasam and Nellore districts for providing irrigation enroute the link canal. The net annual benefit after introduction of irrigation in enroute areas along the link canal is estimated to be Rs.10,530 lakh. The water requirements in the command area for domestic and industrial uses are estimated as 55 Mm^3 and 69 Mm^3 respectively. The annual net revenue from the water supplies for domestic and industrial uses adopting the rates in vogue in Hyderabad is estimated as Rs. 7999 lakh.

14.1.2   Indirect benefits

Apart from the direct benefits, many indirect benefits would also accrue from the link project leading to tremendous development in all the socio-economic aspects of the enroute region. These indirect benefits could be visualised or quantified in broad perspective only. Some of these likely indirect benefits are listed below:

1) Assured irrigation in the enroute region, which is hitherto devoid of any significant irrigation facilities, will create direct employment opportunities for the agricultural labourers and for other professionals in this sector and several job opportunities would become available for the local people during the construction of the project.

2) With the implementation of the scheme, living standards of the local farmers, in general, would improve because of better yields from their fields and hence higher returns for their work.

3) Once the irrigation facilities are developed, agro-based industries, dairy farms, poultry farms, marketing facilities for the agricultural inputs like pesticides and fertilisers etc. are likely come up in the region, leading to general prosperity and economic upliftment of the people of the towns and villages in the enroute area.

4) The ground water availability in the command area would get enhanced on account of increased recharge to the ground water as a part of the water supplied for irrigation gets percolated into the ground.

5) Better communication facilities would become available resulting in better connectivity among the villages.

6) Infrastructural facilities would improve due to increased industrial and marketing activity in the enroute region.

7) Plantation along the canal banks and the proposed afforestation of surrounding areas would enhance environmental status of the region.

8) Rehabilitated people are likely to have better living conditions in planned colonies provided with all the basic amenities.

14.2 Cost

The cost of this link project is estimated under three main components viz. Unit I- Head works, Unit II - Conveyance system and Unit III - Power house. The total cost of the project is estimated to be Rs.6321 crore at the 1998-99 year price level. For the purpose of working out the B.C. ratio, the annual cost is worked out considering the

apportioned cost of the water consumed enroute the link. The apportioned cost of the project is works out to be Rs.881 crore.

The annual cost is estimated considering 10% interest and 1% depreciation on the apportioned capital cost and adding annual O&M charges for the project, taken @ Rs.150/ha. The annual cost is worked out to be Rs. 9938 lakh.

14.3 Benefit-cost ratio

The benefit-cost ratio is worked out as follows.

		Amount (Rs. in lakh)
I	**Capital cost**	
	Estimated cost of the project	Rs. 632054
	Apportioned cost of the project	88061.00
II	**Annual benefits**	
	A. Irrigation	
	a) Post project	
	i) Gross value of produce 51400	
	ii) Expenditure 19396	
	iii) Net value of produce(i-ii)	32004.00
	b) Pre-project	
	i) Gross value of produce 39195	
	ii) Expenditure 21641	
	iii) Net value of produce (i-ii)	(-) 17554.00
	c) Loss in agricultural production in land going out of cultivation due to distributary system @ 10% of gross value of produce before irrigation	(-) 3920.00
	Net benefit from agriculture (a-b-c)	10530.00
	B. Water supply	
	a) Revenue from domestic water supply 55 Mm^3 @ Rs.31.12 lakh/Mm^3	1712
	b) Revenue from industrial water supply 69 Mm^3 @ Rs.91.12 lakh/Mm^3	6287
	Net benefit from domestic and industrial water supply	7999.00
	Total benefit (10530+7999)	18529.00
III	**Annual cost**	
	a) Interest @ 10% of capital cost	8806.00

	b) Depreciation @ 1% of capital cost		880.00
	c) Annual O&M charges @ Rs.150.00/ha		
	for 168017 ha		252.00
	Total		9938.00
IV	**Benefit -cost ratio = 18529/9938**		
			1.86

The B.C. ratio is worked out considering the likely enroute benefits and cost of the Nagarjunasagar-Somasila link only, which is not an independent link project by itself. This B.C. ratio is helpful to have an idea about the worth of the benefits from this particular link in comparison to the annual cost likely to be incurred on the same. The high value of the B.C. ratio is mainly due to the fact that the existing Nagarjunasagar reservoir at the link canal is proposed to be utilised without any change in its capacity.

The Nagarjunasagar-Somasila link canal linking Krishna and Pennar rivers is an integral part of the peninsular rivers linking system viz. Mahanadi-Godavari- Krishna-Pennar-Cauvery-Vaigai, which is intended to divert the surplus flows of Mahanadi and Godavari rivers to the water-deficit Krishna, Pennar, Cauvery, Vaigai and other minor southern river basins. Thus the Nagarjunasagar - Somasila link is dependent on the surplus waters to be brought from Mahanadi and Godavari to the Krishna River. Hence, some additional cost on this count will have to be added to the estimated cost of the Nagarjunasagar - Somasila link project. The apportionment of costs to various link canals proposed under peninsular rivers linking system will be possible only after completion of studies of all the link canals of the system. With the addition of such apportioned cost to the Nagarjunasagar - Somasila link, the benefit-cost ratio of 1.86 as worked out above independently for the link is likely to undergo a change.

It would be more realistic and appropriate to work out the benefit-cost ratio for the peninsular rivers linking system as a whole to determine the economic viability of the system in its totality.

Internal rate of return

The internal rate of return worked out considering the annual benefits and apportioned cost of enroute water consumption is given in Table 14.1.

Table 14.1
Internal rate of return

1.	Life of project	100 years
2.	Construction period	8 years
3.	Apportioned cost of project	Rs. 880 crores
4.	Annual benefits	Rs. 185 crores
5.	Maintenance cost @ 1% of I-Works	Rs. 8 crores

Year (s)	Cost	Benefit	Net benefit	Discounting factor		Present worth of net benefits	
				14%	16%	14%	16%
	Rs. in cores	Rs. in cores	Rs. in cores				
0	26	-	-26	1.000	1.000	-26	-26
1	29	-	-29	0.877	0.862	-25	-25
2	99	-	-99	0.769	0.743	-76	-74
3	112	-	-112	0.675	0.641	-76	-72
4	130	-	-130	0.592	0.552	-77	-72
5	164	-	-164	0.519	0.476	-85	-78
6	168	-	-168	0.456	0.410	-77	-69
7	152	-	-152	0.400	0.354	-61	-54
8	8	185	177				
9	8	185	177				
10	8	185	177				
				2.855	2.211	505	391
Continued up to 107th year							
107	8	185	177				
	Total					2	-79

Internal Rate of Return = 14 + {2x(2/81)} = 14.05%