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FESIBILITY AND COST BENEFIT ANALYSIS OF INTERLINKING OF INDIAN RIVER

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Abstract –Presently, the rainfall in the country is irregular and due to these problems like drought and flood occurs in different parts of the globe. An proposal for effective management of droughts and floods at the national level; the Central Water Commission formulated National Perspective Plan (NPP) in the year, 1980 and developed a plan called "Interlinking of Rivers in India". The special feature of this project is to provide proper distribution of water by transferring water from surplus basin to deficit basin. About 30 interlinking of rivers are proposed on 38 Indian rivers under NPP plan. Godavari-Krishana (Polavaram-Vijayawada and Inchaampali-Nagarjunasagar) Links are the proposed rivers inter links. The main concern of the paper is to study feasibility and cost benefit analysis of Godavari-Krishana (Polavaram-Vijayawada and Inchampalli-Nagarjunsagar) Link project. The enrouted and command areas of the link canal covers in the State of Andhra Pradesh in India. The purpose of Godavari-Krishana link canal is to transfer the water from Godavari surplus River to Krishana deficit basin for benefit of farmer.

1. INTRODUCTION

Water is an important source and one of the most essential natural resources. Some researchers have calculated that by 2025 more than half of the world population will be facing water disaster and suggested that by 2030, in some developing regions of the world, water demand will overreach supply by 50%. Water resources are however restricted due to developmental schemes, industrialization, pollution, population, dropped rainfall levels, droughts, floods and other factors. In future more water will be needed to produce food because the Earth's population is forecast to rise to 9 billion by 2050. More than one-third of all counties face higher risks of water shortages by mid-century as a result of climate change in the developed countries which causes due to increasing pollution, population, industrialization, deforestation, urbanization and depleting natural resources. Climate change is affected by many things from natural processes or by human activities. Considering the future demands, conservation and management of water resources are very essential.

1.1 National Perspective Plan (NPP) for Water Resources Development: "Inter-Linking of River's" (ILR)

A National Perspective Plan (NPP) was developed in the year 1980, by Ministry of Water Resources and the Central Water Commission identified a number of large scale Inter- Basin Water Transfer Links "Inter-Linking of River's" (ILR) to increase the availability of water by transferring from surplus water basins to deficit basins in India and also to manage the problems of flood and drought disasters. River interlinking (ILR) is a water conservation method to reduce the non-uniform distribution of water and for providing solution to reduce floods and droughts in India. Practices should be needed for water resource management .Various practices have been made by the Indian Govt. for water management and conservation. To overcome the problems of flood and drought, National Water Development Agency (NWDA) has taken up massive project ILR which includes 30 major river link canals over 38 rivers throughout the country. National Perspective Plan

(NPP) consists of 2 parts Himalayan component and peninsular component.

2. LITERATURE REVIEW:

1. The economic cost and benefits of past irrigation speculation and also of the advance water transfers were the focus of this session. The study by Inocencio and McCornick (Paper 1), which is based on a global data set of 315 water development projects, included 38 projects from India that showed that although the economic performance of surface irrigation projects is growing globally, it has been reducing in India in recent years. However, large projects with many small schemes, projects with diversified cropping patterns, and projects that are farmer-managed and others managed by water user associations tend to have a higher economic performance.

2. The study by Anik Bhaduri et al. (Paper 2) shows groundwater irrigates more than 91% of the command area of the Godavari-Krishna Link at present. Thus, the additional net value added as economic benefits per additional cubic meter of proposed water transfer, is estimated to be low. However, a substantial part of the command area has declining water tables due to over abstraction of groundwater, and is presently a constraint for further diversification and economic growth in the command area. The proposed water transfers will assist more diversification to high-value annual crops and recharge the depleting groundwater tables in the command area.

3. METHODOLOGY

3.1.Links in the Study

This study evaluate financial benefits of 8 links in the peninsular component (Figure 1) that connect Mahanadi, Godavari, Pennar and Cauvery river basins. These paper included Links 2 and 4 connecting Godavari and Krishna. The full implementation of these links is largely dependent on water transfers between one another. Water diverts from Mahanadi to Godavari make possible water transfer from Godavari to Krishna that, in turn, make possible water transfer to Pennar, and then to Cauvery.

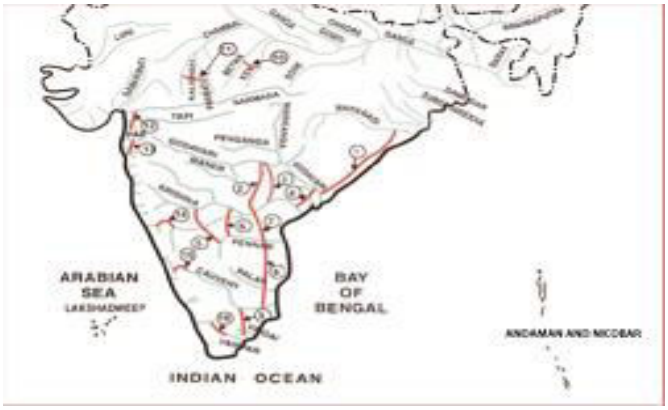

FIGURE NO 01:INTERLINKING OF RIVER

Godavari (Polavaram)-Krishna (Vijayawada) is the lowermost link from the Godavari Basin. The primary objective of this link is to make possible water diverts from Krishna to Pennar by way of substituting the water demand of Krishna below Vijayawada. This link also has major supply for irrigation, and domestic and industrial purposes en route from the canal command.

Godavari (Inchampalli)-Krishna (Nagarjunasagar) is the uppermost link originating from the Godavari Basin and, en route, this link also supplies water for irrigation, domestic and industrial purposes, and then transfers water from Krishna to the Pennar Basin at Nagarjunasagar.

Table 1. Details of river links in the study

Name of the link	Water transfer from the canal	Area of water receipt	Share of CCA	District of CCA
	Mm^3	Ha	Ha	
Godavari(ichampalli)-Krishna(Nagarjunasagar)	16426	Andhra_Pradesh	255264	Warangal Nalgonda Khammam
Godavari(polavram)-Krishna(Vijaywa	5325	Andhra Pradesh	139740	West godavari

da)				Krishna

Table 2. Total cost of supplying water to en-route commands of the links.

Name of the link	Total Cost Rs million	Year of cost level assessment	Financial exchange rate of US$1 in Rs	Capital cost in million US$ (in 2003-04 constant prices)
Godavari (Inchampalli)-Krishna (Nagarjunasagar)	27540	2003-04	46	599
Godavari (Polavaram)-Krishna (Vijayawada)	14839	1994-95	31.4	473

3.2.Methodology of Benefit Assessment

We estimate financial benefit-cost ratio (BCR) and internal rate of return (IRR) of water supply to en-route commands of these two links. The financial benefit-cost analysis indicates long-term financial ability of the proposed links. The analysis of social and economic benefits and costs assesses the effect of the project on the national or regional economy and society. Indeed, for a project to be economically and socially able, first it must be financially bearable, and second the social and economic security should exceed the cost over the life span of the project. . In our analysis, first we estimate the net present value (NPV) of each link, which is the present value of net incremental value-added benefit that the project will result over its lifetime. We also estimate the Internal Rate of Return (IRR) to assess the discount rate at which the project is a financially able undertake. The IRR is the discount rate at which the NPV equals to zero. A major part of the water transfers of the links is for irrigation. Of the given links, 74% of the water transfers to en-route command areas is for irrigation, and 11% for meeting domestic and industrial water needs (Table 1). Further, 15% is accounted for as transmission losses. Thus, a primary focus of this analysis is to estimate the net value-added benefits of crop production. This paper deals with the estimation of the benefits which are direct. In addition to the increases in crop production, water transfers also generate other benefits in the form of generation of hydropower, and water transfers to domestic and industrial sections. For these benefits, we dependent on the estimates in the feasibility reports (NWDA 2008). They also give the capital costs of link construction.

3.3.Benefits and Costs

All canals, except those in the Godavari (Inchampalli)-Krishna (Nagarjunasagar) Link, have positive net benefits. The decreased benefits in these canals are mainly due to minor differences in yields under irrigated and dry land areas at present and changes in proposed cropping patterns. The proposed cropping patterns in the Godavari (Inchampalli)-Krishna (Nagarjunasagar) link don't have rice or other Rice crops, which highly dominate the cropping patterns at present. Although increase in area under fruits and vegetables, with the highest net benefit/ha of different crops at present, the decreases in rice and other crops in the proposed cropping patterns have decreased the total NVACOUP

If the proposed cropping pattern is the same as that existing at present, then the NVACOUP increases from a negative 262/ha to a positive 2,093/ha. Another plan has the next best NVACOUP, i.e., $613/ha. This plan still generates decreased benefits in the Godavari (Inchampalli)-Krishna (Nagarjunasagar) Link, due to changes in cropping patterns. If the proposed cropping pattern is same as that of existing at present, then NVACOUP in this link changes from a negative $719/ha to a positive $411 /ha. Next plan has the lowest benefits, i.e., $279/ha. These three links of the eight links under this scenario have negative value-added benefits. This is again mainly due to differences in cropping patterns. If the proposed cropping pattern is similar to that existing at present, then NVACOUP of the Godavari (Inchampalli)-Krishna (Nagarjunasagar) Link will benefit from a negative $860/ha to a positive $134/ha.

This shows that the selection of a proper highly beneficial cropping pattern, even after irrigation transfers, should be a necessary condition for the links to make positive net benefits. Any extreme changes from the present cropping

patterns, especially from fruits/ vegetables and other highly beneficial crops would not yield any crop production benefits in the proposed command areas. At present, fruits, vegetables, rice and sugarcane provide the highest value-added net benefit per ha of all crops. For crop production to make positive net benefits, the proposed cropping patterns should include a higher percentage of highly beneficial crops. This is more important in the command areas, where yields of irrigated crops are not more than those of rain-fed crops.

Table 3. Existing and proposed cropping and irrigation patterns.

	No. and name of link. (Figure 1)	Net command area	Cropping and irrigation patterns (%).												
				Rice	Maize	Wheat	Other cereals	Pulses	Oil seeds	Sugarcane	Fruits and vegetables	Cotton	Other	Total
1	Mahanadi (Manibhadra) Godavari (Dowlaiswaram)	363,959	%CA-2000[1]	74	2	0	4	35	15	3	8	4	8	152
			%IA-2000[1]	47	0	0	1	2	1	3	3	1	0	57
			%CA (= %IA) - proposed	73	1	0	1	17	21	0	7	1	11	131
2	Godavari (Inchampalli)-Krishna (Nagarjunasagar)	255,264	%CA-2000[1]	42	4	0	6	17	12	0	5	12	21	119
			%IA-2000[1]	41	1	0	0	0	3	0	2	2	0	50
			%CA (= %IA) - proposed	0	15	0	28	17	22	0	10	8	0	100
3	Godavari (Inchampalli)-Krishna (Pulichintala)	467,589	%CA-2000[1]	66	4	0	2	20	4	6	5	12	21	140
			%IA-2000[1]	64	1	0	1	0	2	5	2	2	0	77
			%CA (= %IA) - proposed	0	0	0	0	15	45	0	30	10	0	100
4	Godavari (Polavaram)-Krishna (Vijayawada)	139,740	%CA-2000[2]	91	2	0	0	21	2	9	5	10	14	155
			%IA-2000[1]	91	2	0	0	0	1	8	2	2	0	106
			%CA (= %IA) - proposed	48	6	12	12	15	18	6	21	6	6	150

Table 4. Net value of crop output before and after water transfers

	Name and no. of link (Figure 1)	Net value of crop output per ha of gross cropped area ($/ha in 2000 prices)											
		Scenario I			Scenario II			Scenario III			Scenario IV		
		Before	After	Change	Before	After	Change	Before	After	Change	Before	After	Change
1	Mahanadi-Godavari	0	948	948	622	948	326	668	948	280	703	864	161
2	Godavari–Krishna (Nagarjunasagar)	0	972	972	1,233	972	-261	1,681	972	-709	1,677	870	-807
3	Godavari-Krishna (Pulichintala)	0	2,792	2,792	1,125	2,792	1,667	1,672	2,792	1,120	1,651	2,114	463
4	Godavari-Krishna (Vijayawada)	0	1,874	1,874	697	1,874	1,177	1,357	1,874	517	1,360	1,834	474

3.4.Net Present Value (NPV) & Internal Rate of Return (IRR)

A major part of the water deliveries is for irrigation. Of the two links in this study, 84% of the water transfer is for the irrigation sector, and 9 and 7% for domestic and industrial sectors, respectively. The contribution to net value-added benefits varies with existing extent of cropped and irrigated area. Plan I has the highest contribution of irrigation to net value-added benefits. This contribution decreases from 89 to 62% from plan I and IV.

If the command at present has only rain-fed cropping (plan 2), then all links, except the Godavari (Inchampalli)-Krishna (Nagarjunasagar) and Pamba-AchankvoilVaipar links are financially viable. The proposed cropping pattern is the major reason for financial no ability. If this link also has a high-value cropping pattern it can also be a financially able option. If the proposed cropping patters are similar to those existing now, the BCR and IRR of the Godavari (Inchampalli)-Krishna (Nagarjunasagar) Link under Scenario 2 increase between 2.5 and 20%.

A considerable part of the proposed command areas in all links already has some cropped area, and within that some irrigation. Scenarios III and IV correlate to these conditions. Under these scenarios, the IRR of all links, except the Godavari (Inchampalli)-Krishna (Nagarjunasagar), Krishna (Nagarjunasagar)-Pennar (Somasila) and Pamba-AchankvoilVaipar links, are higher than the discount rate and BCR is more than 1, indicating that they will be financially able investments with the projected benefit streams.

4. DISCUSSION AND CONCLUSIONS

We discuss a few issues here that arise from our cost benefit analysis or from lack of detailed information on the proposed links.

This paper focus on the description of proposed inter basin water transfer from Godavari basin to Krishana basin which is the part of peninsular region.

Our analysis indicates that if fresh water transfers only bring new lands into cultivation, the benefits are huge. Also, if water transfers are only used for irrigating the existing rainfed lands, the net value-added benefits could still exceed costs by several factors. However, in reality this is not the case. The proposed command areas for irrigation in many river links already have some cropped areas and, in some cases, irrigated areas too. The financial feasibility of these links depends on the proposed cropping patterns. They require irrigating considerably highly beneficial crops such as vegetables and fruits. The IRR and BCRs of links depend on many factors other than net value-added benefits of irrigation, domestic and industrial sectors in the en-route command areas and hydropower generation. These include hydrological factors related to groundwater recharge and benefits; environmental factors due to area

submergence and loss of river flows, and social factors due to displacement, resettlement and rehabilitation of project-affected people. They need to be considered for a proper financial and social benefit cost analysis framework.

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