INTERLINKING INDIAN RIVERS – ISSUES AND CHALLENGES

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ABSTRACT

Interlinking Indian Rivers for transfer of water from surplus to deficit areas has been proposed by a number of engineers in the past. But the recent Supreme Court directive to the Central Government has accelerated the process. Needs and benefits of the interlink as proposed by NWDA have been discussed after narrating briefly the historical developments. Various challenges and complicated issues to be resolved before execution of the project have been outlined. Before implementation of this costly project, it is necessary that there is a national debate amongst the professionals from different disciplines and opinion is sought from experts – both Indian and foreign.

INTRODUCTION

History shows that the economic prosperity of a country and its cultural wealth are closely related with water resources development. India is blessed with ample water resources, but its enormous population growth has resulted in poor per capita availability. It may be interesting to know the per capita water availability of India-vis-à-vis other countries in the World.

Per Capita Availability of Fresh Water Per Year (Cum / Per Person)

USSR	USA	Australia	China	India	Ethiopia
19500	9900	5000	2420	2214	250

Areas with availability less than 1000 cu.m. per capita per year is designated as scarcity areas. Although, the average figure (2,214) for India, as a whole, shows it is not deficit, but when we look at the spatial distribution of water from basin to basin, it is noticed that there is a great deal of non-uniformity principally due to extreme non-uniform rainfall distribution. **Table-1** gives the list of surplus and scarce basins in India.

Table 1 : Surplus and Scarce Basins in India

Surplus Basins		Scarce Basins	
Basins	**Per Capita Availability in Cum. Per Year**	**Basins**	**Per Capita Availability in Cum. Per Year**
Brahmaputra Basin	18,417	East flowing Rivers between Mahanadi and Pennar	919
Barak Basin	7,646	Cauvery	666
West flowing Rivers between Tadri and Kanyakumari	3,538	Pennar	648
West flowing Rivers between Tapi and Tadri	3,194	West flowing River Basin of Kutch and Saurashtra including Luni	631
Narmada	2,855		
Brahmani-Baitarni	2,696		
Mahanadi	2,546	East flowing River Basins between Pennar and Kanyakumari	383
Godavari	2,026		
Indus	1,757		

Ganga	1,473		

The scarce basins are often subjected to droughts and the surplus basins are frequently devasted by floods. The flood and the drought occur almost simultaneously leading to loss of human life and animals, damage to crops and properties, disruption of communication and so many other miseries. Annual average flood damage has increased from Rs. 52 Crores in 1952 to Rs. 5,846 Crore in 1998. Flood prone area in India is about 40 mha out of which 7.5 mha gets flood affected almost every year. Droughts, on the other hand, result in loss of soil moisture leading to loss of crops and the people are deprived of even the basic need of drinking water. The flood-drought-flood syndrome in India, occurring almost regularly, is causing disaster to the nation.

NECESSITY, OBJECTIVES AND BENEFITS OF INTERLINKING

As already stated, the primary purpose of interlinking of Indian rivers is to transfer water from the surplus basins to the deficit (scarce) basins for optimal use of national water resources and its equitable distribution amongst the States.

By 2025 our total demand of water of 1050 Km^3 (Food – 770, Domestic Water Supply - 52, Industrial Use – 120, Power – 71, Miscellaneous e.g. Salinity, Pollution Control, Navigation, Recreation etc. – 37) is going to be more or less equal to utilizable water resources of the country estimated as 1100 Km^3 (700 Km^3 from surface water and about 400 Km^3 from ground water). Acute scarcity of water supply will arise after 2025 unless we control the growth of population and demand. Various benefits from the interlinking Projects are irrigation, hydropower, municipal and industrial water supply, inland water transport, flood and drought protection, recreation etc. There will be a massive employment generation, especially in rural areas.

HISTORICAL DEVELOPMENT

The idea of linking Indian rivers is not new. In Mughal period, Western Yamuna Canal and Agra Canal were built for transferring water from Himalayas to Punjab, U.P. and Rajasthan. In 1839, Sir Arthur Cotton built the unique Ganga canal to bring Himalayan Ganga water to the agricultural belt in western U.P. now in Uttaranchal. Kurnool-Cuddapah link Canal and Periyar-Vaigai link canals were built in 1870 and 1896 respectively. In the last century, India has built a large number of Projects for water transfer eg. Rajasthan Canal, Ravi-Beas-Sutlej Link, Sutlej -Yamuna Link, Telegu-Ganga Project, Narmada Canal, Tista-Mahanda Links etc.

Captain Dastur (1974) proposed garland Canals & Himalayan Canals – 4200 Km. long, 300 m wide for bringing Ganga-Brahmaputra basin surplus water to the deficit areas in south and west. The Project Proposal was found to be unsound and technically not feasible by experts.

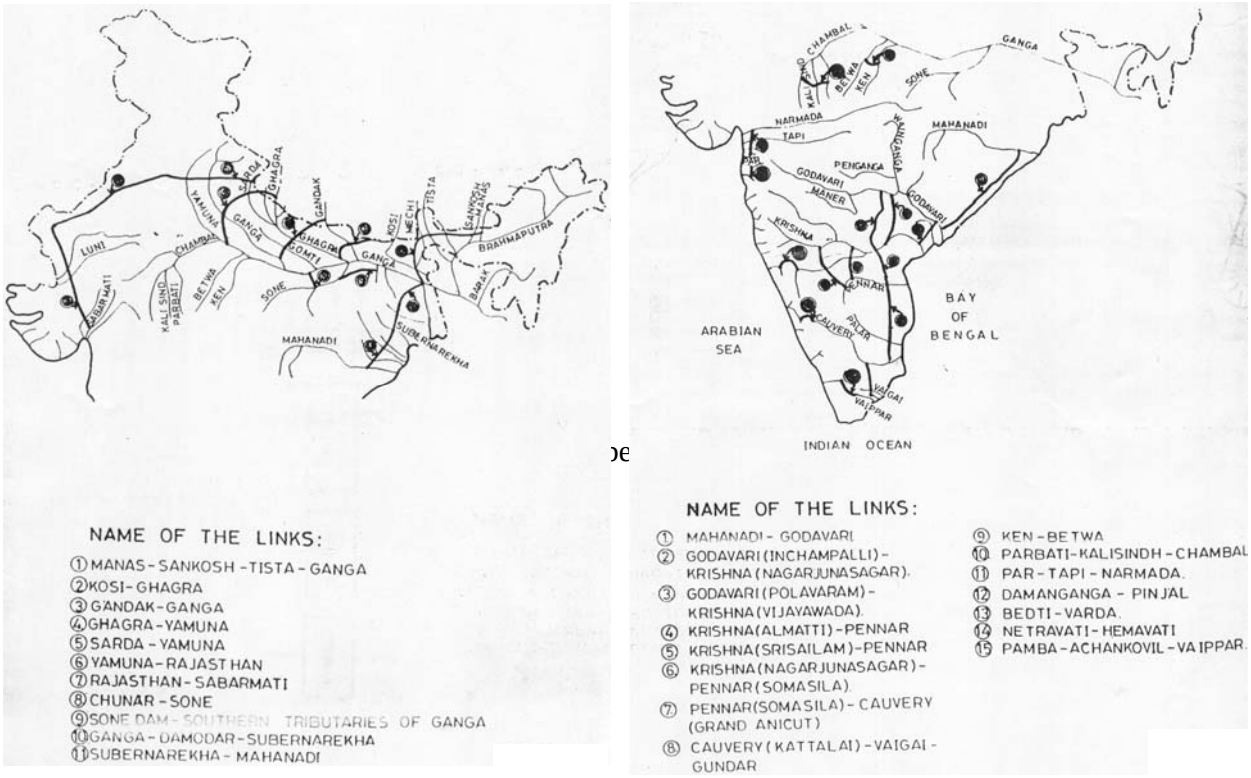
National Water Grid (1972). Proposed by Dr. K.L. Rao envisaged pumping surplus water of Ganga-Brahmputra to South linking Ganga with Cauvery. The Proposal was not accepted, as it was not technically feasible and economically not viable and it required large scale pumping up to 540 m head. It also did not provide any flood mitigation for the north and north-east.

Similar water transfer Projects have been successfully implemented in Countries like USA, Canada, USSR, China, Iran etc.

NATIONAL PERSPECTIVE

In 1980, Ministry of Water Resources (MOWR), formerly known as Ministry of Irrigation and Power, formulated a National Perspective for National Water Development and interlinking of Indian rivers. National Water Development Agency (NWDA) was established in 1982 to examine in depth the link proposals planned by the MOWR.

The National Perspective Plan (**Fig. 1)** formulated by NWDA and now accepted by MOWR, Govt. of India, comprises of Himalayan River Component and Peninsular River Components



(a) **(b)**

Fig. 1: Showing the National Perspective Plan of Interlinking of Indian Rivers (a) Himalayan Component (b) Penninsular Component

Himalayan Rivers Component

As shown in **Fig. 1**, the Himalayan River Component envisages construction of storages on the main Ganga and the Brahmaputra rivers and their principal tributaries in India and Nepal so as to conserve monsoon flows for flood control, hydropower generation and irrigation. Inter-linking canal systems will be provided to transfer surplus flows of the Kosi, Gandak and Ghagra to the west. In addition, Brahmaputra-Ganga Link will be constructed for augmenting dry weather flows of the Ganga. Surplus flows available on account of inter-linking of Ganga and Yamuna are proposed to be transferred to the drought areas of Haryana, Rajasthan and Gujarat. The scheme will benefit not only parts of India but also our neighbours – Nepal and Bangladesh. Planning and implementation of this scheme will have to include Nepal, Bhutan and Bangladesh as they also are part of the same hydrological unit.

Peninsular River Component

Amongst the Peninsular Rivers, the Mahanadi and Godavari have sizeable surpluses after meeting the existing and projected needs of the State within these basins. It is, therefore, proposed to provide terminal storages on Mahanadi and Godavari rivers to divert surplus flows

of Mahanadi to the Godavari system and to further transfer surplus from the Godavari Systems to water short rivers namely, Krishna, Pennar and Cauvery. The link from Mahanadi to Godavari will be along the east coast and will not involve any lift. The link between Godavari and Krishna will be partly by gravity and partly by lift of the order of 120 m. The transfer of waters by successive exchange would enable irrigation in drought areas of Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. It also envisages interlinking of west flowing rivers, benefitting states like Tamil Nadu, Karnataka, Gujarat, M.P. and Rajasthan.

NATIONAL COMMISSION REPORT

The National Commission on Integrated Water Resources Development and Management (NCIWRDM) has projected the improved irrigation efficiencies of the surface and groundwater irrigation system for the future. The Commission also assessed the returns from the various uses, which would flow into the hydrologic system and thus make themselves available for reuse.

The Commission recognized that inter-basin transfer of water is an outstandingly large complex programme of water management. Studies have to be done with the help of computer simulation models and systems analysis. They concluded that with improved management and inbasin development, there would be no major water scarcity problem except a few isolated pockets up to the year 2050.

CHALLENGES OF INTERLINKING INDIAN RIVERS

The Interlinking Project undoubtedly offers a great challenge to meet the future developmental needs summarized below:

Providing food for 280 crore of people by 2050 from present 205 M.Tons to 450 M Tons.

Supply of irrigation water to additional area of 35 MHA (22 MHA from Himalayan Component and 13 Mha from Peninsular Component).

Generation of additional 34,000 mw hydropower for peaking purpose. 30,000 MW from storages in Himalayan areas including Nepal and Bhutan and 4,000 MW from storages in Peninsular Component.

Clean drinking water and water for industrial use amounting to 90 and 64.8 billion Cum. respectively

Navigation for inland water transport to ease pressure on railways and roads by introducing inland navigation – through National Waterways 1,2,3.

Flood and drought protection are the main challenge as to how can the water causing devastation and running waste into the sea (especially from Brahmaputra, Ganga and Mahanadi Basin) can be diverted for productive use in the drought prone areas in the South and the West, so that the country gets rid of the current flood-drought-flood syndrome causing frequent disaster.

Lack of employment opportunities in rural areas, compelling people to migrate to cities in search of jobs, is causing rapid deterioration of our national economy. Villages are getting poorer and cities are getting congested – resulting in unprecedented pollution of air, water and soil in the cities. Only way to reverse this unhealthy trend is to create more job opportunities in rural areas through agricultural and agro industry based projects. As the links and storages are going to be mostly in rural areas, it is going to create much more employment for the rural youths.

Dry weather flow augmentation due to transfer of surplus water through successive exchange of river water will help in pollution control, navigation, fisheries, growth of forests, protection of wild life etc. Any water body either in storages or in flowing links will be very attractive and offer recreational opportunities for both rural and urban people.

Challenges of Construction, Operation and Maintenance

- Construction of 30 links (14 under Himalayan and 16 under Peninsular Component) linking 39 rivers.
- Total length of link Canals – 9600 Km. longest link (Sarda-Yamuna-Rajasthan) 1068 Km carrying 1092 cusec flow.
- Maximum design discharge capacity – 3725 M^3/S (1,31,625 Cusec) for the 114 Km link between Manas and Sankosh Rivers.
- Construction of 36 storage dams requiring 56 million tons cement and 2 million tons of steel.
- Construction of massive cross-drainages/tunnels required to pass the links over existing river en-route or mountains.
- Pumping large quantum of water from Godavari to Krishna basin up to a maximum head of
  120 m.
- Operation of reservoirs and canals in accordance with inflow and demand from different consumers in different states. A system math model will be required for management of water.
- Maintenance of the massive networks of canals and hydraulic structures.

VARIOUS ISSUES REGARDING INTERBASIN WATER TRANSFER

Issues Regarding Broad Objectives

- Criteria to define surplus and deficit areas keeping in view the existing and future requirements with population and industrial growth and most importantly equity in economic growth of all Indian States especially east and north-east states of India, where large quantum of surplus water is available.
- Massive transport of water (80% of total) is required for irrigation only. One school of thought is India must be self-sufficient in food to avoid massive import. Other school of thought prescribes food production depending on water availability by changing cropping pattern. NCIWRDM found that up to 2050 there is no overall shortage of water – although regional disparity will be there according to rainfall. Other alternatives of demand and supply management should also be examined. Whether equity in water utilization across the country is a desirable goal to be addressed or whether the water deficit basins of India need to reconcile themselves to the situation importing only the quantum of water required to meet the basic need. Is it necessary that all states should produce enough food to feed its people or it can be procured from states with abundant potential?
- Whether providing livelihood to the rural population in the water-deficit areas of India through irrigated agriculture should be considered as a desirable objective or whether the natural forces of adjustment through migration etc should be considered suitable for enabling these sections to achieve better economic status.
- What is the extent of national responsibility in providing water to the people for (a) sustenance of life and minimum hygiene and (b) livelihood. What minimum volume of water is required to be transported, so that the channel / storage and duct size can be

reduced accordingly. Is it possible to assure that this water can be supplied by intrabasin transfer to avoid long distance links to transfer large volume of water for agriculture.

Legal Issues

- Water is a state subject under entry 17 of State List II subject to entry 56 of Central List I. It is to be brought under concurrent List III by amendment of Indian Constitution.
- Is it possible to plan and execute inter-basin transfers entirely through consensus amongst all co-basin states of the donor basins through which the links pass and the recipient basins, or is a legislation by the Central Government necessary considering the impracticability of reaching such an agreement against a large number of states.
- Should water like air, space and solar energy be considered as a negative commodity in which no ownership rights can exist or should an ownership of the co-basin states conceded, thus allowing them to trade water with the recipient states.

Issues Pertaining to Proper Planning and Management as Alternative to Interbasin Transfer

- Can better in-basin water planning and management be a substitute to inter-basin transfers? For example, various possible demand and supply management are improved irrigation efficiency (Drip, Sprinkler Irrigation), change in cropping pattern, evaporation/seepage control, recycling of industrial and domestic wastewater, improved on-farm management of irrigation water, desalination of seawater, recharging (artificial and natural), cloud seeding, etc. Present performance of many a major and medium irrigation projects is poor causing not only loss of water but serious problems of water logging, salinity and alkalinity affecting about 36 mha of agricultural land in India. Even a marginal increase in irrigation efficiency will help in additional irrigation and no major water transfer shall be required.
- Does the concept of "basin as a natural hydrologic unit for planning and management of water" need to be modified in view of the national objectives related to equity and the possibilities of inter-basin integration.

Issues about Social & Environmental Impacts

- Big storages and link canals will need huge areas of land resulting in submergence and dislocation of population. For example, in the Peninsular component of the Project only, following three major reservoirs will cause problems as detailed below:-

Name of proposed Reservoirs	Loss of Forest (Ha.)	Loss of Cultivated land (Ha.)	Removal of Population (Nos.)
Mani Bhadra	9,825	9,500	79,000
Ichampalli	21,734	37,782	1,00,080
Pollavaram	3,857	43,138	1,09,082

- Possibility of adverse impacts due to introduction of undesirable and alien flora and fauna from donor basins to recipient basins through inter-basin transfer.
- Possible adverse impact on fisheries and other aquatic eco-systems, increased salinity and pollution due to water transfer and what minimum dry weather flow must be guaranteed to avoid adverse environmental impacts.

- What will be the morphologic impact of water transfer on the river basins?

Economic Issues

- In the conventional practice for any major project, benefit-cost analysis is a recognized tool for decision-making regarding viability and feasibility of the project. With the same type of analysis, the projects may not be justified.
- Equity in water utilization, regional redistribution of economic benefits and the need to provide in situ employment in water short rural areas are likely to be important economic objectives of inter-basin transfers. How can the present methods of economic analysis which mainly address the b/c ratio (more than unity) be modified to meet these objectives.

Issues in Financial Management

- Estimated cost of the project is 5,60,000 crores at 2000 price index. With time overrun and inflation, the cost will increase several times more. Estimated time of completion is 35 years at present, but may be much more due to so many obstacles government has to face. Can India afford to spend such a large amount at the present state of national economy or should we spend it in such important sectors of public life like health, education, housing, infrastructures etc.
- Can the large financial requirements of the proposals be met from sources other than public finance and soft loans from international agencies? How can the cost of operation and maintenance, administration and direction, depreciation, interest on capital etc be realized from the project beneficiaries? Experience from major and medium projects is discouraging in this regard. These projects have fast been a national liability instead of national assets. Government, on the one hand is handing over all public property to the private sector and again trying to invest in the public sector.
- Can the water transferred through these links be priced considerably higher than the current water rate through in-basin developments. Even if priced more, what about the realization of rates, which in the case of existing major and medium irrigation projects have sharply fallen over years due to political and other reasons.
- What is the scope of privatization in regard to these proposals?

Issues in Implementation

- The various possible steps for implementing these proposals are stated in NWDA documents. Should these (pre-feasibility and feasibility) reports be made public for transparency? The appropriateness of the steps needs to be discussed and possible alterations or modifications need to be worked out.
- For a national debate on the subject, government should make its plan public for being examined by Engineers, Geographers, Environmentalists, Economists, Sociologists, Agronomists, River Morphologists, and Financial Analysts. The plan should also be examined by experts from India and abroad for its soundness so that the scarce resources of the country can be utilized in a judicious manner for an all round development of the country.

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