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The Interlinking of Indian Rivers: Questions on the Scientific, Economic and Environmental Dimensions of the Proposal

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4.1 BACKGROUND

The availability of freshwater at various spots on the Earth's terrestrial surface will continue to be determined by the hydrological cycle, till such a time when technologies like desalination of seawater is practiced on a reasonably extended scale. The rapid growth in the demand of freshwater driven by growth in the global population and of the economies, has led to this natural resource becoming scarce in many parts of the world. As a result, the ratio between the number of people and the available water resource is worsening day by day. By 2020, the global population is projected to be in the range of 7.3 to 7.9 billion, which is 50 per cent larger than that in 1990 (UN, 2006). Because of this rapidly growing human population, the world may see more than a six-fold increase in the number of people living in conditions of water stress - from 470 million today to 3 billion in 2025 (Postel, 1999).

In the global picture, India is identified as a country where water scarcity is expected to grow considerably in the coming decades. Further, drought conditions resulting from climatic variability cause considerable human suffering in many parts of the country, in the form of scarcity of water for both satisfaction of domestic needs and for crop protection. The project for interlinking of rivers of India emanates from a desire of the political leadership of the country to bring a permanent solution to the negative impacts of drought and water shortages in these parts (IWRS, 1996). Such a desire is, without question, worthy of applause because satisfaction of domestic water needs should be considered as a human right and be given the top priority.

The interlinking project is based on the National Perspective for Water Development as framed by the Ministry of Water Resources in August 1980. The National Water Development Agency (NWDA) was set up in 1982 to carry out detailed studies in the context of the National Perspective. In late 2002, the proposals of the NWDA started to receive great media attention after the Supreme Court of India passed an order in a Public Interest Litigation, that the government should complete the construction of the interlinking project by 2016. In response to this order of the Supreme Court, the Government of India appointed a Task Force headed by Mr. Suresh Prabhu. The same order of the apex court made the professionals interested in sustainable development of water resources in India (see Chapter 3), to wake up to the realities and examine the techno-economic feasibility of this project, which is perceived as the largest construction project in the world. It is estimated that only the construction cost of the project may very well be of the order of US$ 125 to 200 billion. One needs to add to this amount, the social, environmental as well as the operational costs. Indeed, any country, whether developing or developed, large or small, would surely take up diverse, strict and open assessments of the techno-economic feasibility before investing in a project, the cost of which is of the order of its annual GDP.

Unfortunately, contrary to the above professional expectation, no technical details of the interlinking project are available in the public domain. Excepting a few lines drawn on the map of the country to indicate the rough location of the dams and the canals, nothing is available to the open professional world to verify the justifiability and efficacy of the various official claims of benefits from the project, which are also not substantiated by any data. On 8 February 2003, in an open public debate held in New Delhi, organized for discussing the interlinking project, Mr. Prabhu had appreciated the public request for putting all technical information on the river interlinking project in the public domain, through the web site of the National Water Development Agency (NWDA). Feasibility Reports of 14 Peninsular components are available on but not the technical details.

In this background of the total non-availability of the technical details of the project for interlinking of Indian rivers, it is not possible to take any clear position on the technical feasibility or otherwise of the claims made by NWDA. Yet, it is not easy to turn a blind eye to a proposal for such a large investment by the nation, which can also drastically alter the hydrographic picture of the country.

As a result, in this chapter, a limited attempt has been made to analyze some crucial policy issues related to the project on interlinking of rivers in India. In making this analysis, the ongoing shift in the paradigm that is going on in the field of water resource management the world over has been kept in mind. This process is of special significance in the case of India, characterized by serious spatial and temporal variations in precipitation, as has been stressed by Bandyopadhyay and Mallik (2003). Considering the reality that the making of water policy in India has so far been guided by a conceptual framework, characteristic of reductionist engineering, the arguments presented in this paper are also indicative of the major generic conceptual problems in water resource management in India.

4.1.1 DECISION TO INTERLINK THE RIVERS OF INDIA

Human societies have always tried to expand the spatial extent of availability of water by the diversion of streams or rivers. The idea of drawing water from the rivers in eastern India, which have larger runoff, in comparison to certain places in the peninsular region, where the precipitation levels are much lower, can be seen as an extension of that practice. The idea of linking the rivers of India has its roots in the thoughts of Visveswarya, the stalwart engineer of yesteryears. The idea was further extended by Dr K.L. Rao, the legendary irrigation minister of India (Rao, 1975), and Captain Dastur, a pilot. Dr Rao and Captain Dastur thought of the Ganga-Cauvery Link Canal and the Garland Canals, respectively. Dr Rao's ideas were based on his identification of some river basins in the country as 'surplus', and some others as 'deficit', and seeking solution to the problem of water scarcity in many parts of the country by connecting them through a "National Water Grid" (NCIWRDP, 1999a: pp.179-180). Captain Dastur proposed 'an impressionistic scheme which became known as Garland Canal scheme' to feed Himalayan waters to the peninsular parts of the country by means of pipelines (for details of this proposal, see Chapter 1 and 3). The National Commission for Integrated Water Resource Development Plan (NCIWRDP) found this scheme prima facie impractical. Both the proposals were examined and were not found worthy of being followed up.

The recent revival of the idea of interlinking of 'surplus' basins with 'deficit' basins has been the result of work done by the National Water Development Agency (NWDA) and bears a conceptual continuity with Dr Rao's proposal. However, the recent hurry of the government in the execution of the project is rooted in the order of 31 October 2002 by the Supreme Court of India, issued in connection with a Public Interest Litigation (Writ Petition (Civil) No: 512/2002). Commenting on the long time period of 43 years as identified by the NCIWRDP for the completion of the proposed interlinking project, the Supreme Court ordered that:

> *It is difficult to appreciate that in this country with all the resources available to it, there will be a further delay of 43 years for completion of the project to which no State has objection and whose necessity and desirability is recognized and acknowledged by the Union of India……We do expect that the programme drawn up would try and ensure that the link projects are completed within a reasonable time of not more than ten years.*

The recent wider interest in the NWDA proposals for interlinking of rivers needs to be seen in the background of the assessment by the Central Water Commission (CWC) of the two earlier proposals by Dr Rao and Captain Dastur. It had mentioned specifically that Dr Rao's proposal was "grossly under-estimated" and that the scheme "will also have no flood control benefits". Therefore the "proposal was not pursued as such". Regarding the proposal by Captain Dastur, the CWC and the associated experts were of the opinion that, "the proposal was technically unsound and economically prohibitive" (MoWR, 2002). Given the fact that the present proposal on interlinking supports the general idea of transferring water from 'surplus' to deficit basins, these projects also need to be examined through a rigorous and open professional assessment. It is in this background that the present analysis is being undertaken.

4.2 WATER RESOURCES IN INDIA AND THE LOGIC FOR THE INTERLINKING PROJECT

The country receives about 4,000 km^3 of water as precipitation annually (NCIWRDP, 1999a: p.23). However, unlike the precipitation patterns in the temperate regions of the world, precipitation in India is characterized by acute variations in both space and time. A large part of the total precipitation on the country is received in the Himalayan catchments of the Ganges-Brahmaputra-Meghna (GBM) basin (Figure 4.1). The distribution of precipitation over India is predominantly governed by the Monsoon, as a result of which the northeastern quarter of the country receives substantially larger precipitation, in comparison with the northwestern, western and southern parts. For example, in the eastern parts of the GBM basin, Cherrapunji receives an annual precipitation of about 11,000 mm, while Ajmer just outside the western boundary of the GBM basin may receive only 200 mm of annual rainfall. Though the west flowing rivers draining the western aspect of the Western Ghats have substantial runoff, the spatial scope for their wider utilization is limited. For assessing the water resources of India, the area of the country has been divided in 24 river-basins in which the west flowing rivers from the Western Ghats have all been clubbed as one.

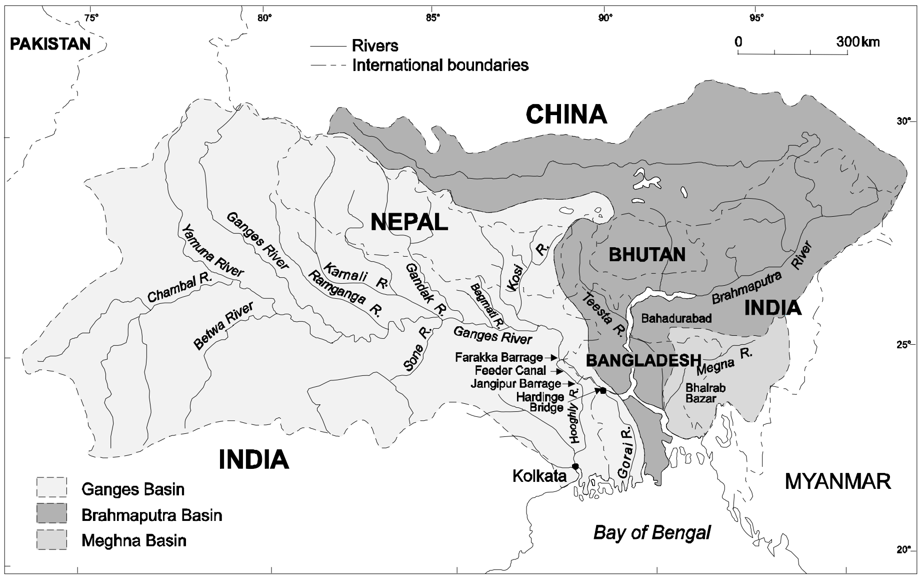

Fig. 4.1 The Ganges basin and Farakka Barrage. Boundaries of the Brahmaputra and Meghna basins are also shown (Mirza, 2003).

The spatial and temporal variations in the precipitation over India often lead to human sufferings through scarcity of drinking water, inundation of agricultural lands, failure of crops, etc. There is no doubt that the satisfaction of the domestic needs of water should be seen as a basic human right and should receive the highest priority in our water policy. Further, protection of rainfed farm lands from variations in the climate, especially long spells of droughts, should be an equally important and high priority objective in India's water policy. The logic behind the interlinking project is based on the view that there is 'surplus' water in some river basins or sub-basins, which, if transferred to the other 'deficit' river basins, would provide a permanent solution to the problem of human sufferings from droughts and water scarcity. On the face of it, this is convincing enough logic for undertaking the project for interlinking of India's rivers.

On the basis of the National Perspective on water resource development, the interlinking project has two components - the Himalayan and the Peninsular. The Himalayan component includes construction of storage dams on the main tributaries of Ganga and Brahmaputra to transfer 'surplus' water to the west. The Peninsular component involves connecting rivers like Godavari and Mahanadi that have 'surplus' water with rivers like Krishna and Cauvery. Thirty link canals are envisaged, of which 14 will be in the Himalayan component and 16 in the Peninsular component (Figure 4.2). On the whole, the interlinking project is aimed at providing large scale human-induced connectivity for water flows in almost all parts of India. This, indeed, is the largest construction project thought of in the world as of now.

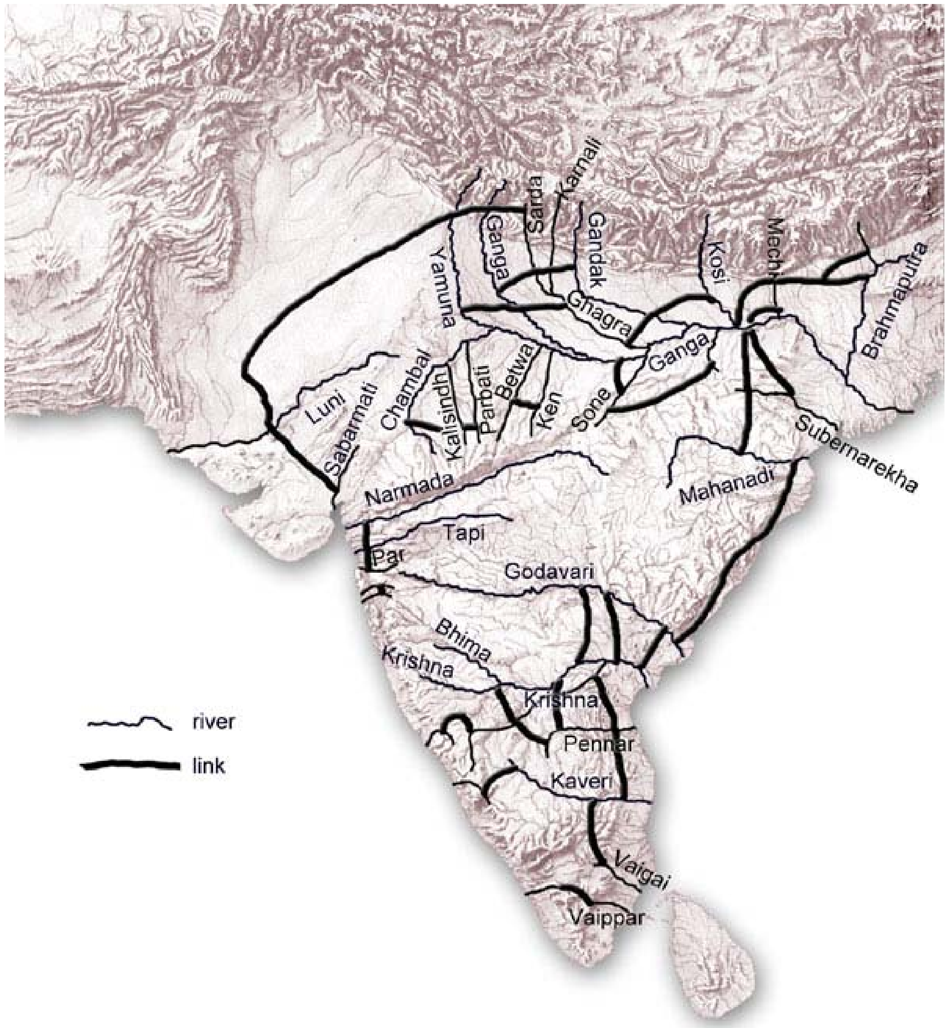

Fig. 4.2 Links Envisaged as per the National Perspective Plan.

4.2.1 CHANGING PARADIGM FOR WATER MANAGEMENT

Over the past few years, concepts of water resource management all over the world have been undergoing a clear paradigm shift and the need for new water professionals is being heard from the highest international levels (Cosgrove and Rijsberman, 2000; Matsura, 2003). It is indeed expected that the project on the interlinking of India's rivers, which is also the largest water related project of the world, would base itself on the emerging new knowledge base, rather than the traditional one, which is beating a retreat each passing day. However, such a professional analysis of the interlinking project is not possible, since the necessary detailed technical information on the project has not been made openly available. On that account, the very limited information that one can gather about the project from open sources, does not even permit a good understanding of it, leave apart an examination of the veracity of the proposed links and appurtenant structures. This leaves one with the only option of examining the conceptual basis and policy approach for the project.

The present estimates available for the construction cost alone of the interlinking project hovers around an astronomical figure of US$ 125 to 200 billion. It needs to be stressed here that no pre-feasibility or feasibility reports have been made available in the public domain for an open professional assessment of the accuracy of this estimate. The cost estimates may turn out to be far higher, if, as and when the detailed project reports are prepared. The period of implementation for this gigantic project, as given in the Supreme Court order, is a mere 10 years from now. However, there are various opinions on the practicability of this time limit. On this point, Verghese (2002), an eminent writer on water resources of India has commented that:

> *The notion that this 'project' can be 'sanctioned' and implemented in a decade is simplistic in the extreme. …Interlinking of rivers is a highly complex process with huge backward and forward and inter-sectoral linkages that may be accomplished incrementally over the next 50 to 100 years.*

Further, with the total pending cost for incomplete major, medium and minor irrigation projects coming to R. 1.5 lakh crores[1] (Jain, 2003) the logic behind taking up another such a major projects does not seem convincing. Iyer (2002) further points out that, since plan outlays are barely adequate even for the completion of on-going projects, there seems to be little likelihood of finding massive resources for a major river linking undertaking. What is equally surprising is that Mr. Bharat Singh, who chaired the 'Working Group on Inter-basin Transfer of Water' of the Ministry of Water Resources (NCIWRDP, 1999b), takes the position that, "...there really seems to be no convincing argument or vital national interest which can justify taking up the river linking project in its entirety" (Singh B., 2003). In this way, it is apparent that there are many important reasons for exploring the logical basis and policy framework for this very costly project.

4.2.2 THE CONCEPT OF 'SURPLUS' RIVER BASINS

The starting point for the interlinking project is the subjective concept of the availability of 'surplus' flows in some river basins. In the conceptual framework of reductionist engineering it will be a win-win situation if one can simply utilize "...the water otherwise going to waste in the surplus river basins" (NCIWRDP, 1999a: p.181). The official methodology for working out whether a basin has any 'surplus' or not, is based on an unpublished paper by Mohile *et al.* (1998). In this approach, the overall surface water availability in a basin/sub-basin is assessed both at 75 per cent and 50 per cent dependability's. These are compared with the estimated water requirements for various uses, viz; irrigation, domestic supplies, industrial requirements, hydropower and salinity control, say by 2025. The process for the assessment of irrigation, domestic and industrial needs are given in some details in the Report of the Working Group on Inter-basin Transfer of Water (NCIWRDP, 1999b: p.30). Interestingly, there is no information in this Report on how the assessment of the water need for salinity control or other water needs for the continuation of diverse ecosystems services provided by water in the various parts of the basin, would be made.

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[1] one lakh = 10^5; ten lakh = one million = 10^6; one crore = 10 million = 10^7

This is quite expected, because from the viewpoint of reductionist engineering it is not possible to recognize and assess the diverse ecosystem services performed by water in all parts of the river basin, from the moment it gets precipitated to the moment it is drained out into the sea. The arithmetical hydrology of reductionist water resource engineering sees water purely from the point of storage, transfer and allocation for supplies. It is, thus, unable to recognize that in all river basins, from a holistic perspective, one does not see any 'surplus' water, because every drop performs some ecological service all the time. The ecosystems evolve by making optimal use of all the water available. If a decision is taken to move some amount of water away from a basin, a proportional damage will be done to the ecosystem, depending on the service provided by that amount of water. Thus, no amount of water in a river basin can be taken out without causing some damage to the ecosystem services. In other words, there is no 'free' 'surplus' water in a basin that can be taken away without a price.

In the narrow perspective of arithmetical hydrology, such perceptions are absent. Hence, there is little difficulty in identifying river basins as 'surplus' and taking out, that 'surplus' water from the basin without seeing any harm in such an act (Singh R., 2003a). It is so, because, otherwise, the reductionist view concludes that 'surplus' water as being lost or wasted, as it flows down to the sea. Prabhu (2003) makes a more clear statement in this regard when he claims that "...the (interlinking) project is about rationalization of water that is lost to the sea".

However, when the reductionist vision of arithmetic hydrology is replaced by the holistic perspective of ecohydrology, the outflow of a river to the sea is no more seen as a 'loss', nor flood water is seen as a harmful 'surplus'. In the ecohydrological perspective, there is always some cost, known, unknown or perceived, associated with the transfer of water from one basin to another, whether in small amounts or large. For example, flood water in eastern India may appear to be a harmful surplus from the viewpoint of arithmetical hydrology. Accordingly, the transfer of water from a 'surplus' basin in eastern India to a drier one in another part of the country represents something of a win-win situation. On the other hand, from the holistic ecohydrological viewpoint, flood water is seen as the source of free minerals for the land, free recharge for the groundwater resources, free medium for the growth and transportation of fish and conservation of biological diversity, free bumper harvest for the humans, etc. At the macro-level, the flood flows flush the silt from the riverbeds in the plains to the delta areas free of cost. They support the rich fisheries in the estuaries and keep away the saline incursion from the sea. When flood water is diverted away from a basin, the reductionist hydrology sees it as a 'harmless' transfer, which has all gains and no losses. From an ecohydrological perspective such transfer of flows affects the processes of many ecosystem services. If any view of the natural ecosystem is unable to recognize and accept the diverse ecosystems services water performs or is incapable of understanding their scientific status, it is likely that the narrow point of view would generate the false concept of 'surplus' flows in riparian ecosystems or lakes.

Thus, from a holistic viewpoint, there are always costs, big or small, associated with transfer of water from one basin to another, which results in loss to many ecosystem services. One has only to look at the state of the ecology and economy of the Aral Sea today, to find what economic damage can be done by water transfer projects that are not ecologically informed. As a World Bank Report (1992) says:

> *This ecological disaster is the consequence of excessive extraction of water for irrigation from the Amu Darya and Syr Darya rivers, which feed the Aral Sea. Total river runoff into the sea fell from an average 55 cubic kilometers a year in the 1950s to zero in the early 1980s.… … If current trends continue unchecked, the sea will eventually shrink to a saline lake one-sixth of its 1960 size.*

As the paradigmatic transformation in water resource management advances, the old practice of seeing 'surplus' water is also retreating. For example, the Murray-Darling Basin Commission in Australia is seriously contemplating on extending financial encouragement to farmers for saving on their allocation of irrigation water and to allow the savings to remain instream. In another instance, Chile's National Water Code of 1981 established a system of water rights that are transferable and independent of land use and ownership. The most frequent transaction in Chile's water markets is the "renting" of water between neighbouring farmers with different water requirements (Gazmuri, 1992). In the USA today, the country which started the old global trend of building large dams, 'there is a new trend to take out or decommission dams that either no longer serve a useful purpose or have caused such egregious ecological impacts as to warrant removal. Nearly 500 dams in the USA and elsewhere have already been removed and the movement towards river restoration is accelerating' (Gleick, 2000).

The expression of interest in the policy framework and technical details of the interlinking project is not an expression of the opinion that rivers should never be linked. The concern relates to the justifiability or otherwise of such a large national investment. In this regard, even a memorandum has been sent by a group of concerned citizens to the Prime Minister on 22 April 2003, asking for a more comprehensive assessment of the river link proposal before it proceeds further. In that memorandum, it has been suggested that, "Where a river linking or long-distance water transfer proposal seems *prima facie* a good option, (it will be good to) get a thorough, professional feasibility report prepared in a fully interdisciplinary manner, internalizing not merely the techno-economic but also the environmental, human, social, equity, 'gender' and other relevant aspects and concerns and put it through a comprehensive, interdisciplinary, rigorous and stringent process of detailed examination, appraisal and approval". The stand taken here is that if some rivers need to be linked for some proven and unavoidable reasons, it should be undertaken with full recognition of the serious ecological damages that may be caused by the interlinking, and that the benefits would far outweigh these costs. The rapid improvements in the field of ecological economics are making valuation of such damages increasingly accurate. By adopting a holistic approach, projects like the interlinking of rivers can be exposed to a more comprehensive and realistic assessment, thus offering a more mature tool for decision making. Unfortunately, in the absence of any detailed technical information on the proposed interlinking project, the type and extent of ecological damage to be caused by its implementation can not be ascertained or assessed fully.

On the basis of such scanty technical details what can, however, be undertaken, is a realistic review of the knowledge base and policy framework for the project and a general examination whether it offers the most cost-effective option for generating the claimed benefits of the project. These benefits are provision of domestic water supplies in dry areas, food security for the country, water supplies for appropriate type of agriculture and industries in the drier areas, flood control, improvement in water flows and navigation, etc., without causing major ecological damages to any part of the concerned river basins. While these objectives are quite appreciable, whether the project actually can address these problems and a construction cost of US$ 125 to 200 billion, the operational costs and the cost of consequent environmental damages are justified or not, remains a big question. It is in this background that, in this paper, the interlinking project will be examined through raising the following questions:

- Does the interlinking project offer the most cost-effective option for domestic water security in drought-prone areas in India?
- Is India's food security critically dependent on the interlinking project?
- Who will bridge the crucial knowledge gaps on the Himalayan Component?
- Will the interlinking of rivers multiply the conflicts related to water?

4.3 DOES THE INTERLINKING PROJECT OFFER THE MOST COST-EFFECTIVE OPTION FOR DOMESTIC WATER SECURITY IN DROUGHT-PRONE AREAS IN INDIA?

One of the claimed benefits of the interlinking project is that it will provide drinking water to large areas in the country facing drought and water scarcity. The task of providing domestic water supplies, including for sanitation, should obviously receive the highest priority. Solution to this problem is of particular importance in the case of rural India, where water for sanitation is still not available to many people. Domestic water requirements are very important in terms of priority, but account for a very small part of the total national water needs. The official process for the identification of river basins as 'surplus' or 'deficit' clubs together all water needs, and agricultural requirements dominates that classification. If the domestic water needs are considered separately, and not clubbed with their irrigational or industrial requirements, and compared with the water availability over smaller watersheds and sub-basins, a completely different picture of availability will surely emerge. In that picture, not many areas in India will come out as water deficit in a water balance study.

With this assessment in mind, a few case studies had been undertaken by the UNICEF and the Worldwide Fund for Nature (WWF) in a few areas of the country where scarcity of water supplies during the pre-monsoon months becomes a problem. From the report that emerged, it becomes clear that if the precipitation within the watersheds or sub-basins is harvested and conserved properly, satisfaction of domestic water needs will not be a problem in most parts of the country (Nigam *et al.*, 1997). This observation is completely in consonance with the result of numerous community initiatives for water harvesting, whether in Maharashtra, Gujarat, Rajasthan, Tamil Nadu, Uttaranchal, or anywhere else in the country. The Prime Minister's call to promote water harvesting in India as a people's movement is directed to this immense potential of local level water harvesting and conservation in providing domestic water security in the dry areas of India.

In contrast, the interlinking project tries to supply domestic water through collection at far away points and distribution through long canals or existing riverbeds. However, no cost estimate for the supply of drinking water from the related dams and canals is available. As a result, a clear comparison of the cost of water supply from the interlinking project can not be made with the small and localized community initiatives. Indications are however quite clear that from the point of both the financial cost and the amount of water lost; the centralized interlinking project will be much costlier than the decentralized ones. While the whole country needed about 30 km^3 of water for satisfying annual domestic needs in 1997 to 1998, India managed to lose 36 km^3 of water in that year only through evaporation from the reservoirs. By the year 2010, while the annual domestic requirements of India would become 42 km^3, an equal amount would be lost through evaporation (NCIWRDP, 1999a: p.69). Indeed, the centralized collection at far away points and long distance distribution in the interlinking project is a very water wasteful way of supplying domestic water needs. In the large rural areas, specially the arid and semiarid areas, the economic efficacy and optimality of the proven technology of local level harvesting and conservation in providing domestic water security, has not been disproved by any analysis.

Through the popularization of the promises of the interlinking project, a policy obsession has started to grow in the country that the 'surplus' basins have all the solutions in store, for addressing the problem of water scarcity in the rest of the country. One has only to wait for the US$ 125 to 200 billion project to be completed, to have all the water scarcity problems solved. This has brought the country to such a situation of costly sedation, that if Rajasthan receives rainfall above average, as a result of the integral variability of climate, as has been the case in the summer of 2003, no serious governmental steps for harvesting and conservation of the rainwater at the micro-level is noticed. However, in many villages of Rajasthan, micro-level harvesting and conservation structures have been built through non-governmental initiatives (for more details see Chapter 15). In those villages people will probably enjoy security of domestic water supplies, in the drier periods. In other places, their water security is flowing out with the local runoff, making an unrealistic and artificial justification for dependence on long distance transfers. This need for harvesting and conservation of water is equally true whether it is in rain-scarce Ajmer (550 mm annually) or rain-covered Cherrapunji (11,000 mm annually). In the words of Verghese (2003) the interlinking project:

> *is not a single stand-alone panacea for the country's water problems but the apex of a progression of integrated micro to mega measures in an over all but unarticulated national water strategy.*

There is a clear danger in believing that the interlinking project is the last word for domestic water security all over the country.

The problem of providing domestic water supplies in areas away from the rivers will largely remain unsolved, even if the interlinking project is completed. Moreover, as far as only the domestic water needs are concerned, and not extraction for meeting the irrigation requirements, the existing flows in the rivers may be enough in most locations near the rivers. The interlinking will not have much effect on improving the supply situations in the vast dry areas which are in the higher parts of the basins and away from the rivers to be interlinked rivers, and hence, most critically dependent on local rain water. It needs to be stressed that the poor and the vulnerable populations in arid regions usually reside in the upper parts of the watersheds or basins, while the rich live on the water rich lands at the lowest parts of the basins. The interlinking project, which will make more water flow along the riverbeds, will have very marginal reach to these poorer populations. The NCIWRDP (1999a: p.152) has given a clear indication that for secure domestic water security local level arrangements worked out by popular participation needs to be promoted. Local level harvesting and conservation has not only satisfied the domestic water needs in many such arid and semiarid areas, in many cases, it has also provided protective irrigation to rainfed farmlands.

Similarly, along the long coast-line of India, several technological options for supply of domestic water requirements are emerging in the form of desalination. Capacity for desalinating water has increased globally from 1.5 million m^3 per day to the current figure of more than 20 million m^3 per day. This has reduced the cost-price of desalinated water to less than US$ 1.00/m^3 for seawater and less than US$ 0.50/m^3 for brackish water, largely by cutting the energy requirements of desalination plants (Anon, 1999). As a result, companies are now ready to market drinking water at a price of 5 paise (0.1 cent) per litre (New Indian Express, 2003). The emerging technology of rapid spray evaporation (RSE) is expected to further bring down the price level (Ellis, 2003). The interlinking project needs to be examined from this point, otherwise, after all the huge construction in the name of delivering water to the water scarce areas, it may soon prove to be not the most cost-effective way of doing so. In short, in the absence of comparative cost figures, answers to the questions related to the desirability or otherwise of this gigantic project for promoting domestic water security in India can not be found. However, the primary importance in this respect, of local level harvesting and conservation of rainwater remains unchallenged.

There is, however, a good case for long distance water transfer projects, whether inter-basin, or otherwise, when large urban areas need to be supplied with adequate domestic water. However, such transfer projects do not need a great amount of water, when compared with irrigation. It will be wiser to address the issue of urban water security in India as a priority issue, separate from irrigation. For the domestic water security of most of the rural areas suffering from water scarcity, there is no alternative to intensive and extensive promotion of local level harvesting of water. For these areas, the option of long distance transfer should be the last one, not the first.

4.4 IS INDIA'S FOOD SECURITY CRITICALLY DEPENDENT ON THE INTERLINKING PROJECT?

The growth in irrigated area, along with improvements in farming technologies and plant genetics, has been responsible for the rapid growth in crop production over the last few decades in our country. The total irrigation potential created till the 9th Plan period is about 107 million hectares (Mha) (NCIWRDP, 1999a: p.79). Using an additional 173 billion cubic meters (BCM) of water, the interlinking project plans to bring under irrigation an additional 34 Mha of land with the objective of meeting 'the requirements of increasing food and fibre production for a growing and increasingly prosperous population' (Vaidyanathan, 2003).

Recent agricultural statistics reveal that we have achieved a record food grain production of 209 million tons in 2005-2006 which is 11 million tonnes more than that of the previous year (MoF, 2006). The data from the Food Corporation of India (FCI) indicates that the national buffer stock stands at an all time high of 62 million tons. The Government of India has issued a statement saying that there is no problem in the food front. Food security is, however, not a matter of food production alone. Good production and good distribution together can deliver food security. Despite the huge buffer stock of food grains in India, an estimated 200 million people are underfed and 50 million are reportedly cringing below starvation (Goyal, 2002).

Food security in India, accordingly, is as much a matter of access and distribution, as production. The growth of the population in India is expected to flatten towards the middle of the present century. There will be a consequent flattening of food requirements. Food production is a matter of area under agriculture and yield. India has the largest irrigation network and second largest arable area in the world. However, in spite of the availability of good water and land, our agricultural productivity stands very low when compared with other countries of the world. Our neighbouring country, China faces problems similar to ours, in a more acute manner. It has a larger population to feed, with much less arable land. However, as Swaminathan (1999: p.73) has pointed out, China produces 13 per cent more food grains per capita than India. Data from the FAO (CWC, 1998: pp.223-224) indicates that while the cereal yield for India stood at 2,134 kg per ha in 1995, the same for China stood at 4,664 kg per ha (Figure 4.3).

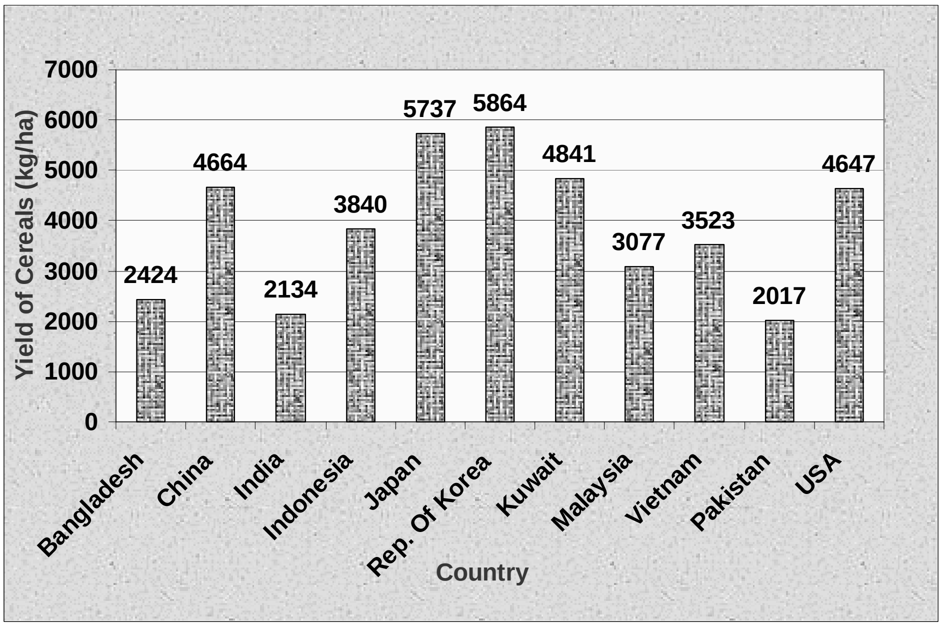

Fig. 4.3 Country Wise Yield of Cereals in kg per ha (Source: Water and Related Statistics, Central Water Commission, 1998).

Eminent agricultural scientists in India are foreseeing great technological breakthroughs in agricultural productivity in the coming years. The NCIWRDP has pointed out that the yield of wheat in experimental farms in India has already exceeded 6,000 kg per ha. However, the calculations of India's food production in the coming decades, made for showing the interlinking project as an essential step for food security, are made with the assumption that even after 50 years from now, India will attain yield levels only two-thirds of what has already been achieved in the experimental farms. The NCIWRDP (1999a: p.57) has taken yield levels of 4,000 kg per ha in irrigated land, as the basis for making projection for food crop production in 2050. Similarly, in the rain fed land, NCIWRDP has projected that the food crop yield is expected to grow from the present 1,000 kg per ha to 1,500 kg per ha only in 2050.

The other important way to look at the justification or otherwise of the projected essentiality of the interlinking project, is to look at food grain productivity per unit volume of water. Singh (2003) takes the view that India is "already producing enough food; production can be further increased by at least 25 per cent from existing irrigated area itself by improved inputs and agricultural technology". This view is reiterated by Carruthers and Morrison (1994), when they say that "we do not anticipate or call for an increased rate of capital intensive investment in irrigation infrastructure but we do need to see that more is achieved with what is presently developed”. Thus, the justification for such a costly physical expansion of irrigation based on macro-level collection and long distance transfer of large volumes of water does not have universal support.

It is important to note that China, with only half as much arable land per capita as India, today is not thinking in terms of drastically increasing the use of water in agriculture but increasing the water use efficiency in the existing irrigated areas. Wang (2002: p.15 and p.110), the Water Resource Minister of China, writes that, “Irrigation is no longer ‘watering the land’ but supplying water for growth of crops…At present, the average agricultural water use efficiency is 0.43 in China. If water saving irrigation is extended to raise the figure up to 0.55 (some experts consider 0.6), food security can be guaranteed when the population increases to 1.6 billion in 2030 without increase of total agricultural water use”.

In the case of India, blessed with more arable land and more irrigation potential, while similar figures for the improvement in the efficiency of the use of irrigation water (from 0.35 at present to 0.60 in 2050) are being projected (NCIWRDP, 1999a: p.58), probably with a weaker conviction, there is no clear policy perspective for achieving higher water use efficiency and reach the declared targets. Thus, the perceived dependence of India’s food security on the continued physical expansion of irrigation will remain inextricably linked with the interlinking project. However, as Swaminathan (1999: p.93) has cautioned that:

> *the inefficient and negligent use of water in agriculture is one of the most serious barriers to sustainable expansion of agricultural production. Public policy regarding the cost of water supplied by major irrigation projects and low-cost or free distribution of power for pumping underground water aggravate the problem……Water consumption can be reduced radically, by as much as five-to-ten fold, at the same time as significantly increasing crop yields.*

Vaidyanathan (2003), who has examined the methodology and estimates in the NCIWRDP Report, questions the very concept of this efficiency underlying the measures. He says that:

> *the present available efficiency of surface irrigation, according to the figures cited in the report, ranges between 30 and 50 per cent..…..The concept of efficiency not being specified, their relation to projections cannot be verified without comparable estimates of current and future water balances and irrigation efficiencies overall for the two major sources separately*.

The World Bank Irrigation Sector Report on India takes a similar view on irrigation and takes the position that “from the past heavy emphasis on physical expansion, effort now needs to turn to a much greater emphasis on productivity enhancement” (World Bank, 1999: p.11). It is clear that the view that physical expansion of irrigation is the best possible and the most cost-effective option for India maintaining food security is open to scrutiny.

The above makes it clear that the line of linkage between the interlinking project and India’s food security is not uniquely established. There are many other ways to sustain food security and they need to be seriously explored. Hence, before such a gigantic and expensive project is taken up, comparisons of the costs for maintaining food security along all possible technological options, is a pre-requisite. Particular attention should be given as to why, even after 50 long years, yield from India’s irrigated fields will not be even two-thirds of the yield that has already been achieved in experimental farms (6,000 kg per ha).

In addition to this, before the decision for further physical expansion of irrigation is cleared, one needs to examine the use of the quantity and quality of the use of the irrigation potential already created. Till the end of the 9th Plan, the irrigation potential created and utilisation achieved in India was reported as 106.6 Mha and 93.4 Mha, respectively (NCIWRDP, 1999a: p.79). The reasons for taking the figure of 77 Mha as the projected irrigated cropped area as far away in future, as in 2010 needs to be examined from the point whether it is a conservative figure. It is quite logical for the country to expect that the irrigation potential already created be achieved with the projected high level of efficiency. In such a situation, the need for the interlinking project would have to be reassessed.

In addition, the interlinking project envisages that 30 per cent of the irrigated area would be used for the cultivation of non-food crops. Thus, it is very reasonable to expect that the additional irrigation potential of 34 Mha to be created by the interlinking project would actually mean some at most another 17 to 18 Mha for irrigated food crop cultivation. Does the expenditure of US$ 125 to 200 billlion seem justified for such a limited return at the national level? Of course, the ready availability additional water and absence of any legal control on its use may encourage the growth of water intensive industries and commercial crops in the dry areas, notwithstanding their natural limitations. This makes the case for the ‘surplus’ basins supplying that water to ‘deficit’ basins to receive a good price for the water, the use of which would make a good amount of value addition. In fact, inter-state water markets can flourish and solve the problem without a huge national investment. In fact, if such a market is established, there may be a beginning of mutually agreed inter basin transfers, making the very expensive interlinking project redundant.

From the above analysis, it becomes clear that though the main declared justification of the interlinking project comes from its claim about providing additional 173 BCM of water, reportedly for India’s food security, much less expensive options are possibly available. It is imperative that comparative costs of all the possible paths to food security like introduction of qualitative changes in agriculture, technological improvements including more efficient use of water in irrigated areas, be assessed and only then appropriate decision taken. Otherwise, as Postel (1999) has cautioned, “...it is not enough to meet a short term goal of feeding the global population. If we do so by consuming so much land and water that ecosystems cease to function, we will have, not a claim to victory, but a recipe for economic and social decline”.

However, ignoring the serious questions raised above on the official justifications, the interlinking project may still be pushed through without any open professional assessment. In that event, several more serious questions will come to the fore. Part of these questions relates to the lack an adequate knowledge base, and part, to the conflicts, that are inherent in the project idea and will express themselves as and when the realization of the project starts. In the following sections, these questions are being explained.

4.5 WHO WILL BRIDGE THE CRUCIAL KNOWLEDGE GAP ON THE HIMALAYAN COMPONENT?

The mountains play a very significant role in providing the supplies of water the human societies need (Bandyopadhyay *et al.*, 1997). Like all major mountains, the Himalaya is the source of many large rivers, like the Yangtse, Irrawadi, Yarlung Tsangpo-Brahmaputra, Ganga, Indus, Amu Darya, etc. Indeed, the Himalaya can be called the ‘water tower of Asia’. There is little surprise that the basic idea of the interlinking project in India is to transfer water from Himalayan river basins to others. The interlinking project has a Himalayan component that envisages construction of several dams on the Himalayan rivers and 14 links. The complexity of the ecology of the Himalaya is well known and Ives and Messerli (1989) have described quite well the uncertainty associated with taking a mechanical and traditional view of Himalayan development. Bandyopadhyay and Gyawali (1994) have presented a more detailed analysis of the ecological and political challenges associated with the development of Himalayan waters. They have identified several important gaps in knowledge in the conventional approach to development of the Himalayan rivers based on dams and embankments. Bandyopadhyay (2002) has made a detailed analysis of the problems associated with dams on the Himalayan rivers, in respect of the Report of the World Commission on Dams. Of special significance in terms of the safety of Himalayan dams is the knowledge about the seismic hazard, the gaps on which have been articulated by Gaur (1993). Thus, the significant gaps in knowledge can be summarized as on:

a) the mechanism of the generation and draining out of flood waters in the Himalayan foothills and floodplains
b) the dynamics of the generation, transportation and deposition of sediments all along the course of the Himalayan rivers
c) the nature of seismic risks associated with high dams in the Himalaya
d) the impacts of structural interventions in the Himalayan rivers, like embankments
e) the impact of the four points above on the economic feasibility of water development projects

Recognizing the seriousness of the gaps in knowledge mentioned above, the NCIWRDP (1999a: p.187-188) took the wise view that:

> *the Himalayan component would require more detailed study using systems analysis techniques. Actual implementation is unlikely to be undertaken in the immediate coming decades.*

The problem of the knowledge gap was not limited to theories or concepts alone. Even as a National Commission, the NCIWRDP could not have access to data related to the Himalayan component (NCIWRDP, 1999: p.187). Thus, a large part of water development projects and the related knowledge will have to be accepted without any open professional assessment. It is not clear what are the reasons behind this non-availability of data on the Himalayan rivers, in the absence of which it would become difficult to get an open scientific picture of India's huge water resources. Recognizing the urgent need for open professional research on the Himalayan rivers, the NCIWRDP (1999: p.370) has further stressed that, "hydrological data of all the basins need to be made available to the public on demand".

It was in this background, that the order from the Supreme Court was made directing that all the construction activities related to the interlinking project needs to be completed in the next 10 years. Does it mean that the order clears the path for investment in and construction of the project without any dependable and open professional examination based on detailed hydrological data and growing body of technical knowledge about the Himalayan ecohydrology (Chalise and Khanal, 1996)? Will the proponents of the project be correct in saying that the order of the Apex Court makes the need for a scientific and technical examination of the project redundant? Or, otherwise, does the order mean that all scientific and technical research related to Himalayan waters are to be completed within the stipulated period? If so, is it possible to complete all the research studies within that period? Or, in view of the confidentiality associated with hydrological data on the Himalayan rivers, no such need for an open professional research and assessment is envisaged?

This leaves one with the vital question that - in the event of the Himalayan component being taken up for implementation, who would bridge the above knowledge gap? To any professional involved in serious research on ecohydrology of the Himalayan rivers, it is no news that only the development of systematic knowledge needed for making credible impact assessment of the dams and canals proposed in the interlinking project would need quite a long time. If such an exercise gets completed in an open and professional manner, in all probability, many large projects may turn out to be technically and economically unfeasible. One example of the significance of the knowledge gap is related to the declared benefits of 'flood control' from the interlinking project. Floods in the Himalayan foothills and the adjoining plains are the result of a complex ecological process, and much of it is not well understood. Simplistic engineering claims about projects that will control floods in the Himalayan rivers are not new, and have been made over decades. The only thing missing is a good scientific support to the claims; because the real life observations do not substantiate the claims and floods in the Himalayan rivers have certainly not declined over the years. There is a clear case for a transparent and professional examination of the claims of 'flood control' by the interlinking project.

In addition, it is clear to a layman that the realization of the Himalayan component is critically dependent on the agreement of neighbouring countries of Nepal and Bhutan to the proposed constructions, especially of dams, in their respective territories. Bangladesh, as a downstream country, will be an affected party, and needs to be taken into confidence. No progress has been made in the direction of officially informing the neighbouring countries about the interlinking project. This is evident from a statement from the then Nepalese Water Resource Secretary, Aryal (2003) or the recent writing of Vidal (2003). The Himalayan component, thus, runs the risk of becoming a non-starter. In case there is an attempt to give it an immediate push start, the genuine question by whom and how will the crucial knowledge gap on the Himalayan rivers be bridged, will remain unanswered. Can India afford to make huge investments in such a gigantic 21st century project on the basis of an outdated knowledge base?

4.6 WILL THE INTERLINKING OF RIVERS MULTIPLY THE CONFLICTS RELATED TO WATER?

India is known for major water related conflicts, whether it is between Haryana and Punjab in the north, or between Karnataka and Tamil Nadu, in the south. More recently, serious conflicts have emerged among the states sharing the Krishna river basin. Away from the conflicts among the states, India has experienced a large number of water related conflicts between the officials and the people. The lack of an easy access to information about projects and the limited nature of the framework for project appraisal and approval as used at present in India make such conflicts an inevitable part of project execution. It is so because the calculation of benefits and cost of the projects are undertaken according to some very old guidelines. For example, the recommendations of the Third Conference of the State Irrigation Ministers held in 1977 is the latest contribution to the guidelines (NCIWRDP, 1999b: p.165). Naturally, these guidelines are old and are unable to address the present day scientific, social or environmental consciousness. If the administrative rules are not keeping up with time, it is not surprising that conflicts are becoming inevitable. As a result, the courts are increasingly taking up the administration of water resources in India. On this basis, the interlinking project is seen to have the potential for generating four distinct types of conflicts. They are:

- over compensations for resettlement and rehabilitation of the displaced,
- over compensation for environmental damages from the project,
- over sharing the benefits and costs of the project among the states of India, and
- over cooperative management of the project in an international river basins.

4.6.1 COMPENSATIONS FOR RESETTLEMENT AND REHABILITATION OF THE DISPLACED

Conventionally, in making the benefit-cost analysis of developmental projects in India, the social costs are invariably downplayed. Most significant of the social costs are the costs suffered by the people from involuntary displacement. The burden of displacement thus remains unaccounted for and relocation causes profound economic and cultural disruption to the individuals affected as well as to the social fabric of local communities (Cernea, 1988). In this context, Roy (1999) states that, "In India, fifty million people are estimated to have been displaced in last five decades by the construction of dams, power plants, highways and such other infrastructure development projects. Subsequently no more than one-fourth of them could be assisted to regain their livelihoods". Wolfensohn (1995) rightly surmises the situation that, 'Such social injustice can destroy economic and political advances'.

In the case of the interlinking project, no official figure is available for the number of people to be displaced. It is estimated that the network of canals extending to about 10,500 km would displace about 5.5 million people, who are mostly tribals and farmers (Vombatkere, 2003). One has to add to it the people to be displaced by the various reservoirs that may be built, in India or in the neighboring countries. In view of the fact that the river interlinking proposal has been slotted as the largest construction project ever in the world, the above-mentioned figure for the number displaced seems a probable underestimation of the true picture. This gets compounded with the fact that the government is yet to commit itself on a sound and clearly spelt out resettlement and rehabilitation policy. If this crucial step is not completed the issue of the resettlement and rehabilitation related to the interlinking project is sure to generate a great number of protests and public interest litigation, the cost of which will be enormous.

4.6.2 COMPENSATION FOR ENVIRONMENTAL DAMAGES FROM THE PROJECT

As has been stressed earlier in this paper, the existence of 'surplus' water in one basin and its transfer to another does not constitute a win-win situation. In correctly assessing the environmental costs, as Vaidyanathan (2003) suggests, "One needs to know when, for what duration and how much water can be drawn from each basin, for transfer to the next, and how well it matches the irrigation requirements in the recipient basin". The ruinous results of ecologically un-informed economic development activities, like widespread waterlogging, salinization and the resulting desertification in the command areas of many large irrigation projects, can be cited. In the absence of an appropriate study for determining the actual water needs in an area, the river link plan can similarly prove to be ecologically disastrous.

Guided by the aspiration of rapid economic growth, quest for every drop of water becomes the practice. There is little in the proposed interlinking project, for promoting protection against drought. It plans to extend the conventional intensive irrigation to the arid areas. The result is that heavily water-demanding crops start to be grown in arid areas. One is aware that the roots of the conflict over the famous Cauvery waters were in the adoption of water intensive cropping systems and the abandonment of many traditional water harvesting structures. In this situation of increasing emphasis on the commercialization of some crops at the cost of staple food grains, Athavale *et al.*, (2003) fears that:

> *In irrigated areas, the provision of additional water from outside based on questionable calculations of water-deficits, may weaken the motivation for improving the efficiency of water-conveyance and water-use, further encourage the recourse to water-intensive crops and induce the repetition of some of the ills associated with the Green Revolution approaches. In arid or drought-prone areas, it may even lead to the introduction of irrigated agriculture of a kind more appropriate to wet areas.*

On the other hand, the experiences in the successful promotion of water harvesting and resilience against drought in dry land farming systems, as gained from non-governmental initiatives like the *Pani Panchayat* in Maharashtra, are almost externalized from the interlinking project.

On 23 May 2003, the Ministry of Environment and Forests had put out a 23-point concern about the environmental implications of the proposed interlinking project. These included the submergence of forests and cultivable areas, displacement and resettlement and serious implications in terms of bio-diversity loss (Hazarika, 2003). Bandyopadhyay (2003) has raised the question "How are the environmental damages that may be caused by the interlinking project identified and their financial costs estimated, if at all?" Martin (2003) warned that linking rivers like straight pipelines without looking at the ecological impact could lead to serious repercussions. Factorization of environmental impacts into project planning is an absolute necessity and more important are the monetized costs of environmental impacts in evaluation approaches to develop prices for environmental services and amenities. Decisions, which include these impacts, support sustainability. Scientists are also skeptical of the fact that river diversion would bring in significant changes in the physical and chemical compositions of the sediment load, river morphology and the shape of the delta formed at the river mouth. All these downstream processes have serious economic and livelihood implications, presently ignored by the project.

4.6.3 SHARING THE BENEFITS AND COSTS OF THE PROJECT AMONG THE STATES OF INDIA

Whether it's the erratic water supply forcing families to shift out of Chennai, or the procession in Gujarat to protest against the lack in water supply or fights of the farmers over opening of field channels in Haryana or Punjab, the 'central conflict over water resources revolves around the question of ownership, access and control over water' (Upadhyay, 2001). In the last decade, there have been reports of violence and deaths on account of conflicts over water rights between upstream and downstream areas in many river basins in India - Narmada, Cauvery, Krishna, Godavari basins are some examples for such incidents (Rajagopal, 2002).

States have always enjoyed right over water for apportionment and allocation. If under the centralized scheme of river linking, the riparian rights of the states gets disturbed and right over the same gets transferred, then the issue which emanates from the same would also need to be resolved. Singh (2003b) the additional secretary in the MoWR has empathetically enquired whether there are any hard and fast rules, conventions, best practices, executive fiats, which require intra-basin disputes to be resolved first before seeking to resolve inter-basin issues.

Two clear roots for new inter-state conflicts are seen in the interlinking project. The first one is on the description of the total requirement of the states in the 'surplus' basins, for example, Assam or West Bengal. While the arithmetical hydrology will be able to calculate the obvious and supply oriented requirements and project them in both space and time, the problem will arise on the requirements that arithmetical hydrology can not recognize. Take for example, how would one scientifically arrive at the need for minimum flow in Padma (the other name of the Ganges in Bangladesh) or Meghna or the Hooghly-Bhagirathi for the sustainability of the livelihoods of the millions involved in fishing in southern Bangladesh and the state of West Bengal? What will be the impact of the diversion of the 10 per cent of the lean season flow from 'surplus' river basins on the groundwater resources and saline incursion in the downstream areas? These estimates are not easy to make.

However, it is also not easy to ignore them. In assessing the full requirements, the states need to liberate themselves from the limits of arithmetical hydrology and use ecohydrology as the knowledge base for the estimation of these water requirements. Indeed, there will be a great conflict of worldviews when such claims would be put forward by the 'surplus' states. The second part of the potential for conflict is related to the limits that will be imposed on the 'surplus' states, if, as and when the interlinking project gets realized. By virtue of the principle of prior extraction, the 'deficit' states would have the luxury of promoting water intensive export oriented agriculture or polluting industries that are not otherwise feasible or sustainable in those areas. Economic growth is good, when all damages from the growth are paid according to the principle of full costing. What market mechanism would be instituted for the 'surplus' states to receive the price for water that would be used by the 'deficit' states commercially for large profits? If this is not sorted out, the project is bound to face constant problems, as is seen in the case of Cauvery waters today.

In this commotion, people of the country also deserve to know whether this centralized plan is a step for 'nationalization' for subsequent privatization of water. There have been several articles put up in the print media both in support of and strongly critical of the interlinking project. Athavale *et al.* (2003) says that:

> *Even if we assume that the conflict at one end (i.e., in a 'water short' river basin) is eased by the importation of external water, we may be initiating a new conflict at the other end (the donor basin). The project has already led to strong objections form several states and it now appears that several new inter-state conflicts may arise because of this project".*

Singh (2003) points out that, "Looking at the on-going disputes between states, inter-state agreements would be extremely difficult to achieve".

4.6.4 COOPERATIVE MANAGEMENT OF THE PROJECT IN INTERNATIONAL RIVER BASINS

About half of the world's terrestrial surface belongs to international river basins. A large part of India also belongs to the two large international basins, the Ganges-Brahmaputra-Meghna (GBM) and the Indus. The interlinking project is fundamentally related to the development and transfer of water, particularly within and from the GBM basin. Worldwide shared water resources are covered by over 2,000 bilateral agreements on various aspects of navigation, research, fishing, water quotas and flood control (McNeely, 1999). These principles of international law have thus been developed to allocate water within a river basin and to prevent or resolve international water disputes regarding the extent of upstream and downstream use of water. Unfortunately, they rarely are easy to apply and often are contradictory. Sharing river water is particularly difficult because the effects are one-way, with upstream-downstream supply dispute being among the most common (Kilgour and Dinar, 1995). Referring to the GBM basin, Gately (1995) has commented that:

> *A tussle is simmering in South Asia's Ganges-Brahmaputra Basin, where Bangladesh, India, and Nepal dispute the best uses of water. India and Nepal want to exploit the basin's huge water resources, whereas Bangladesh wants the water managed in such a way as to minimize flooding during monsoon months and water shortages during dry months. Of equal concern are the water conflicts between states in India that share river basins, such as Karnataka and Tamil Nadu, which border the Cauvery River.*

The ideal way to address the development of water resources in an international river basin is to recognize the ecological integrity of the basin, take a basin-wide approach and involve all co-riparian countries in the process of conceptualization of a project. In the case of the GBM basin, separate and bilateral agreements on smaller aspects exist between India and the three other countries, Bangladesh, Bhutan and Nepal. Indeed, much of the success of the Himalayan component depends on the ability of India to get these three countries to endorse the interlinking project. As it appears now, no concrete and positive steps have been taken so far in that direction. On the contrary, it appears from Vidal (2003) that Bangladesh is thinking of taking the matter of the interlinking project up to the UN. For India, the opening of the discussion with Nepal is even more difficult, in the background of the present and serious political instability in that country. Thus, together with inter-state conflicts, the interlinking project is sure to generate important inter-country conflicts, reducing the political feasibility of the project. However, even if all the negotiations are supposedly concluded successfully, the final battle at the financial front will remain. As Rath (2003) has cautioned, the enormity of the financial requirement may be the most useful tool for India to rethink giving the people too many 'pie-in-the-sky' type of slogan for addressing the challenge of water resource development.

4.7 CONCLUSIONS

At the end of the above review and analysis made on the basis of whatever open information is available on the project for interlinking the rivers in India, there appears a great inconsistency in the declared claims of the project, and their feasibility. Indeed, the confidentiality associated with the technical information on water resource projects comes as a great obstacle to its transparent professional assessment. The first and foremost commitment of a water project should be for providing domestic water supply. The indicative policy assessment show that the approach based on dams and canals is not the best choice for promoting domestic water security in India. Such a technology is wasteful of water and of a low level of dependency. Domestic water security in drought-prone rural areas can be better achieved through local level harvesting and conservation. There is, however, a need for long distance transfers to provide large urban areas with domestic water supplies.

Physical expansion of irrigation by 34 Mha is the main plank for the interlinking project. The food security of India has been shown to be fully dependent on the interlinking project. However, this dependence has not been clearly established. This choice of the most effective approach to food security of India will depend on the nature of the progress of Indian agriculture in the coming decades. Fifty years is a long period and in the next 50 years, the projected yield of food crops in both irrigated and rain fed lands may increase substantially, deviating from the present low rate of growth. Similarly, if the agricultural water use efficiency goes up from 0.35 at present to 0.60 in 2050, there may not be a great increase in demand for irrigation water for producing these amounts of food crops. However, as assumed by the NCIWRDP, if Indian agriculture does keep a very low profile and maintains the present low growth of only 1 per cent per year over the next 5 decades, then the projected yields in 2050 will be about 4,000 and 1,500 kg per ha, in irrigated and rainfed lands. In such a scenario, if the water use efficiency remains low, the weaknesses of agriculture will have to be made up by better utilization of the available potential as well as physical expansion of irrigation. Whether that expansion will be achieved through the interlinking project, or by giving greater stress on micro- and meso-level water harvesting and conservation, will have to be decided on the basis of their economics. Thus, the picture of the interlinking project as the only instrument for maintaining India's food security under a scenario of low agricultural development is not clearly established. Accordingly, there is more reason for an open and professional assessment of the project proposal.

The interlinking project, even to start with, will have to face many potential inter-state conflicts. If the so called 'surplus' basin areas use ecohydrological arguments, and not be guided by arithmetical hydrology, in calculating their maximum water demands, then there will be quite a disagreement on what is the 'surplus' that can be transferred. The second point of discontent will be on the sharing of the all-important flows in the pre-monsoon period, when 'surplus' states cease to be so and need the water in the river as much as the 'deficit' basins. If the past is any indicator of the trends in future, and if the perception of the water resource engineers remains unchanged, the interlinking project may lead to so many water related conflicts, as a result of which, the Supreme Court may soon get fully overburdened with them.

The interlinking project, as described now, looks like a set of linkages, developed primarily for irrigation, but looking for diverse other justifications, of drought proofing, drinking water supply, flood control, etc. Its idea of providing domestic water supply to large urban areas in dry regions is very plausible. Other claims are not that convincing. The Himalayan component is not based on any open and professionally assessed knowledge base. This is a source of serious concern. In the interest of the people of India, justifications put forward for such a gigantic project should be assessed in an open and professional manner. There is a clear need for examining the presuppositions on which the whole interlinking project has been put. The need to study the feasibility of the independent links will arise only after the premises are found agreeable. If the old practice of getting feasibility studies on water related projects conducted away from the public view is continued, it will be against the expectations of the changing times of openness and transparency.

REFERENCES

Anon: Desalination: A Real Alternative for Water Supply in the 21st Century Annual Report. The Hague, NEDECO (www.nedeco.nl/files/jv99.pdf), 1999.

Aryal, K.B.: As quoted in S. Pant, Nepal has No Official Knowledge of Mammoth Indian Project. The Kathmandu Post, July 29, 2003.

Athavale, R.N. *et al.*: Stop This River Link Project. The Statesman, Kolkata, May 17, 2003.

Bandyopadhyay, J.: A Critical Look at the Report of the World Commission on Dams in the Context of the Debate on Large Dams on the Himalayan Rivers. International Journal of Water Resource Development **18**(1), March 2002, pp.127-145.

Bandyopadhyay, J.: And Quiet Flows the River Project. The Hindu Business Line (Chennai), March 14, 2003.

Bandyopadhyay, J., J.C. Rodda, R. Kattelmann, Z. Kundzewicz and D. Kraemer: Highland Waters: A Resource of Global Significance. In: Mountain of the World: A Global Priority (Messerli, B and J.D. Ives Eds.), Carnforth, Parthenon, 1997, pp.131-156.

Bandyopadhyay, J. and B. Mallik: Population and Water Resources in India: Crucial Gaps in Knowledge for Sustainable Use in Future. In: Challenge of Sustainable Development: The Indian Dynamics (Sengupta, R. and A.K. Sinha Eds.), Kolkata, CDEP-IIMC and New Delhi, Manak Publishers, 2003, pp.81-111.

Bandyopadhyay, J. and D. Gyawali: Himalayan Water Resources: Ecological and Political Aspects of Management. Mountain Research and Development **14**(1) (1994), pp.1-24.

Carruthers, I. and J. Morrison: 2020 Vision - Dramatic Changes in the World Agricultural and Industrial Production Systems. IIMI Review **8**(1) (1994), pp.14-20.

Central Water Commission (CWC): Water and Related Statistics. CWC, New Delhi, 1998.

Cernea, M.: Involuntary Resettlement in Development Projects: Policy Guidelines in World-Bank Financed Projects. World Bank Technical Paper **80**, Washington, D.C., 1988.

Chalise, S.R. and N.R. Khanal: Extended Abstracts: International Conference on Ecohydrology of High Mountain Areas. ICIMOD, Kathmandu, 1996.

Cosgrove, W. and F.R. Rijsberman: World Water Vision: Making Water Everybody's Business. Earthscan, London, 2000.

Ellis, C.: Hot Mist Strips Salt from the Sea. New Scientist **179**(2403) (July 12, 2003), p.15.

Gately, D.: Potential for International and National Water Conflicts is High in Coming Years According to Research Organization. International Food Policy Research Institute, Washington D.C., USA (http://www.ifpri.org/pressrel/061495c.htm), June 1995.

Gaur, V.K. (ed.): Earthquake Hazard and Large Dams in the Himalaya. Indian National Trust for Art and Cultural Heritage, New Delhi, 1993.

Gazmuri, R.: Chilean Water Policy Experience." Paper presented at the Ninth Annual Irrigation and Drainage Seminar, Agriculture and Water Resources Department, World Bank, Washington D.C., USA, 1992.

Gleick, P.H.: The World's Water 2000 to 2001: The Biennial Report on Freshwater Resources. Island Press, Washington D.C., USA, 2000.

Goyal, P.: Food Security in India. Online Edition (www.hinduonnet.com/the hindu/biz/ 2002/01/10/ stories/ 200201000440200.htm), January 2002.

Hazarika, S.: Climb-Down on River Linking. The Statesman, May 28, 2003.

Indian Water Resources Society (IWRS): Theme Paper on Inter-basin Transfers of Water for National Development: Problems and Perspectives. IWRS, 1996.

Ives, J.D. and B. Messerli: The Himalayan Dilemma. Routledge, London, 1989.

Iyer, R.R.: Rivers of Discord? The Times of India, New Delhi, November 9, 2002.

Jain, S.: The River Sutra. Indian Express, New Delhi, March 2, 2003.

Kilgour, M. and A. Dinar: Are Stable Agreements for Sharing International River Waters Now Possible? Working Paper **1474**, The World Bank, Washington D.C., USA, 1995.

Martin, C: Dams, Rivers and People **1**(2-3) (March - April 2003). Also in Hindustan Times, New Delhi (http://www.narmada.org/sandrp/apr2003_1.doc), February 10, 2003.

Matsura, K.: Quoted in http://www.edie.net/news/Arch, 2003.

McNeely, J.: Freshwater Management: From Conflict to Cooperation. Gland, IUCN (http://www.iucn.org/bookstore/bulletin/1999/wc2/content/conflict.pdf), 1996.

Mohile, A.D.: India's Water and Its Plausible Balance in Distant Future, 1998. Unpublished paper as cited in NCIWRDP (1999a: p.29).

Ministry of Finance (MoF): Economic Survey 2006 to 2007." MoF, New Delhi, 2006.

Ministry of Water Resources (MoWR): Inter-basin Transfer: Planning for Inter-basin Transfers (http://wrmin.nic.in/interbasin/header8.htm), 2002.

Mirza, M.M.Q., A. Dixit and A. Nishat (eds.): Flood Problem and Management in South Asia. Kluwer Academic Publishers, Dordrecht, The Netherlands, 2003.

National Commission on Integrated Water Resource Development Plan (NCIWRDP): Integrated Water Resource Development: A Plan for Action. New Delhi, NCIWRDP, MoWR, 1999a.

National Commission on Integrated Water Resource Development Plan (NCIWRDP): Report of the Working Group on Inter-basin Transfer of Water. New Delhi, NCIWRDP, MoWR, 1999b.

New Indian Express: Bangalore, June 13, 2003.

Nigam, A., B. Gujja, J. Bandyopadhyay and R. Talbot: Freshwater for India's Children and Nature. WWF and UNICEF, New Delhi, 1997.

Postel, S.: Pillar of Sand, Can the Irrigation Miracle Last? WW Norton, New York, 1999.

Prabhu, Suresh: Interview in Indian Express. New Delhi, March 2, 2003.

Rajagopal, A.: Aquaculture 'Prosperity' - Some Reflections from India. South Asian Consortium for Interdisciplinary Water Resources Studies, Hyderabad, 2002.

Rath, N.: Linking Rivers: Some Elementary Arithmetic. Economic and Political Weekly **38**(29) (2003), p.3033.

Rao, K.L.: India's Water Wealth. Orient Longman, New Delhi, 1975.

Roy, A.: The Greater Common Good. India Book Distributors (Bombay) Limited, Bombay, 1999.

Singh, B.: A Big Dream of Little Logic. The Hindustan Times, New Delhi, March 9, 2003.

Singh, R.: The Linking will Augment the Flow of Ganga. Indian Express, New Delhi, March 2, 2003a.

Singh, R.: Interlinking of Rivers. Economic and Political Weekly **38**(19), May 10, 2003b, pp.1885-1886.

Swaminathan, M.S.: A Century of Hope: Harmony with Nature and Freedom from Hunger. East West Books, Madras, 1999.

United Nations (UN): World Population Prospects: 2005 Revision. United Nations Population Division, New York, USA, 2006.

Upadhyay, V.: Legal Conflicts Over Land, Forests and Water in India: A Review of Cases and Concepts. Aga Khan Foundation, 2001.

Vaidyanathan, A.: Interlinking of Rivers. The Hindu, Chennai, March 26, 2003.

Verghese, B.G.: Rivers of Discord. The Times of India, New Delhi, November 9, 2002.

Verghese, B.G.: Waiting for Godaganga. Outlook Magazine, June 30, 2003.

Vidal, J.: Troubled Waters for Bangladesh as India Presses on with Plan to Divert Major Rivers: UN Urged to Act Amid Warnings of Social and Ecological Disaster. The Guardian, London, July 24, 2003.

Vombatkere, S.G.: Interlinking: Salvation or Folly - II? India Together (http://www.indiatogether.org/2003/jan/wtr-sgvintlink02.htm), January 2003.

Wang, Shucheng: Resource Oriented Water Management. China WaterPower Press, Beijing, 2002.

Wolfensohn, James D.: Address at the Annual Meeting of the World Bank and IMF. World Bank, Washington, D.C., USA, October 1995.

World Bank: World Development Report 1992: Development and the Environment. Oxford University Press, New York, 1992.

World Bank: India: Water Resource Management - The Irrigation Sector. Allied Publishers, New Delhi, 1999.