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A CASE STUDY TO INCREASE THE BENEFITS ON INTERLINKING OF PAR-TAPI-NARMADA LINK PROJECT

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ABSTRACT

The complexity of uneven distribution of rainfall in time and space necessitates need for storages and transfer of water from water surplus region to water deficit regions. The ILRP advocates diversion of water outside command area of catchment up to storage site to fill up gap between availability and requirements of water. The research is aimed to conduct critical analysis of project benefits, Irrigated area, quantum of water to be transferred and enhancement of benefits of one of interlinking project viz Par-Tapi-Narmada link basic genesis of feasibility level proposal of Par-Tapi-Narmada link. An attempt has been made to review the proposal at Feasibility Stage and suggest measures for improvement. The Par-Tapi-Narmada Link ILR proposal at Feasibility Stage (2005) was finalized with diversion of 1350 MCM of water out of which a major portion was used for supplementing Narmada Command and later use of saved water by substitution in Narmada Command of Saurashtra and Kutch. The cost of Rs. 60,164 Million was mainly for 7 Dams and 400 km long canal only. Thus, there was a need to optimize benefits by using better irrigation techniques. At that time perhaps there was less or no practice of micro irrigation in Project Command which could have served 169 thousand hectares in less or no water thus making more water available for target command in Saurashtra and Kutch region. There is possibility of optimizing water utilization by reducing irrigation intensity in enroute command. Reduction of water can be done by deleting dams and B-C ratio can be increased from 1.08 to 1.29 as observed in various combinations. Therefore, there is need for re considering 7 dams in position and adopting 5 to 6 dams. An introduction of micro irrigation in the command area by switching over from gravity flow irrigation increases the Benefit Cost ratio of the project considerably. The B C ratio goes on increasing with the increase in percentage of micro irrigation. While working out the same, the yield/benefits of the crops have been kept as per FR. In addition to above, possibility of mitigation of climate change and generating solar power at top canal has been explored.

KEYWORDS : Rivers interlinking, Par-Tapi-Narmada Link Project, Micro irrigation, Solar power.

INTRODUCTION

General

The complexity of uneven distribution of rainfall in time and space necessitates need for storages and transfer of water from water surplus region to water deficit regions. Here, it is also emphasized that Interlinking of Rivers Project is nothing but alike normal water resources Projects which are having depending upon type of utilizationcanal or piped network in own command area. The ILRP advocates diversion of water outside command area of catchment up to storage site to fill up gap between availability and requirements of water.

The National Perspective Plan (NPP) of Government of India

The ILRP was conceptualized by Government of India in 1980 as a National Perspective Plan of Water Resources Project which included two components

of Himalayan and Peninsular are shown in Table 1. (NWDA FR 2005)

The Peninsular component of ILRP include 16 links out of which 2 links namely Par-Tapi-Narmada Link and Damanganga-Pinjal Link benefiting and concerning Gujarat and Maharashtra States in western India. The present paper is concentrating impact of Change in Irrigation Pattern on4 priority Interlinking of Rivers Projects. Projects selected are Par-Tapi-Narmada, Ken-Betwa Phase-I&II, Kosi-Mechi and Godavari-Krishna Link. The present analysis pertains to Par-Tapi-Narmada link.

RESEARCH METHODOLOGY

The case study has been done to critically examine the Par-Tapi-Narmada Link Feasibility Report and suggest measures to enhance its viability.The study is an analytical research work. First the Project proposed head works link canal, water transfer, command area benefits costs and internal rate of return etc. Thereafter detailed analysis has been done to maximise project parameters. The broad parameters are reduction in irrigation intensity increase in command, cost, cost per MCM storage of 7 Dams-possibility of now reducing storage dams in various combinations and visualising impacts and step by step introduction of micro irrigation in thecommand area replacing gravity flow irrigation increasing crop yield and impact on Benefit-Cost Ratio and IRR of the project considerably. In addition to above, possibility of generating solar power at top canal has been explored.

RESULTS AND DISCUSSION

PAR – TAPI – NARMADA LINK PROJECT SURVEY

Par-Tapi-Narmada Link at Feasibility Stage

For any water resources project including ILRP the steps in framing out any project include preparation

Table 1. National Perspective Plan of Water Resources Project

S.no.	Himalayan component	Peninsular component
1	Manas-Sankosh-Tista-Ganga	Mahanadi (Manibhadra)-Godavari (Dowlaiswaram
2	SoneDam – Southern Tributaries of Ganga	Godavari (Inchampalli)-Krishna (Pulichintala)
3	Kosi-Ghagra link	Godavari (Inchampalli)-Krishna (Nagarjunasagar)
4	Gandak-Ganga	Godavari (Polavaram)-Krishna (Vijayawada)
5	Ghagra-Yamuna	Krishna (Almatti)-Pennar
6	Sarda-Yamuna	Krishna (Srisailam)-Pennar
7	Yamuna-Rajasthan	Krishna (Nagarjunasagar)-Pennar (Somasila
8	Rajasthan-Sabarmati	Pennar (Somasila)-Cauvery (Grand Anicut)
9	Chunar-Sone Barrage	Cauvery (Kattalai)-Vaigai-Gundar
10	Ganga-Damodar-Subernarekha	Ken-Betwa
11	Subernarekha-Mahanadi	Parbati-Kalisindh- Chambal
12	Kosi-Mechi	Damanganga-Pinjal
13	Farakka-Sunderbans	Par-Tapi-Narmada
14	Jogighopa-Tista-Farakka (Alternative to Sl. No.1)	Bedti-Varada
15		Netravati-Hemavati
16		Pamba-Achankovil-Vaippar

Table 2. Divertible quantum of water in Par-Tapi-Narmada Link ((NWDA FR 2005))

Sl. No.	Storage	River	Divertible water yield in Million Cubic Meter (MCM)
1.	Jheri	Par	242
2.	Mohankavchali	Par	137
3.	Paikhed	Par	212
4.	Chasmandva	Auranga	76
5.	Chikkar	Ambica	146
6.	Dabdar	Ambica	267
7.	Kelwan	Purna	270
	Total	1350 MCM	

of pre-feasibility/feasibility reports based on secondary data and preparation of Detailed Project Report based on primary data to establish the viability of link project.

The project envisages link canal backed up by storages to interlink west flowing rivers from Mumbai to Tapi and transfer water for needy areas of Mumbai (Southward) and Narmada (Northward) to Saurashtra and Kutchh area of Gujarat. During preliminary feasibility studies (1990) it was established that water can be stored in dams proposed on Damanganga River to be transferred to needy areas of Mumbai city and seven Dams from small rivers excluding Damanganga to Tapi and transferred to needy areas en-route canal and Tapi by link canal cover command of existing Sarda Sarovar Narmada Project by substitution. The arrangement was twin links concerning and benefitting both Gujarat and Maharashtra States. The Par-Tapi-Narmada Link Project at PFR level was planned to link (i) Par river in Par basin with Tapi river near existing Ukai Dam on Tapi river through seven storage Dams, weirs, 185km link Canal. (ii) To link Tapi river in Tapi basin with Narmada river by 173km link terminating at RD 39.60 km of existing Miyagam branch of Sardar Sarovar Narmada canal. The water diverted at Miyagam branch will be used in extension of irrigation in Kutch and Saurashtra area through substitution. The pre-feasibility study proposal was later found suitable for taking up feasibility studies. The feasibility studies were first carried out in 1995 and later revised in 2005as it was established that Tapi river up to Ukai Dam is not having surplus water thus, it is not possible to divert water from existing Ukai reservoir, thus total diversion 1350 MCM only. The revised reach wise length of canal and irrigation benefits are tabulated below. Seven Dams were proposed at FR level and a

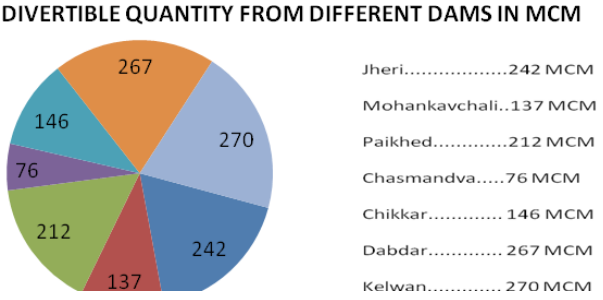

Fig. 1. Divertible Quantity from Different Dams in MCM

400 km long canal connecting Par toTapireach-I and Tapi to Narmada 190 Km was proposed. The details of reservoirs in the project and divertible water yield based upon simulation studies. The abstract of CCA and area to be irrigated and at FR stage and Cost and Benefits from Par-Tapi-Narmada Link (FR 2005) are tabulated below.

Table 3. Benefits from Par-Tapi-Narmada Link (FR 2005)

Sl. No.	Reach	Canal Capacity	CCA (ha.)	Irrigation (ha.)	Irrigation intensity	Hydro Power generation (Million KWH)
1.	Par-Tapi	44 to 91 Cumecs	17411	21764	125%	93
2.	Tapi-Narmada	71 to 45 Cumecs	23940	29925	125%	
3.	Sub-Total		41351	51689	125%	
3.	Target Narmada Command	–	147063	117650	80%	
	Total		188414 ha	169339 ha	—	93

Table 4. Abstract of cost

Unit	Description	Cost
Unit I	Head works	Rs. 26122 Million
Unit II	Canal and Canalization	Rs. 31539 Million
Unit III	Power Generation	Rs. 2504 Million
Unit IV	Navigation	—
Unit V	Water Supply	—
Unit VI	Command Area Development	Rs. 6708 Million*
Total	Rs. 60164 Million	

*Included in Unit II

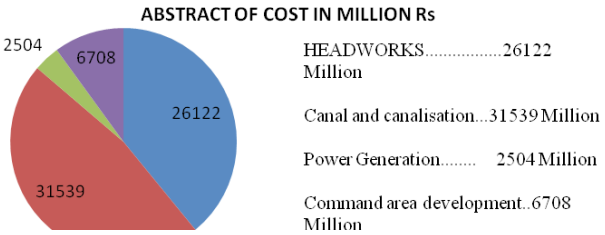

Fig. 2. Abstract of Cost in Million Rs

Annual cost	Rs.12236 Million
Annual benefit	Rs.12659 Million
Benefit Cost Ratio	1.082%
IRR	8.82%

Review of Proposal at Feasibility Stage and need for improvement

So far, we have discussed basic genesis of feasibility level proposal of Par-Tapi-Narmada link. While PFR was elementary study, FR was based on surveys and investigations and found fit for preparation of Detailed Project Report. An attempt has been made to review the proposal at Feasibility Stage and suggest measures for improvement. The Par-Tapi-Narmada Link ILR proposal at Feasibility Stage (2005) was finalized with diversion of 1350 MCM of water out of which a major portion was used for supplementing Narmada Command and later use of saved water by substitution in Narmada Command of Saurashtra and Kutch. The cost of Rs. 60,164 Million was mainly for 7 Dams and 400 km long canal only. Thus, there was a need to optimize benefits by using better irrigation techniques. At that time perhaps there was less or no practice of micro irrigation in Project Command which could have served 169 thousand hectare in less or no water thus making more water available for target command in Saurashtra and Kutch region

Analysis of Par-Tapi-Narmada Link Proposal and scope of improvement

The paper mainly concentrates study and analysis of available material at PFR/FR/DPR stage, what has been done and what to be done, review of existing papers done at preliminary stage by Author.

1. Review of existing Papers on Par-Tapi-Narmada Link
   i) R.K. Jain (2019) has advocated needs of canal top solar power to increase benefits and reduce evaporation losses.
   ii) Kumar (2016) studied the Sardar Sarovar Project on river Narmada considering it as a land mark case in ILR. He advocated utilization of saved water in SSP in upper areas in MP and diverted through Par-Tapi-Narmada Link needs to be utilized to benefit the drought prone areas of Gujarat.
   iii) Jain and Gupta (2017) have also stressed the need of implementation of Par-Tapi-Narmada Link.
   iv) Jain (2017) studied the need of Inter Basin Water Transfer for development of country-ILR for Gujarat and Maharastra with specific reference to Par-Tapi-Narmada Daman Ganga Pinjal Links. The two proposals i.e., Par-Tapi-Narmada and Damanganga-Pinjal link projects formulated by NWDA will provide immense benefits to Gujarat and Maharashtra.
2. Analysis of project benefits, Irrigated area, quantum of water to be transferred and enhancement of benefits.
3. Need of measures to increase irrigation efficiency and adoption of micro

Irrigation and EIA issues/measures for

Table 5. Savings in water requirement adopting lower irrigation intensity

Annual irrigation intensity (%)	Water utilization (MCM)
125	1350
100	1274
90	1213
80	1138
70	1032

S. No.	Name of command	Water requirement 125% irrigation intensity	Water requirement 80% irrigation intensity	Saving
1.	Enroute Command Par-Tapi reach	193.70	119.78	73.92
2.	Enroute Command Tapi-Narmada reach	266.33	164.71	101.62
	Grand Total	460.03	284.49	

mitigation of flood and drought benefits and impact of Project in climate change scenario.

Savings in water requirement adopting lower irrigation intensity in enroute command area

Presently the irrigation intensity in enroute areas of Par-Tapi and Tapi-Narmada reaches of Par-Tapi-Narmada link is 125% against 80% in Target Narmada Command. In case this is kept 80% in all command, there will be saving of 175 MCM as detailed at Annex-1.2. The saving of 175 MCM can be used to provide additional irrigation of 20412 MCM. Otherwise out of 7 dams proposed in Par-Tapi-Narmada link, possibility of omitting one dam having higher cost per MCM storage can be done. The abstract of saving is tabulated below:

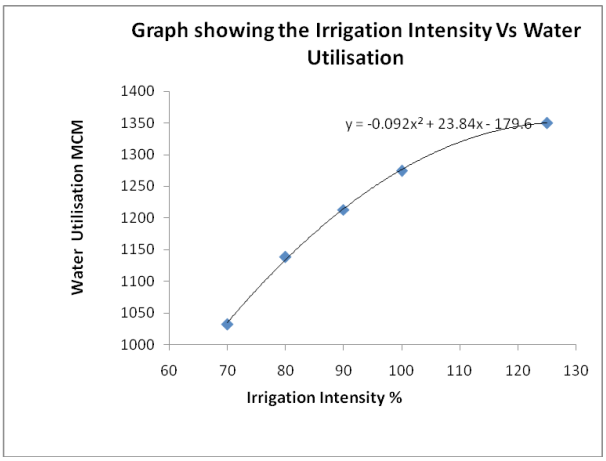

Fig. 3. Irrigation Intensity Vs Water Utilisation

Based on the Table 5 and Fig. 3 results. It is evident that these kind interlinking projects will help to reduce the water scarcity and cost of maintenance of reservoir/dam will get reduced and also it help in increasing the irrigation intensity and effective water utilisation till the down reach also possible. So it claear from the outcome that interlinking of river is viable alternative to manage the water crisis.

CONCLUSION

- There is possibility of optimizing water utilization by reducing irrigationintensityin enroute command.
- Reduction of water can be done by deleting dams and B-C ratio can be increased from 1.08 to 1.29 as observed in various combinations. Therefore, there is need for re considering 7 dams in position and adopting 5 to 6 dams.:
- An introduction of micro irrigation in the command area by switching over from gravity flow irrigation increases the Benefit Cost ratio of the project considerably. T
- The B C ratio goes on increasing with the increase in percentage of micro irrigation. While working out the same, the yield/benefits of the crops have been kept as per FR. However, due to introduction of micro irrigation, the yield of crops may also increase.
- Possibility of increasing crop yield per hectare in Post Dam Scenario needs also to be explored.
- Possibility of utilizing unused storage of existing Ukai Reservoir needs to explore.

SUGGESTION FOR FURTHER WORK

Further confirmed Par-Tapi-Narmada Link is one of Project under ILR. Similar analysis needs to be done for other ILR Projects.

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