

# Chapter 14

## Benefit - Cost Ratio

### 14.1 General

The Godavari (Inchampalli) - Krishna (Nagarjunasagar) link canal is an integral part of the Peninsular Rivers linking system. This link canal not only transfers a major part of the water to the Nagarjunasagar reservoir for use in the Krishna and other southern river basins, but also provides a significant part of it for irrigation and domestic use enroute. As such, it will be more appropriate to assess the overall benefits as a whole for the Peninsular rivers development i.e. Mahanadi-Godavari-Krishna-Pennar-Cauvery-Vaigai-Gundar link system and not in isolation. However, for the purpose of present study, an equivalent size and cost of the project that could benefit the enroute irrigation and water supply is assumed and attempted. The benefit-cost (B.C.) ratio has been assessed on the basis of the annual benefits from enroute irrigation and water supply for both domestic and industrial uses against the annual apportioned cost of the water consumed enroute the link, inclusive of the transmission losses.

### 14.2 Benefits

#### 14.2.1 Direct Benefits

##### (a) Irrigation

Probable values of produce in post and pre-irrigation scenarios in the proposed enroute command areas have been separately worked out to estimate the direct benefits from irrigation. Gross values of the benefits for the pre-project and post -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 411872 ha has been identified in Warangal, Nalgonda and Khammam districts for providing irrigation en route the link canal. The net annual benefit after introduction of irrigation is estimated to be Rs.97078 lakh.

##### (b) Revenue from Domestic and Industrial Water Supply

The water requirements in the command area for domestic and industrial uses are estimated as 104 Mm<sup>3</sup> and 133 Mm<sup>3</sup> 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. 24649 lakh.

### **(c) Power**

The power plant proposed at the Inchampalli dam is of pumped storage in nature as such the power generated will be compensated for lifting the water back to the reservoir. Further about 352 MU of power is generated annually from the canal powerhouse at Musi and the benefits from power @ Rs.1.50 per unit works out to Rs.5280 lakh. However, in the present study these are not taken into account while computing benefit –cost ratio.

### **14.2.2 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 region. These indirect benefits could only be visualised or quantified in broad perspective only. Some of the 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 to 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 the increased recharge to the ground water since a part of the water supplied for irrigation get 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.

### **14.3 Cost**

The cost of this link project is estimated under four main components viz. Unit I - Head Works, Unit II - Conveyance System, Unit III - Power Houses and Unit IV - Pump Houses. Total cost of the project is estimated to be Rs.26289 crore at the 2003-04 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 as follows:

Out of the total quantum of 16426 Mm<sup>3</sup> of water diverted through the Godavari (Inchampalli) – Krishna (Nagarjunasagar) link, 1427 Mm<sup>3</sup> is proposed to be utilised for enroute irrigation, 237 Mm<sup>3</sup> for en route domestic and industrial uses and 57 Mm<sup>3</sup> is provided for the transmission losses on pro rata basis. Thus the enroute water consumption from the link canal is 1721 Mm<sup>3</sup> and the cost was worked out proportionately which would be around Rs. 275435 lakh. This apportioned cost is adopted for estimating the annual cost.

The annual cost is estimated considering 10% interest and 1% depreciation on the apportioned capital cost, annual O&M charges for the project, taken @ Rs.250/ha, maintenance of Head works @ 1% of its apportioned cost, depreciation of the pump house electrical & mechanical works and transmission scheme @ 8.33 % of its apportioned cost and adding cost of power required for lifting @ Rs.1.50 per unit. The annual cost works out to Rs. 54070 lakh.

## 14.4 Benefit-Cost Ratio

The benefit-cost ratio is worked out as follows.

<b>I</b>	<b>Capital Cost</b>	Amount Rs.in lakh
	Estimated Cost of Link Project	<b>2628877</b>
	Proportionate cost of link project	275435
<b>II</b>	<b>Annual Benefits</b>	
A.	Irrigation	
1.	Kakatiya Canal Stage – II of SRSP Project Command	
a)	<b>Post project</b>	
	i) Gross value of produce (1995-96)	37002
	ii) Expenditure (1995-96)	14758
	iii) Net value of produce @ 1995-96 price level (i-ii)	22244
	iv) Net value of produce @ 2003-04 price level	47682
b)	<b>Pre-project</b>	
	i) Gross value of produce (1995-96)	5141
	ii) Expenditure (1995-96)	3310
	iii) Net value of produce @ 1995-96 price level (i – ii)	1831
	iv) Net value of produce @ 2003-04 price level	3925
c)	Loss in agricultural production in land going out of cultivation due to distributary system @ 10% of gross value of produce before irrigation @ 2003-04 price level	1102
	Net Benefit from Agriculture (a – b – c)	42655
2	Srisailam Left bank canal Command	
a)	<b>Post project</b>	
	i) Gross value of produce (1995-96)	39454
	ii) Expenditure (1995-96)	13313
	iii) Net Value of produce @ 1995-96 price value (i-ii)	26141
	iv) Net value of produce @ 2003-04 Price value	56036
b)	<b>Pre project</b>	
	i) Gross value of produce (1995-96)	3835
	ii) Expenditure (1995-96)	3466

	iii) Net Value of produce @ 1995-96 price value (i-ii)	369	
	iv) Net value of produce @ 2003-04 Price value	791	791
c)	Loss in agricultural production in land going out of cultivation due to distributary system @ 10% of gross value of produce before irrigation @ 2003-04 price level		822
	Net Benefit from Agriculture (a – b – c)		54423
	Total Net Benefit from Irrigation (1 + 2)		97078
<b>B.</b>	<b>Water Supply</b>		
a)	Revenue from domestic water supply 104 Mm <sup>3</sup> @ Rs.50.69lakh/Mm <sup>3</sup>	5272	
b)	Revenue from Industrial water supply 133 Mm <sup>3</sup> @ Rs.145.69 lakh/Mm <sup>3</sup>	19377	
	Net Benefit from Domestic and Industrial Water Supply		24649
	Total Benefit (A+B)		121727
<b>III</b>	<b>Annual cost</b>		
a)	Interest @ 10% of capital cost		27544
b)	Depreciation @ 1% of capital cost		2754
c)	Annual O&M charges @ Rs.250.00/ha for 411872 ha		1030
d)	Maintenance of head works @ 1% of its apportioned cost		117
e)	cost of power for lifting		18675
f)	Depreciation of the pump house electrical & mechanical orks and transmission scheme @ 8.33% of its cost on pro rata basis		3950
	<b>Total</b>		<b>54070</b>
<b>IV</b>	<b>Benefit -cost ratio (121727 / 54070)</b>		<b>2.25</b>

The Godavari (Inchampalli) - Krishna (Nagarjunasagar) link is dependent on the surplus waters to be brought from Mahanadi to Godavari River. Hence, some additional cost of Mahanadi-Godavari link canal will have to be added to the estimated cost of the Godavari (Inchampalli) - Krishna (Nagarjunasagar) link project. With the addition of such apportioned cost to the Godavari (Inchampalli) - Krishna (Nagarjunasagar) link, the benefit-cost ratio of 2.25 as worked out above independently for the link is likely to undergo a change.

## 14.5 Internal Rate of Return

The internal rate of return worked out considering the annual benefits and apportioned cost of enroute water consumption with distributional and employment effect as 20% of annual benefits is given in Table 14.1.

**Table 14.1**  
**Internal rate of return(with distributional and employment effect)**

Life of project	: 100 years
Construction period	: 10 years
Apportioned cost of project	: Rs. 2754 crores
Annual benefits	: Rs. 1217 crores
Maintenance cost & operational cost (354+187)	: Rs. 541 crores
Distributional and employment effect (20% of annual benefit):	Rs. 243 crores

Unit: Rs. in Crores

Year	Cost	Benefit	Net benefit	Discounting factor		Present worth of net benefits	
				16%	18%	16%	18%
0	78	-	-78	1.000	1.000	- 78	- 78
1	73	-	-73	0.862	0.847	- 63	- 62
2	179	-	-179	0.743	0.718	-133	-129
3	193	-	-193	0.641	0.609	-124	-118
4	322	-	-322	0.552	0.516	-178	-166
5	380	-	-380	0.476	0.437	-181	-166
6	376	-	-376	0.410	0.370	-154	-139
7	391	-	-391	0.354	0.314	-138	-123
8	424	-	-424	0.305	0.266	-129	-113
9	338	-	-338	0.263	0.225	- 89	- 76
10	541	1460	919				
11	541	1460	919				
12	541	1460	919				
				1.643	1.253	1510	1152
Continued up to 109 <sup>th</sup> year							
109	541	1460	919				
	<b>Total</b>					<b>243</b>	<b>-18</b>

$$\text{Internal Rate of Return} = 16 + \{ 2 \times ( 243 / 261) \} = 17.86\%$$

The internal rate of return worked out considering the annual benefits and apportioned cost of enroute water consumption without distributional and employment effect is given in Table 14.2.

**Table 14.2**  
**Internal rate of return(with distributional and employment effect)**

Life of project : 100 years  
 Construction period : 10 years  
 Apportioned cost of project : Rs. 2754 crores  
 Annual benefits : Rs. 1217 crores  
 Maintenance cost & operational cost (354+187) : Rs. 541 crores

Unit: Rs. in Crores

	Cost	Benefit	Net benefit	Discounting factor		Present worth of net benefits	
				14%	16%	14%	16%
0	78	-	-78	1.000	1.000	- 78	- 78
1	73	-	-73	0.877	0.862	- 64	- 63
2	179	-	-179	0.769	0.743	-138	-133
3	193	-	-193	0.675	0.641	-130	-124
4	322	-	-322	0.592	0.552	-191	-178
5	380	-	-380	0.519	0.476	-197	-181
6	376	-	-376	0.456	0.410	-171	-154
7	391	-	-391	0.400	0.354	-156	-138
8	424	-	-424	0.351	0.305	-149	-129
9	338	-	-338	0.308	0.263	-104	- 89
10	541	1217	676				
11	541	1217	676				
12	541	1217	676				
				2.196	1.643	1484	1111
Continued up to 109 <sup>th</sup> year							
109	541	1217	676				
	<b>Total</b>					<b>106</b>	<b>-156</b>

Internal Rate of Return =  $14 + \{ 2 \times ( 106 / 262 ) \} = 14.81\%$