INTER-BASIN WATER TRANSFER: A SOCIO-ECONOMIC ANALYSIS

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Abstract:-Water is one of the most important basic needs and natural resources, without which life is not possible. But the increasing scarcity of water has created a threat for the mankind, all living beings and the environment too. It is said that water can be the cause for next world war. In India, the availability of water is highly uneven, in terms of space and time. As the result of this, some part of the country is badly affected by flood and the same time large area has to face drought. The Ministry of Water Resource, under the government of India, decided to undertake a comprehensive assessment of the feasibility of inter-basin water transfer through linking of rivers. This project proposes many dams, reservoirs, and canals which will affect displacement of people and covers much agricultural land, forests, housings etc. causing impact on the environment, people, wildlife and the economy too. At this backdrop, the current paper is an attempt to conduct a socio-economic analysis of the inter-basin water transfer through the inter-linking of rivers project.

Keywords*: Inter-basin, inter-linking, river, water, drought, flood, socio-economic*
JEL Code*: H13, N55, O13, P28, Q01, Q50*

1. Introduction

Water is one of the most important basic needs and natural resources, without which life is not possible. But it is getting scare and scare and the scarcity is going to escalate in the future. It has created a threat for the mankind, all living beings and the environment too. It is said that water can be the cause for next world war. The rivers in India are truly speaking not only life-line of masses but also for the wild-life. The rivers play a vital role in the lives of the Indian people. The river system helps us irrigation, potable water, cheap transportation, electricity as well as a source of livelihood for our ever increasing population.(Mehta & Mehta, 2013)In India, the availability of water is highly uneven, in terms of space and time. As the result of this, some part of the country is badly affected by flood and the same time large area has to face drought.Demand for the world's increasingly scarce water supply is rising rapidly, challenging its availability for food production and putting global food security at risk. Agriculture, upon which theescalating population depends for food, is competing with industrial, household, and environmental uses for this scarce water supply. Even as demand for water by all users grows, groundwater is being depleted, other water ecosystems are becoming polluted and degraded, and developing new sources of water is getting more costly.(Rosegrant, Cai, & Cline, 2002). Pahl-Wostl suggested transition towards adaptive management of water on the face of climate change and global change. (Pahl-Wostl, 2007)

The rainfall over the country is primarily orographic. The uncertainty of occurrence of rainfall causing fluctuations in average rainfall and prolonged dry spells. A regional variation in the rainfall leads to situations when some parts of the country do not have enough water even for raising a single crop. On the other hand, excess rainfall occurring in some parts of the country creates havoc due to floods. [1]Again, that feature is also recurring. Floods are recurring almost every year in Brahmaputra, Ganga and many other rivers. The damage is huge in terms of money, infrastructure as well as agricultural. On the other hand, large areas in the states of Rajasthan, Gujarat, Andhra Pradesh, Karnataka, Maharashtra, and Tamil Nadu face recurring droughts. Indian economy is highly dependent on agriculture and hence, agricultural economic initiatives are very crucial for the overall economy. The government is fully aware of the fact and hence high weightage is given for agriculture in every five-year plan. Current 11th five-year plan is also not an exception to that.(Rayate, Dhande, & Mahanubhav, 2013)Sustaining agricultural production, particularly the production of food grains in tune with population growth and changing consumption pattern, is an important task, which is not only essential for feeding the population for a large country like India but also important for supporting livelihood and reducing the poverty of India's large rural population.(Chaturvedi, 2000). The government is taking various initiatives to support agricultural sector, like short term, mid-term and long term loans. (Satpute & Desale, 2014)Moreover, water demand in nonagricultural sectors, including that for the environment, is increasing and many regions in the country are facing severe water stress. (Amarasinghe,et.al.,2005). Efforts to manage water efficiently in the agriculture sector and produce more crop and value per drop are gaining momentum now more than ever before.(Kumar, et al., 2009). Almost all the economist had predicted a certain higher rate of growth of India in the coming future. It is showing strong confidence that Indian economy is no longer the gamble on monsoon, though it will have some impact on the growth.(Dhande & Ghodke, 2011)

Well-aware of the fact, the Ministry of Water Resource (MoWR), under the government of India, decided to undertake a comprehensive assessment of the feasibility of linking of rivers and inter-basinwater transfer of the country. The proposal includes the Himalayan rivers which are flood prone like Ganga and Brahmaputra and Peninsular rivers in four major parts. The proposal is to store and transfer the surplus flood water after meeting all in-basin requirements to the water deficit basins. Also, this is planned mostly by gravity and minimal usage of lifts. The feasibility report and detailed project reports are prepared by National Water Development Agency (NWDA). The general consensus emerged that the monsoon flood waters which otherwise

run waste into the sea and causing damage on the route via floods can be conserved through various storage reservoirs. The conserved water can be utilized for irrigation in later phase or can be diverted to water deficit areas and water those dry areas for increased agriculture.It is indeed gratifying that this Central Government scheme received a favorable response from all the states. At this backdrop, the current paper is an attempt to conduct a socio-economic analysis of the inter-basin water transfer through the inter-linking of rivers project.

2. Review of Literature

The nature and pattern of the development of water markets across regions of India considering the life irrigation potential as a major criterion was studied by Shah and Raju.(Shah & Raju, Working of Groundwater Markets in Andhra Pradesh and Gujrat: Result of Two Villages Studies, 1987) The idea of linking rivers is not new. It was Sir Arthur Cotton who had originally proposed the networking of rivers more than a century ago, and Dr. K. L. Rao, the Minister of Power and Irrigation in the Cabinet of Smt. Indira Gandhi revived this proposal in 1972. Cotton's prime concern was for inland navigational network and Dr. Rao's concern was for irrigation and power. (Shiva & Jalees, 2003).India's National River Linking Project (NRLP), which has been on the drawing board for some three decades, is the largest inter-basin water transfer planned to date in India or elsewhere. The idea has waxed and waned depending upon the political dispensation at any given point in time.

Under the Challenge Program for Water and Food, IWMI undertook a broad strategic exploration of the basic idea of NRLP and its assumptions. This highlight examines few contentious issues of the NRLP that received considerable attention in the national discourse. And it concludes that the donor basins may have surplus water to make NRLP technically feasible; however, there is need for nuanced analysis of whether, as the best possible option available to India, it is justifiable.(Amarasinghe, Water Policy Research Highlights - 16, 2012)

The present form of the river interlinking proposal, made by the National Water Development Agency, has been hailed as a 'must' for the country by many politicians. The paper critically examines the assumptions behind and the main justification extended for the project. The paper disagrees with the concept that river basins can be mechanically divided as 'surplus' or 'deficit' ones, and views the proposed interlinking as an extremely cost-ineffective measure for the expansion of a rather inefficient traditional irrigation process.(Bandyopadhyay & Sharma, 2004)

Master plan should focus more on the demand side principle where it should recharge more in areas where groundwater use is heavy and depletion is higher than where water is abundant and demand is low; optimize allocation of financial resources by allocating according to the degree of depletion of resources; have a clearly defined pathway of implementation, indicating the role of different agencies in supervising implementation and monitoring the performance; consider appropriate strategies for the sustainability of the recharge structures; seek active participation of local stakeholders; understand and respect the contextual specificities of ground water depletion; and harmonize priorities with stakeholders' needs. Such a recharge plan can utilize the millions of dug wells blotting various part of rural landscape to benefit irrigation, drinking water supply, and environmental needs.(Amarasinghe, CPWF Project Number 48: Startegic Analysis of India's National River Linking Project, 2009)

The paper 'Proposed River Linking Project of India: a boon or bane to nature', aims at looking at this long-term plan, the project proposal, its involvement and impact not only on the states of India, India as a whole, but also on its neighboring nations which are linked with India through the waterways, and share the common climatic conditions and economic status. (Misra, Saxena, Yaduvanshi, Mishra, Bhaduuriya, & Thakur, 2007) Verghese writes that such projects often leads to protests and resistance in the exporting region, sparked by the elemental importance of water for life and the economy.(Verghese, 1990)Iyer writes on governance that the most visible manifestation of water politics has been in inter-state river water disputes. (Iyer, 2002)

The book reveals the challenges inherent in the government's policy decision to interlink rivers as envisaged by the bureaucratic agency of state power, a culture of scientific expertise, a perceived need to mobilize global capital and opposition to such plans. (Shukla & Asthana, 2005) Properly planned water resource development and management has the ability to alleviate poverty, improve the quality of life, and reduce regional disparities and to maintain the integrity of the natural environment.(Krueger, Segovia, & Toubia, 2007) The paper layout seven reasons why revisiting the river linking issue is a good idea.(Shah & Singhe, India's River-Linking Project: The States of the Debate, 2007)

3. Project Outline

At the time of independence the country had a population of about 400 million and faced severe food crisis. At that time the irrigation potential of the country was only about 20 Mha. After independence massive programme of irrigation was launched for development and utilization of both surface and ground water resources. This resulted in green revolution, which helped to transform the country from the state of food scarcity to food self-sufficiency. Due to these massive efforts, by the year 1979 the irrigation potential of the country could increase to 57 Mha with the use of high yielding varieties possible under irrigation and with increased use of fertilizers. The food production of the country could be increased to about 125 to 130 million tones by the same time. However, rate of increase in food production could just manage to equal the rate of population growth.

The water is main input to the agriculture and also an important element for the life of human kind, its optimal utilization is necessary. With a view to harness the water resources of the country optimally, Dr. K.L. Rao, the then irrigation Minister, in the year 1972 had mooted the idea of interlinking of rivers by connecting the Ganga with the Cauvery river. Subsequently, in 1977 Capt. Dastur initiated the concept of a "Garland Canal" around the Himalayan, Central and Peninsular India. The proposals although received very good response from all sectors of communities, but not found techno-economical feasible for implementation.

The continued interest shown by many people engaged in Water Resources Development gave further incentive to study inter-basin water transfer through inter-linking rivers proposals in more details. The then Ministry of Irrigation (now Ministry of Water Resources) and Central Water Commission formulated a National Perspective Plan (NPP) for Water Resources Development in

1980, envisaging inter-basin transfer of water from surplus basins to deficit ones with a view to minimizing the regional imbalances and optimally utilize the available water resources.

National Perspective Plan comprises of two components viz. Himalayan Rivers Development and Peninsular Rivers Development.

Himalayan Rivers Development:

Himalayan Rivers Development Component envisages construction of storage reservoirs on the principal tributaries of Ganga and Brahmaputra rivers in India, Nepal and Bhutan along with inter-linking of river systems to transfer surplus flows of the eastern tributaries of the river Ganga to the west, apart from linking of the main Brahmaputra and its tributaries with Ganga and Ganga with the river Mahanadi.

Peninsular Rivers Development Component is divided into four major parts viz.

i. Inter-linking of Mahanadi-Godavari-Krishna-Cauvery rivers and building storages at potential sites in these basins.

This part involves inter-linking of the major river systems where surpluses from the Mahanadi and the Godavari are intended to be transferred to the needy areas in the south, through Krishna and Cauvery rivers.

ii. Inter-linking of west flowing rivers, north of Bombay and south of Tapi.

This scheme envisages construction of as many optimal storages as possible on these streams and inter-linking them to make available appreciable quantum of water for transfer to areas where additional water is needed. The scheme provides for taking water supply canal to the metropolitan areas of Mumbai; it also provides irrigation in the coastal areas in Maharashtra

iii. Inter-linking of Ken-Chambal

The scheme provides for a water grid for Madhya Pradesh, Rajasthan, and Uttar Pradesh and inter-linking canal backed by as many storages as possible.

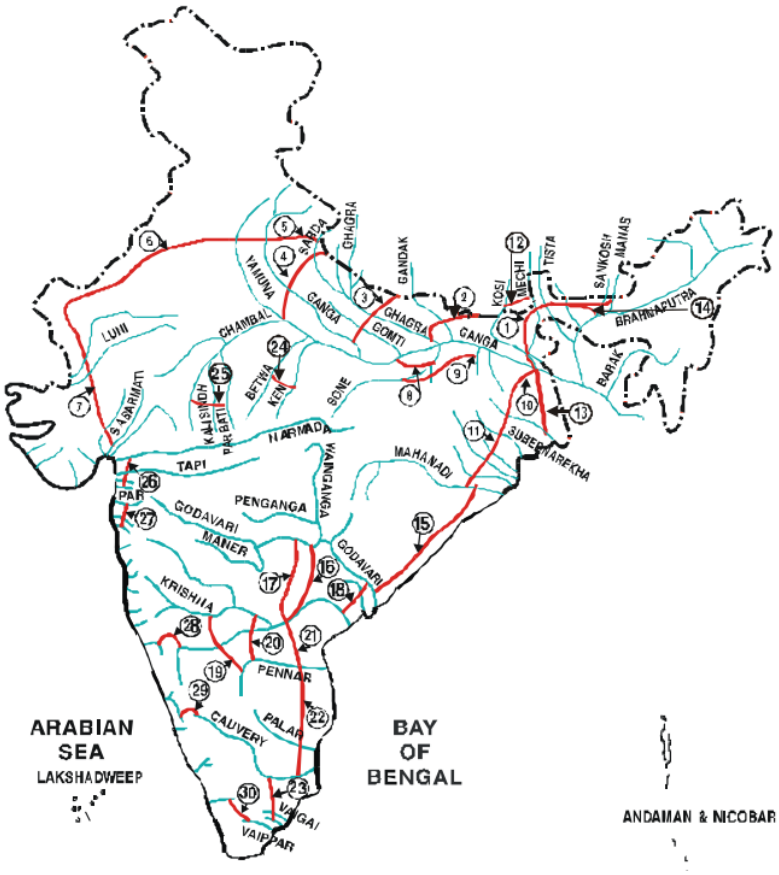
iv. Diversion of other west-flowing rivers

The high rainfall on the western side of the Western Ghats runs down into numerous streams which discharge into the Arabian Sea. The construction of an inter-linking canal system backed up by adequate storages could be planned to meet all requirements of Kerala as also for transfer of some waters towards east to meet the needs of drought-affected areas.

In the proposals of NPP, the transfer of water has been proposed mostly by gravity; lifts were kept minimal and confined to around 120 m and only surplus flood water after meeting all in-basin requirements in foreseeable future has been planned for transfer to water deficit areas.[1]

The complete project is explained in figure 1 and the link-wise benefits are shown in table 1.

Figure 1: Proposed Inter-Basin Water Transfer Link



Source: National Water Development Agency

Table 1: Link-wise Benefits

B.	Himalayan Links				
1	Manas-Sankosh-Tista-Ganga	6.54	5287.0	0	0
2	Jogighopa-Tista-Farakka	5.94	1115.0	1059	216
3	Ganga - Damodar – Subernarekha	8.47	0.0	1278	484
4	Subernarekha – Mahanadi	0.545	9.0	715	0
5	Kosi – Mechi	4.74	3180	0	24
6	Kosi-Ghagara	10.58	0.0	0	48
7	Chunar - Sone Barrage	0.67	0.0	251	0
8	Sone Dam - Southern Tributaries of Ganga	3.07	95.0	0	360
9	Farakka – Sunderbans	1.50	0.0	0	184
10	Sarda – Yamuna	3.75	3600.0	0	6250
11	Yamuna – Rajasthan	2.877	0.0	0	57
12	Rajasthan – Sabarmati	7.39	0.0	0	282
13	Ghagra - Yamuna	26.65	10884.0	0	1382
14	Gandak - Ganga	40.40	3245.0	0	700
Total Benefits from Himalayan Links with the MSTG Link		**117.182**	**26300.0**	**2244**	**9771.0**
Total Benefits from Himalayan Links with the JTF Link		**116.582**	**22128.0**	**3303**	**9987.0**
Total Benefits with the MSTG Link		**164.462**	**28994.5**	**4193**	**11969.2**
Total Benefits with the JTF Link		**163.862**	**24822.5**	**5252**	**12185.2**
Benefits in Nepal		**7.250**	**0.00**	**0.00**	**0.00**
Benefit in India with the MSTG Link		**157.212**	**28994.5**	**4193**	**11969.2**
Benefit in India with the JTF Link		**156.612**	**24822.5**	**5252**	**12185.2**

Sl No.	Link	Annual Irrigation (Lakh Hac.)	Power Generation (MW)	Power Requirement (MW)	Domestic and Industrial Water Supply (Mcum)
A.	Peninsular Links				
1	Mahanadi-Godavari	4.54	966.0	0	0
2	Par-Tapi-Narmada	1.63	32.5	0	0
3	Parbati-Kalisindh-Chambal	2.18	0.0	0	13.2
4	Ken-Betwa	4.97	72.0	0	12
5	Damanganga-Pinjal	0.00	0.0	0	909
6	Godavari (Polavaram)-Krishna (Vijyawada)	5.82	0.0	0	0
7	Godavari (Inchampalli)-Krishna (Nagargunasagar)	3.19	975.0	1705	0
8	Godavari (Inchampalli Low Dam)-Krishna (Nagargunasagar)	6.50	0.0	177	0
9	Krishna (Nagarjunasagar)-Pennar (Somasila)	5.81	120.0	0	0
10	Krishna (Srisailam)-Pennar	0.00	17.0	0	0
11	Krishna (Almatti)-Pennar	2.35	0.0	0	0
12	Pennar (Somasila)-Palar-Cauvery (Grand Anicut)	4.91	0.0	0	1155
13	Cauvery (Kattalai)-Vaigai-Gundar	3.53	0.0	0	109
14	Pamba-Achankovil-Vaippar	0.91	508.0	0	0
15	Bedti-Varada	0.60	4.0	61	0
16	Netravati-Hemavati	0.34	0.0	6	0
	Total Benefits from Peninsular Link	**47.28**	**2694.5**	**1949**	**2198.2**

Source: Task Force on Inter-linking of Rivers Programme

4. Estimated benefits

The entire National River inter-linking project is estimated to give additional benefits of 25 million hectares of irrigation by surface waters, 10 million hectares by increased use of ground water and generation of 40 million kilowatts of power, apart from benefits of flood control, navigation etc. The distinctive feature of the scheme is the transfer of water essentially by gravity and only in small reaches by lifts wherever technically feasible and economically viable.

The technology proposed is already known and tried successfully and does not involve research or experimentation or foreign assistance. Initially, priority is proposed to be given to the development of storage and gravity links in order to exploit maximum benefits of hydro-power generation. State-wise benefits of water for irrigation are estimated as shown in table 2.

Table 2: State-wise benefits of water for irrigation as estimated

State	Additional quantum of water (Million acre feet)	Additional area irrigated (Thousand hectare)
Orissa	6.0	1171
Andhra Pradesh	24.0	4685
Maharashtra	6.5	1269
Karnataka	6.5	1269
Tamil Nadu	12.0	2342
Kerala	5.0	976
Madhya Pradesh	2.5	488
Uttar Pradesh	2.5	488
Gujarat	3.5	683

Source: NWDA

From the Himalayan rivers development, major irrigation benefits would accrue to U.P, Bihar and West Bengal. Substantial benefits would also accrue to M.P. It may also be possible to extend some benefits to Haryana, Punjab, Rajasthan and Gujarat.[1]

5. Methodology

This study was conducted on the basis of secondary data available from various sources along with literature review and then the primary data in the region of Damanganga Pinjal Link. The secondary data was collected from the website of NWDA, magazines, books, newspapers, journals etc. Inthe literature review, research information was collected from 1986 to till date and analysed. All the analysis was done on the backdrop of the guidelines for socio-economic aspects of NWDA. The guidelines aim meaningful assessment of impacts on regional economies; detailed socio-economic analysis of the region with emphasis on project affected and influenced areas in the catchment and command above and below the dam. It analysed the socio-economic goals to be realized and the efficient utilization of increased opportunities available to the people.

Then primary data was collected to understand and analyse the ground level reality on the sampling basis.The focus was on the aspects like an economic, social, cultural and religious environment of the area. The data was collected in the villages affected by Pinjal Dam fall in the remote interiors of the Jawhar-Mokhada forests, under the Damanganga Pinjal Link. Total 11 villages are affected by this link. 131 responses were collected from all 11 villages.

Sample Design

The analysis was done in both the perspectives:

i. Project affected (displaced) areas
ii. Project influenced (benefiting) areas

Around 70% primary data was collected in the project affected area, where people need to displace and around 30 % primary data was collected in the project influenced area, which are the beneficiaries of the link and obviously may not have any objection to the link.

6. Analysis

a) Socio-economic analysis based on the secondary data

The objective of environmental impact assessment and socio-economic studies was to identify the possible environmental and socio-economic effects due to the proposed inter-basin water transfer under inter-linking of rivers and to suggest measures to mitigate or improve the anticipated adverse impacts on the environment or socio-economic aspects.

The study revealed that the proposed inter-basin water transfer under inter-linking of rivers project has enough potential to create positive impacts on the regional and in turn national economy, as one side it will control the adverse effects of floods and on the other side increased agricultural production by way of direct and indirect water supply to deficit area, by canals and ground-water recharge. In some projects, no forest area is coming under submergence and in some projects the forest area coming under submergence isminor. So overall forest area coming under submergence in all projects together is not very significant and hence there will not be any adverse effect on the biodiversity. Rather the flora and fauna of those areas can flourish as floods will be controlled, avoiding damage to the forests.

Many of the projects will not cause any displacement of people and hence Resettlement and Rehabilitation (R&R) issue will not be involved. In few projects, some displacement is likely to happen, which need to be addressed more effectively, to avoid the protest against such projects.

i. Benefits from flood diversion

The total surface water available to India is nearly 1440 million acre feet of which only 220 million acre feet are now being utilized. The rest is flowing waste causing floods and damage. Flood damages occur frequently in lower reaches of most of the major rivers basic. The overall damage to flood can be worked out on the basis of average annual flood damage. As per the simulation studies carried out, the reduction in flood damages to the houses, crops, and public utilities would be of the order of the about 70% of total flood damage. The inter-basin water transfer through inter-linking of rivers has the potential to control the

floods and the damage thereof. Further, the land silting can be controlled and agricultural productivity will be increased. It can also help the government to control other costs on account of flood relief.

ii. Benefits from irrigation

Though the major task of inter-basin water transfer is controlling the damage due to floods, it has the potential to bring a large dry area under irrigation, directly and indirectly. The canals will help direct irrigation and the water percolation on the route will recharge the ground water level and benefit the wells and tube wells. Thus the inter-basin water transfer has ample potential to reduce the vulnerability of agricultural sector to rainfall. It has the potential to boost the horticulture and medicinal plants segment also. It will assist agricultural segment to grow on a sustainable path. A forest can be built on barren land and in turn it will help monsoon. It can also help the government to control other costs on account of drought mitigation.

iii. Infrastructural development

The dams and canal construction will be a major contributing factor in the infrastructural development. A growth in cement, iron and steel sector can be observed. It will also cause transport and communication sector development. It will help the overall economy to grow.

iv. Employment opportunities

All the construction sites in the affected and influenced areaswill boost the direct and indirect employment. This will cause high mid-term employment and few long term employment opportunities. It can further create employment opportunities like agricultural labourers, service sector etc.

v. Allied business

The assured water availability over the year will boost the allied business like fishery, poultry, cattle raising etc. It will create allied businesses in service sector, small shops and services, petty businessmen, too. The fishing generates an income of Rs. 5,000 per month for the locals and main profit goes to the fishing federation of Himachal Pradesh.(Mohan &Lalit, 2004) It can further promote food processing industries. It also has the potential to develop navigation, tourism and built tourist spots, boating etc. This will create an additional opportunity to the farming and improve the quality of life of the rural India.

vi. Benefits from improved quality of life

Improved quality of life will contribute to safe and hygienic conditions and improve on health issues, malnutrition in backward areas. It will reduce pressure and expenditure on medical sector. Improved quality of life will boost educational sector and bring the backward area students into the main stream and can get employment opportunities.

vii. Contribute to the PM's vision

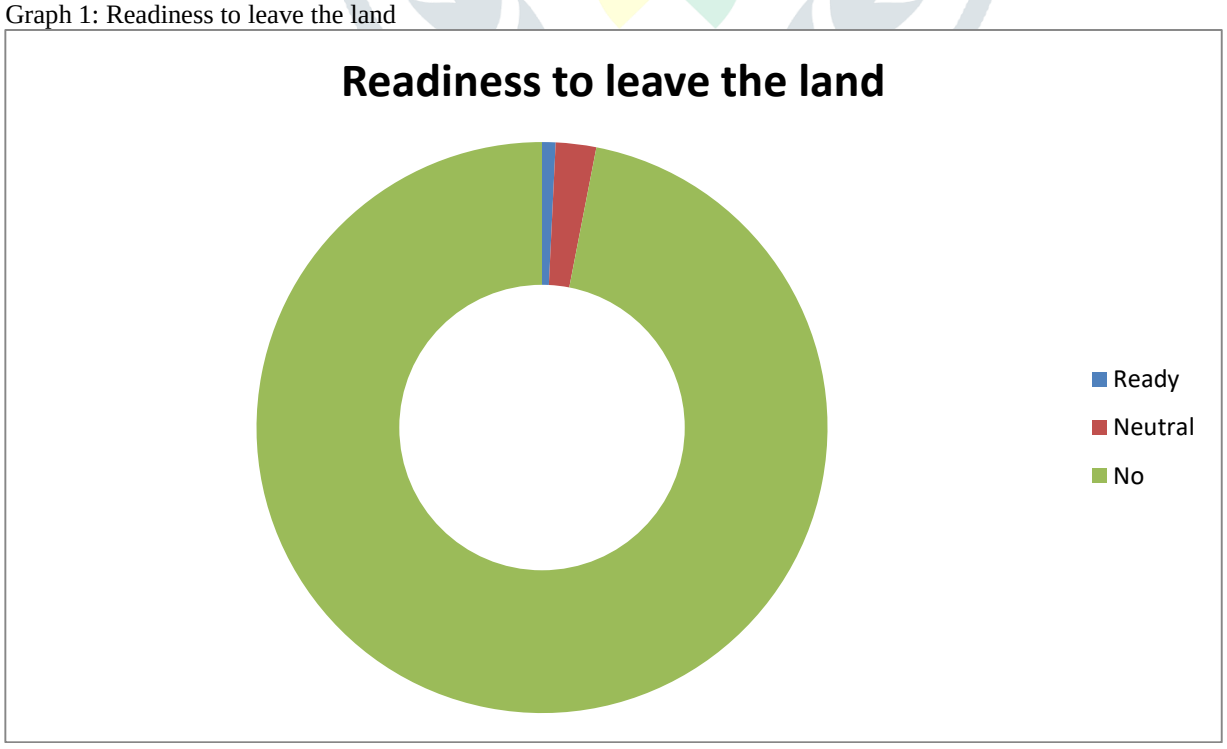
PM and the agricultural minister have the vision to double the agricultural income by 2022. The inter-basin water transfer program has the potential to make agricultural sector sustainable and achieve the vision to double the agricultural income by 2022 and thus boosting the economy.

b) Socio-economic analysis based on the primary data

Table 3: Readiness to leave the land

Aspect	Ready	Neutral	No
Readiness to leave the land	1	3	127

Graph 1: Readiness to leave the land



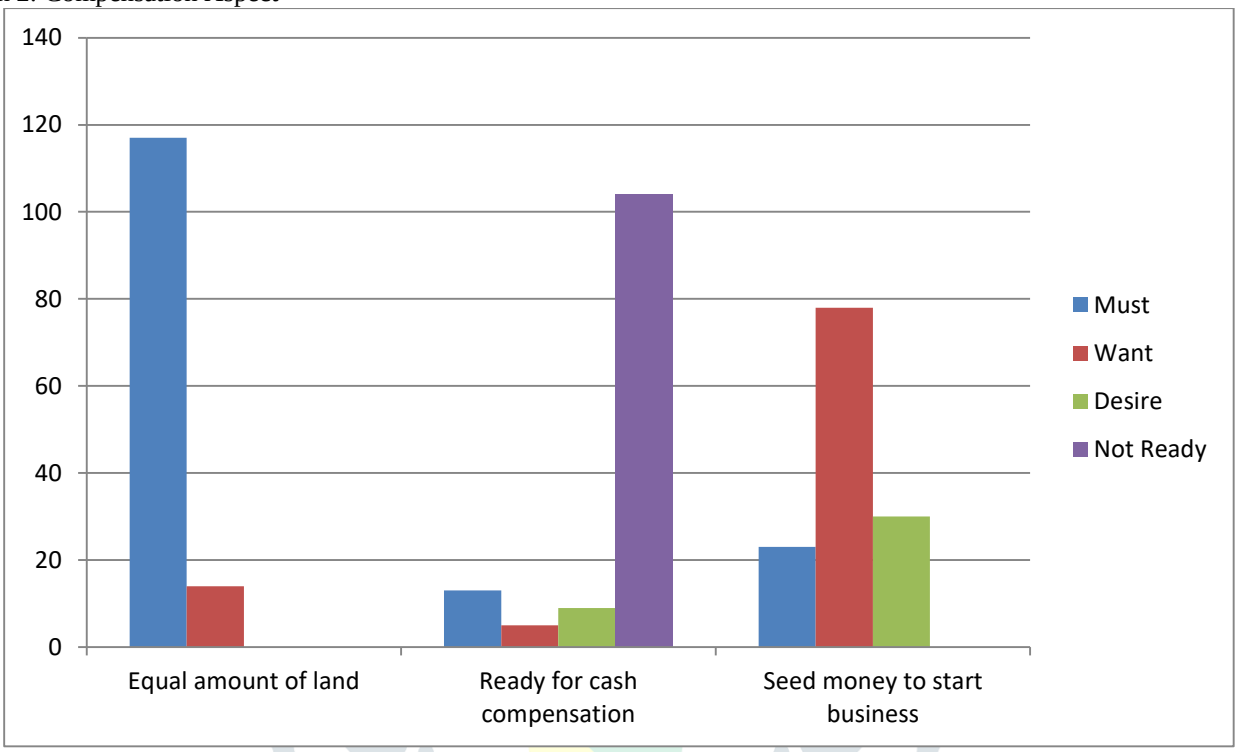
Source: Primary Data

i. As per table 3 and graph 1, most of the respondents have initial apprehension to leave their lands. But after discussion and explaining the effects and benefits of the project, then shown a little positive response on certain conditions.

Table 4: Compensation Aspect

Aspect	Must	Want	Desire	Not Ready
Equal amount of land	117	14	0	0
Ready for cash compensation	13	5	9	104
Seed money to start business	23	78	30	0

Graph 2: Compensation Aspect



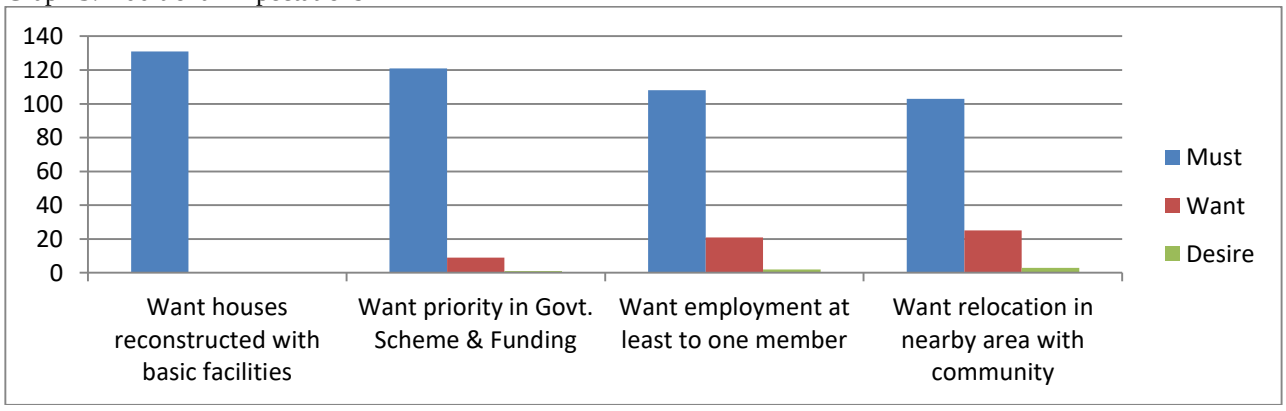
Source: Primary Data

i. As per table 4 and graph 2, most of the respondents want an equal amount of land in the project influenced area
ii. Very few respondents are ready for the cash compensation for their affected land
iii. Many of the respondents expect seed money from the Government to start business or allied industry

Table 5: Additional Expectations

Aspect	Must	Want	Desire
Want houses reconstructed with basic facilities	131	0	0
Want priority in Govt. Scheme & Funding	121	9	1
Want employment at least to one member	108	21	2
Want relocation in nearby area with community	103	25	3

Graph 3: Additional Expectations



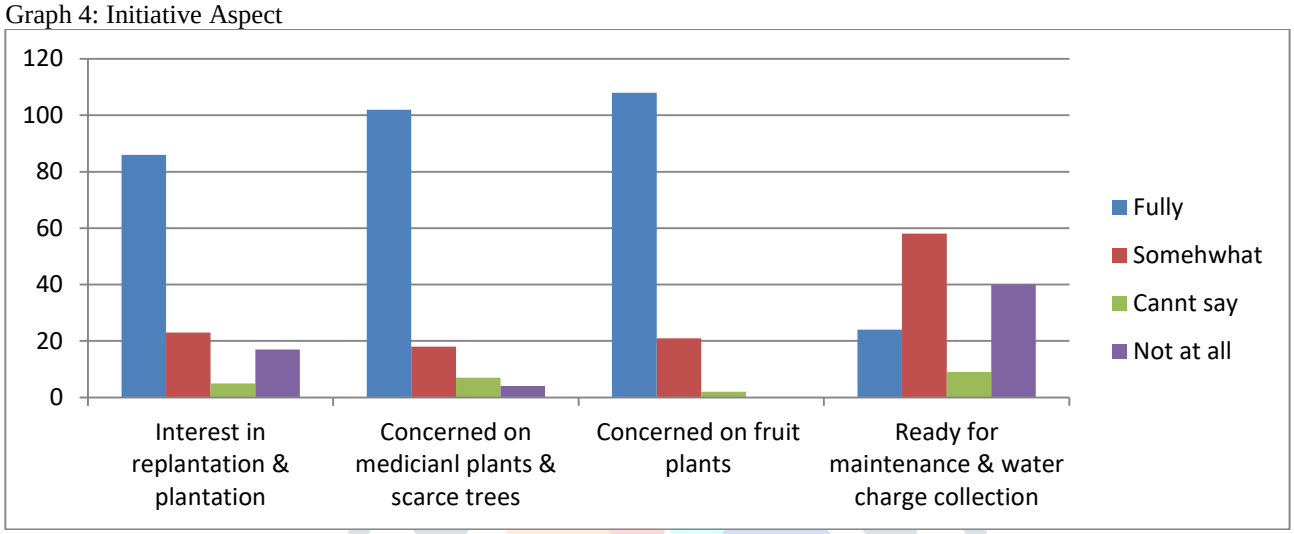
Source: Primary Data

i. As per table 5 and graph 3, all the respondents want their houses reconstructed by Government with basic facilities
ii. Most of the respondents expect priority in the government's schemes and funding.
iii. Most of the respondents want employment to one member at least of the affected family
iv. Most of the respondents want relocation in the nearby area along with their community.

Table 6: Initiative Aspect

Aspect	Fully	Somewhat	Can't say	Not at all
Interest in replantation & plantation	86	23	5	17
Concerned on medicinal plants & scarce trees	102	18	7	4
Concerned on fruit plants	108	21	2	0
Ready for maintenance & water charge collection	24	58	9	40

Graph 4: Initiative Aspect



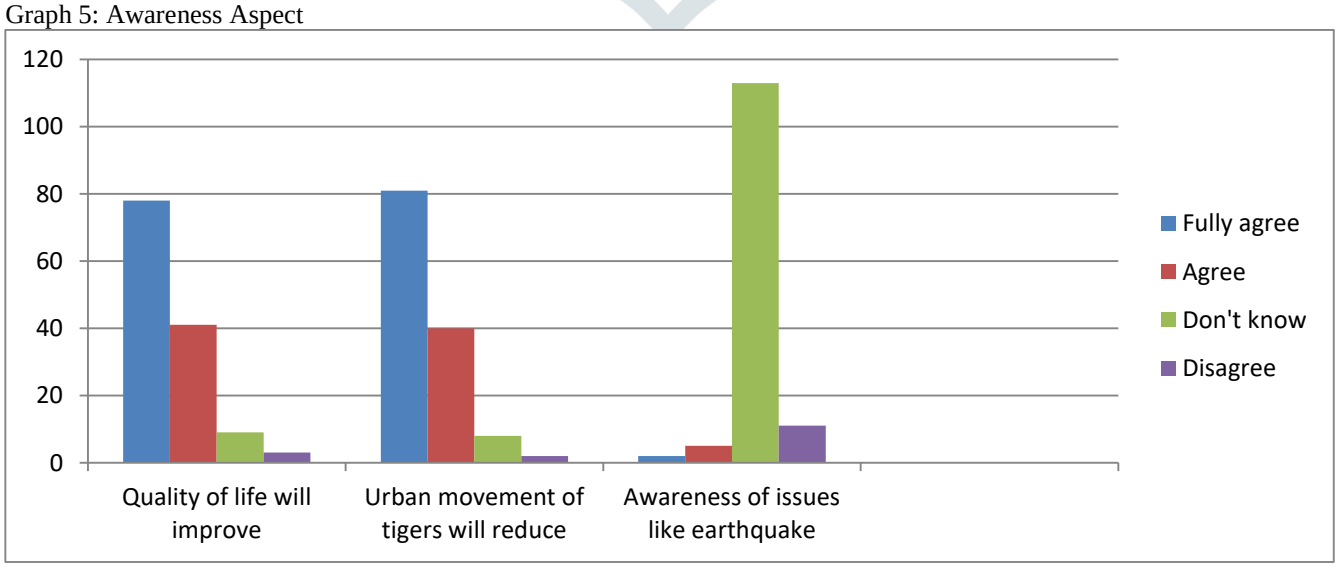
Source: Primary Data

i. As per table 6 and graph 4, a majority of the respondents shown a keen interest in replantation and new plantation
ii. Manyof the respondents shown concern on the medicinal plants and scarce species of trees in the submergence area.
iii. Many of the respondents shown concern on the fruit plants
iv. Few of the respondents are ready to take care of maintenance of the canals and collection of water charges.

Table 7: Awareness Aspect

Aspect	Fully agree	Agree	Don't know	Disagree
Quality of life will improve	78	41	9	3
Urban movement of tigers will reduce	81	40	8	2
Awareness of issues like earthquake	2	5	113	11

Graph 5: Awareness Aspect



Source: Primary Data

v. As per table 7 and graph 5, most of the respondents feel that their quality of life will improve because of the project.

i. Majority of the respondents feel that the tiger movement in the urban areas will get restricted after completion of the project and forest are re-grown.

ii. Most of the respondents are unaware of the presumed issues like converting the area earthquake prone because of dams and reservoirs (as Koina).

7. Conclusion & Prospects

This will be one of the greatest water development projects in the world if completed successfully. This will cause construction of about 150 million acre-feet water storage. The inter-basinwater transfer will enable utilization of nearly 170 million acre-feet water for beneficial use in the country, irrigating additional 35 million hectares of fields and generating about 40 million kilowatts of hydro-power capacity. Damage control due to floods control will be add-on benefit. The inter-basin water transfer through inter-linking of rivers will enable availability of water to the fields, villages, towns and industries throughout the year, even while maintaining environmental purity to combat with both flood and drought simultaneously.

It is already planned to have R&R plan like free residential plots, house building assistance, grant for cattle shed, civic amenities like domestic water, electricity, school, playground, children park, healthcare centers, place of worship, community hall, sanitation, drainage, approach roads, public transport, place of funeral etc. After such detailed care and provision, it should not be difficult to convince the people affected and implement the project successfully.

The advantage India has is that the technology proposed is already known and tried successfully and does not involve any research or experimentation or foreign assistance. The experience of Pakistan in the area of interlinking of the rivers could be as inspiration for India. Pakistan built a network of river links as a part of Indus treaty works, which functions as replacement links to irrigate those areas, which after partition got deprived of irrigation when three eastern rivers of Indus system were allocated to India. Pakistan built ten links, six barrages, and two dams during the post-treaty period of 1960-70. Most of the links are unlined channels. The total length of the links is 899 km and built at a cost of Rs. 400 crore. These links have the aggregate capacity of 140,500 cusecs.(Dhillon, 2003)

The analysis carried out in the current study shows that the inter-basin water transfer program has the potential to increase the growth rate of the overall economy, through construction, agricultural, horticultural, medicinal plantation, and allied agri-businesses. It will indirectly boost education, medical, communication, and transport sector. Direct and indirect employment will boost.

The benefit cost ration of all the projects range from 1.54 to 3.66 and the IRR (Internal Rate of Return) range from 13% to 27%, considering 100 years life of the project. Thus the project has potential to recover the cost in 6-7 years. Government of India is very serious about the project and hence has constituted a task force to examine the project, comprising experts from all aspects like engineering, science, social science, economics and each involved state's members. The completion date for the project is December 31, 2016.

Still, focused group discussion and counseling to all the villagers in the project affected area need to be carried out. An effort has to be done to create awareness and increase stakeholders' participation for thesense of ownership. The impact on forest cover, rare, endangered and threatened species and impacts on wildlife such as corridor loss including birds should be done. Compensatory afforestation measures and bio-diversity conservations measures need to be taken on priority. The impact on aquatic ecology and impact on migratory fish species also need to be taken in hand. This is very crucial for the success of the project.

Notes: www.nwda.gov.in

References:

- Amarasinghe, U. (2009). *CPWF Project Number 48: Startegic Analysis of India's National River Linking Project.* CGIAR Challenge Program on Water and Food Project Report Series.
- Amarasinghe, U. (2012). *Water Policy Research Highlights - 16.* Anand, Gujrat: IWMI-TATA Water Policy Program.
- Bandyopadhyay, J., & Sharma, P. (2004). Interlinking of Rivers in India. *Economic & Political Weekly*.
- Chaturvedi. (2000).
- Dhande, S., & Ghodke, P. R. (2011). Automobile Business- Growth independent of Monsoon? *KRSCMS Journal of Mangement*, 1-5.
- Dhillon, G. S. (2003, June 29). The Tribune. *The Pakistani Experience*, p. 1.
- Iyer, R. (2002, November 16). Linking of Rivers: Judicial Activism or Error? *Economi and Political Weekly*, p. 3.
- Krueger, K., Segovia, F., & Toubia, M. (2007). Assessment of India River Linking Plan: A Closer Look at the Ken-Betwa Pilot Link 1. *Interlinking of Rivers in India: Issues and Challenges*, p. 169.
- Kumar, M. D., Amarasinghe, U. A., Sharma, B., Trivedi, K., Singh, O., Sikka, A., et al. (2009). *Water productivity improvements in Indian agriculture: potentials, constraints and prospects.* 163: Strategic Analyses of the National River Linking Project (NRLP) of India Series 5.
- Mehta, D., & Mehta, N. (2013). Interlinking of Rivers in India: Issues & Challenges. *Geo-Eco-Marina 19*, 137-143.
- Misra, A., Saxena, A., Yaduvanshi, M., Mishra, A., Bhaduuriya, Y., & Thakur, A. (2007). Proposed River-Linking Project of India: a boon or bane to nature. *Enviornmental Geology, 51(8)*, 1361-1376.
- Mohan, & Lalit. (2004, May 22). From Farmers to Expert Fishers. *The Tribune*, p. 1.
- Pahl-Wostl, C. (2007). Transition towards adaptive management of water facing climate and global change. *Water Resource Management*, 49-62.

- Rayate, P., Dhande, S., & Mahanubhav, M. (2013). Government's Agricultural economic initiatives and challenges ahead. *KRSCMS Journal of management*, 26-30.
- Rosegrant, M. W., Cai, X., & Cline, S. (2002). *World water and food to 2025: dealing with scarcity.* International Food Policy Res Inst.
- Satpute, G., & Desale, S. (2014). Realistic Information System for Effective Awareness of Agri-initiatives. *IBMRS's Journal of Management & Research, 3(2)*, 70-76.
- Shah, T., & Raju, K. (1987, March 23). Working of Groundwater Markets in Andhra Pradesh and Gujrat: Result of Two Villages Studies. *Economi & Political Weekly*, p. 2.
- Shah, T., & Singhe, U. M. (2007). India's River-Linking Project: The States of the Debate. *IWMI-CPWF Project on Startegic Analyses of India's National River-Linking Project* (p. 3). Colombo, Sri Lanka: International Water Management Institute.
- Shiva, V., & Jalees, K. (2003). Living Waters, the impact of the river linking project. *Sujalam Pub. Navdanya*, p. 3.
- Shukla, A., & Asthana, V. (2005). *Anatomy of Interlinking Rivers in India: a decision in doubt.* Urbana-Champaign: University of Illinois .
- Verghese, B. (1990). Water of hope: Himalayan-Ganga development and cooperation for a billion people. *Oxford & IBH Publishing House*, p. 2.