Linking River Basins for Agriculture Development: Insights from India

S. Puttaswamaiah
Dept. of Economics, Bangalore University,
Bangalore, INDIA

K. Lenin Babu
Institute for Social & Economic Change,
Bangalore, INDIA

K. V. Raju
Institute for Social & Economic Change,
Bangalore, INDIA

- Water, elixir of life, plays a significant role in development
  - as a resource, input, consumption item, also an environmental assimilator
  - availability and access to safe drinking water indicates public health status
  - agriculture and industrial growth, directly and indirectly depends on water resource
  - water as an input plays a pivotal role in agriculture development
  - as agriculture also depends on other environmental factors, role of water as an environmental resource needs to be stressed

Demand for water

- increasing
- diversified

Water Requirements for various purposes (In billion cubic metres) in India

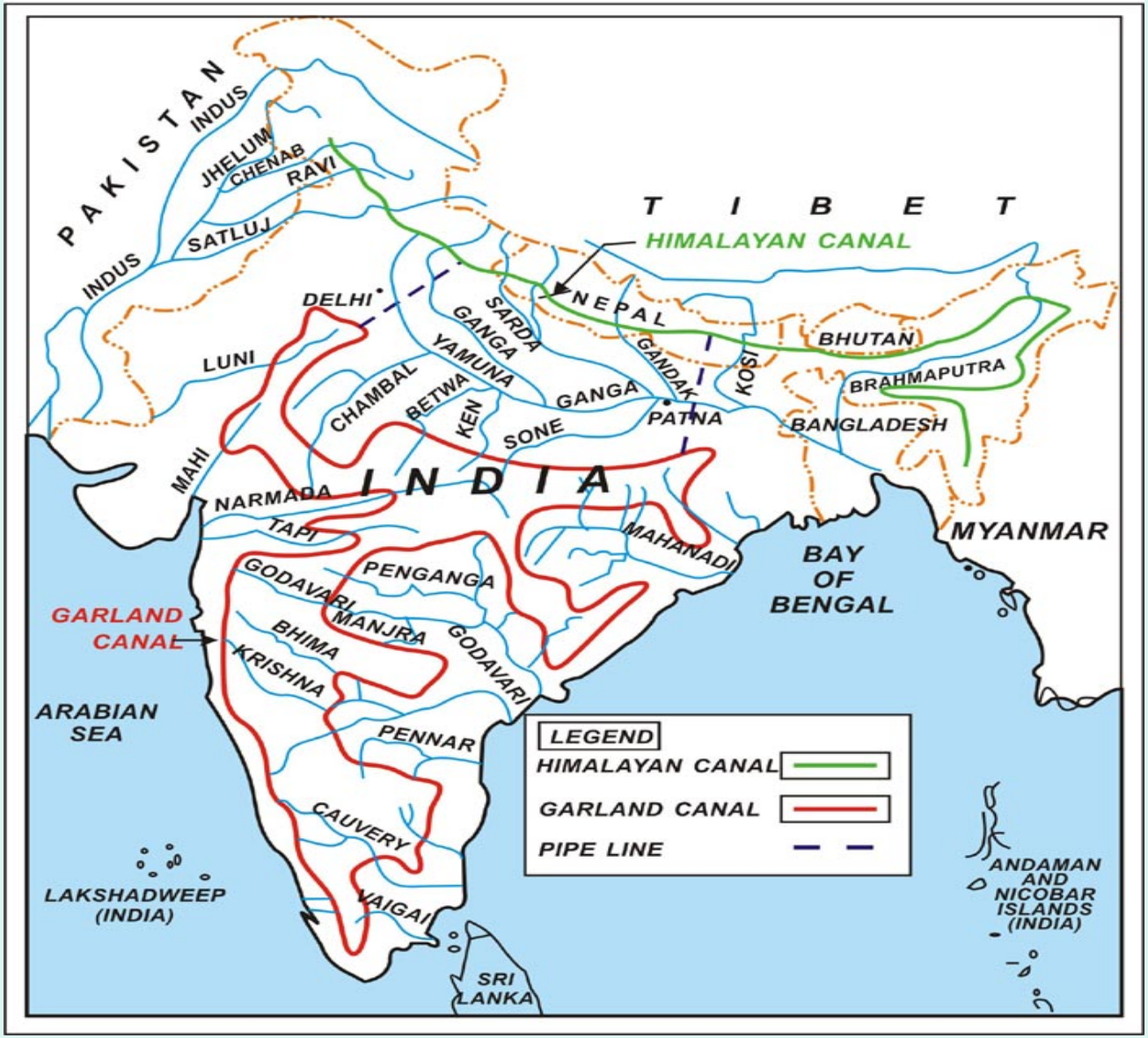
Purpose	Demand in 2000	Demand in 2010	Demand in 2025
Domestic use	42	56	73
Irrigation	541	688	910
Energy	8	12	23
Industrial Use	2	5	15
Others	41	52	72
Total	634	813	1093

Source: Report of 10th Five Year Plan (2002-07)

- Increasing demand compels to find alternative sources of water
- Inter-basin water transfer, one of such alternatives
- Debate on inter-basin transfer of water, in India after independence, started in 1970's
  - Initially, in 1972 the idea of interlinking of rivers by connecting the Ganga with the Cauvery River (National Water Grid)
  - In 1977, discussion on the concept of a "Garland Canal" around the Himalayan, Central and Peninsular India
  - In 1980's a National Perspective Plan constituted to examine water resources development envisaging inter-basin transfer of water from surplus basins to deficit ones
    - Objective - to minimize regional imbalances and optimally utilize available water
  - In 2007, the National Water Convention also recommended that inter-basin transfer of water is an inescapable necessity for the future


DR. K.L. RAO'S PROPOSAL
JAMMU AND KASHMIR
SRINAGAR
HIMACHAL PRADESH
SIMLA
PUNJAB
CHANDIGARH
HARYANA
DELHI
UTTAR PRADESH
LUCKNOW
Yamuna
Ganga
RAJASTHAN
JAIPUR
CHAMBAL
PATNA
BIHAR
SIKKIM
GANGATOK
ARUNACHAL PRADESH
ITANAGAR
Brahmaputra
ASSAM
GAUHATI
NAGALAND
KOHIMA
SHILLONG
MEGHALAYA
MANIPUR
IMPHAL
BANGLA DESH
TRIPURA
AGARTALA
AIZAWAL
MIZORAM
WEST BENGAL
CALCUTTA
GUJARAT
GANDHI NAGAR
BHOPAL
MADHYA PRADESH
Narmada
Tapi
Mahanadi
BHUBHANESHWAR
ORISSA
MUMBAI
MAHARASHTRA
Godavari
Krishna
ANDHRA PRADESH
HYDERABAD
ARABIAN SEA
GOA
Krishna
Pennar
BAY OF BENGAL
KARNATAKA
BANGALORE
CHENNAI
Cauvery
KERALA
TAMILNADU
TRIVANDRUM
INDIAN OCEAN
LEGEND
INTERNATIONAL BOUNDARY
STATE BOUNDARY
STATE CAPITAL
RIVER
LINK CANAL
RIVER REACH
GANGA CAUVERY LINK

CAPTAIN DASTUR'S PROPOSAL



- In India, states like Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Kerala have undertaken inter-basin water transfer projects
  - to meet demand for irrigation, drinking water supply and also industrial use
- Gujarat State implemented a irrigation project, namely Sujalam Suphalam Yojana
- Project inter-links river basins through a canal, transferring surplus water during rainy season from South Gujarat river basins to that in North Gujarat
  - to meet water demand for agriculture, domestic
  - to address problems arresting groundwater depletion by recharging groundwater

Sujalam Suphalam Project

- A major irrigation project initiated by Gujarat Government
  - To provide water for water scarcity areas – Irrigation; drinking water
  - Groundwater recharge
- Started in 2005
- During the study - implementation stage
- Covering
  - North Gujarat (6 districts) – package I
    - Diverting excess water during monsoon through a canal (SSY canal - 337 Kms. Long), from Kadana Reserviour on River Mahi
    - Lifting water (14 lifting stations) from Narmada Main Canal to SSY canal, and other command areas like Darohi
    - Construction of check dams

Surendranagar – Package – II

- Construction of check dams (over 100) on rivers
- Filling them with water from Narmada Main Canal, to supply water during summer season for agriculture, livestock and drinking water

– Kuchchh – Package III

- Construction of check dams, bandharas, etc.

– Pachamahal and Dahod – Package – IV

- Construction of check dams, lift irrigation

Teams in the study

1. Hydrological and other Technical aspects

– Water Resources Engineering and Management Institute (WREMI), M. S. University, Baroda, Gujarat

2. Social, Economic and Ecological aspects

– Institute for Social and Economic Change, Bangalore, Karnataka, (based on WREMI calculations on hydrology and other technical aspects)

Objectives:

- To estimate the impacts on groundwater recharge, socio-economic and ecological conditions
- At implementation stage and after completion of the project
- To examine the issue of water pricing

- Present study examines issues related to North Gujarat Package of SSY

North Gujarat Region - Present

- 57% population - rural,
- upto 44 % households - BPL (Mehsana highest poverty)
- Agriculture
  - 23% cultivators, 21% labourers,
  - average land holding 2.5 ha
- 85% area sown once, 16% sown more than once, - indicate scarcity of water
- 44% of area under food grains – bajra and wheat
- Ground water table declining fast
- Fodder – chronic shortage
- Soil prone to erosion

Intervention

Stage	Interventions	Districts covered
I	Construction of Sujalam Suphalam Spreading Canal	Sabarkantha, Ahmadabad, Gandhinagar, Patan, Banaskantha, Mehsena
	Pipelines to Dharohi, Guhai and Hathmath reservoirs	Mehshana, Gandhinagar, Patan
II	Pipelines	Mehsana, Patan and Gandhinagar
III	Pipelines to Dantiwada, Sipu and Tharad- Dhanera	Banaskantha
IV	Pipelines to Hathmati, Guhai, Watrak and Mashwo dams	Sabarkantha
V	Checkdams	Sabarkantha – 2890, Banaskantha - 1430, Mehsana – 61, Patan -33

Budget Rs. 4,909 crores


INDIA
States and Union Territories
N
TAJIKISTAN
AFGHANISTAN
PAKISTAN
CHINA
TIBET
NEPAL
BHUTAN
BANGLADESH
MYANMAR
SRI LANKA
Srinagar
JAMMU & KASHMIR
HIMACHAL PRADESH
Shimla
Chandigarh
PUNJAB
Dehradun
UTTARAKHAND
HARYANA
DELHI
Jaipur
RAJASTHAN
UTTAR PRADESH
Lucknow
SIKKIM
Gangtok
Itanagar
ARUNACHAL PRADESH
Dispur
Shillong
ASSAM
(Asom)
NAGALAND
Kohima
MEGHALAYA
Imphal
MANIPUR
Agartala
TRIPURA
Aizawl
MIZORAM
BIHAR
Patna
JHARKHAND
Ranchi
WEST BENGAL
Kolkata
Gandhinagar
GUJARAT
Bhopal
MADHYA PRADESH
Raipur
CHHATTISGARH
Diu
Daman
Silvassa
DADRA & NAGAR HAVELI
Mumbai
MAHARASHTRA
ORISSA
Bhubaneshwar
BAY OF BENGAL
ARABIAN SEA
Hyderabad
ANDHRA PRADESH
Yanam (Puducherry)
Panaji
GOA
KARNATAKA
Bengaluru
Chennai
Puducherry
Mahe (Puducherry)
Kavaratti
LAKSHADWEEP (INDIA)
TAMIL NADU
Karaikal (Puducherry)
KERALA
Thiruvananthapuram
Port Blair
ANDAMAN & NICOBAR ISLANDS (INDIA)
LEGEND
International Boundary
State Boundary
National Capital
State & U.T. Capital
Map not to Scale
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INDIAN OCEAN
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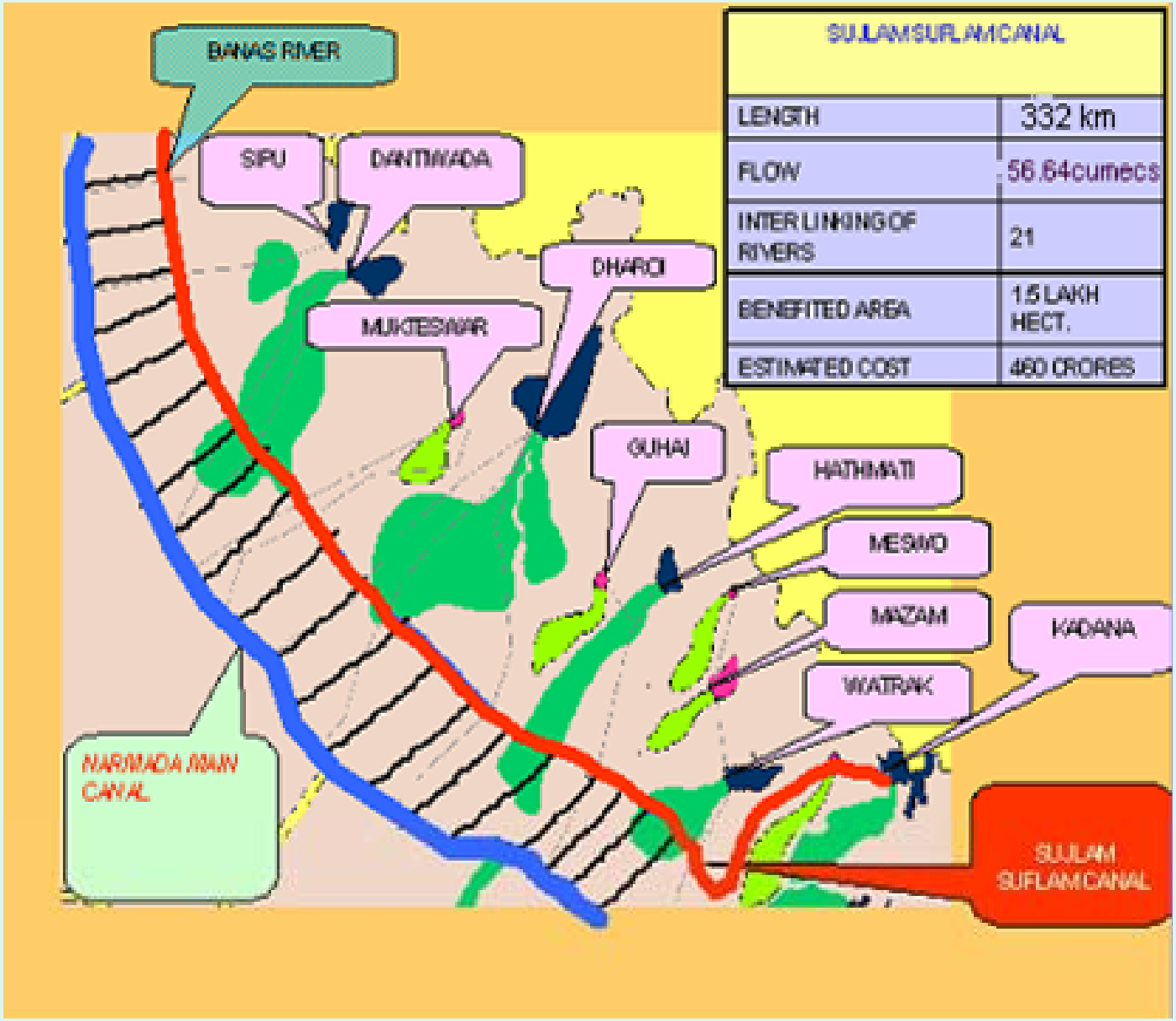
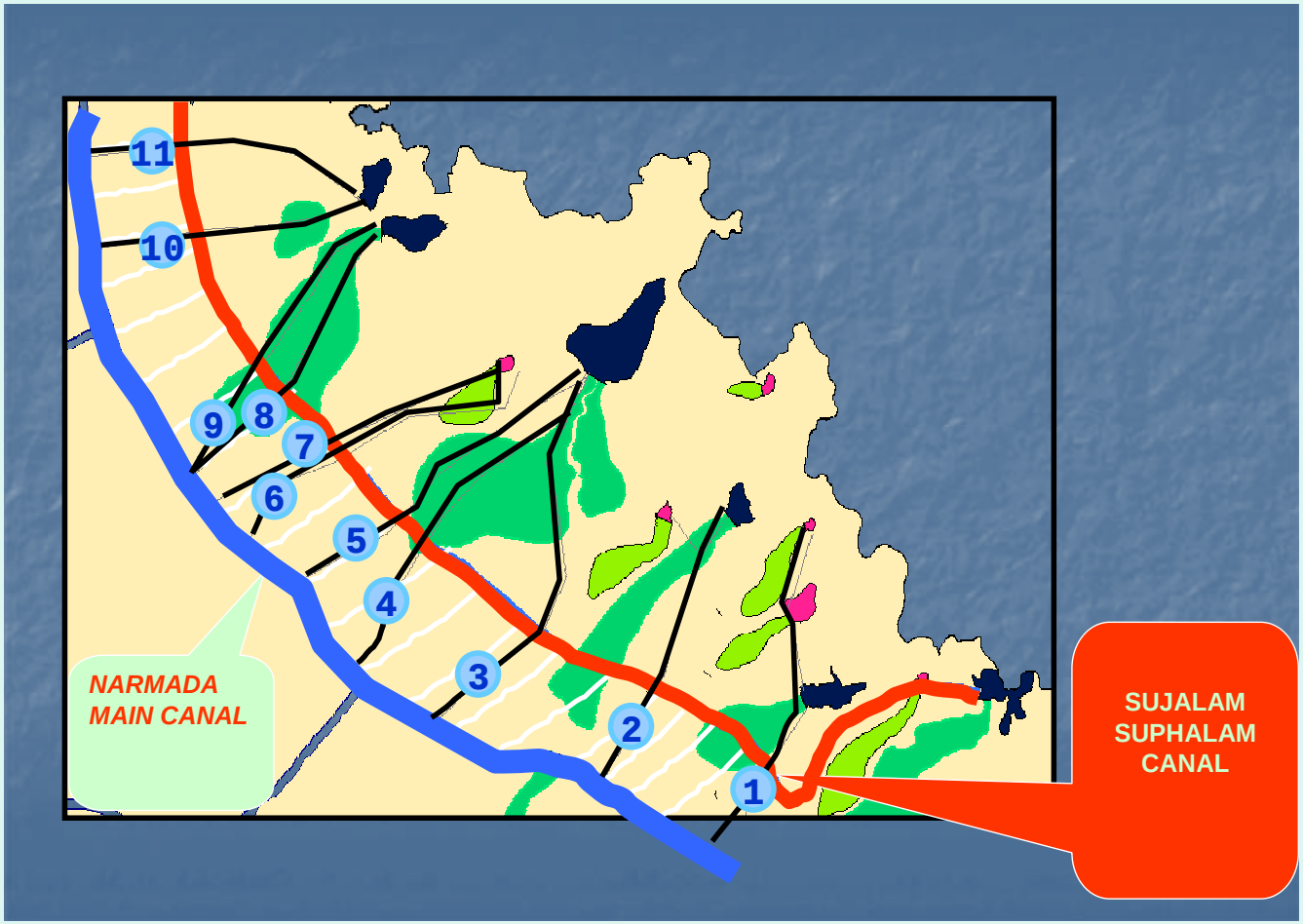

BANAS RIVER
SIPU
DANTIWADA
DHAROI
MUKTESWAR
GUHAI
HATHMATI
MESWO
MAZAM
WATRAK
KADANA
NARMADA MAIN CANAL
SULAM SULFAM CANAL
SULAMSULFAM CANAL
LENGTH 332 km
FLOW 56.64cumecs
INTERLINKING OF RIVERS 21
BENEFITED AREA 1.5 LAKH HECT.
ESTIMATED COST 460 CRORES

Pipelines



Methodology of the study

- Area benefited
  - Based on WREMI inputs
    - Different scenarios of agriculture when
      - 0 % extraction of recharged groundwater
      - 25% extraction of recharged groundwater
      - 50 % extraction of recharged groundwater
      - 75 % extraction of recharged groundwater

    Cropping pattern
    Existing
    Drip irrigation
    surface irrigation
- Data
  - Primary Source: Field visit – 16 villages
    - FGD and Key informants
    - Checklist
  - Secondary sources
    - Published and unpublished documents, reports by Government and other organisations
- Cost Benefit Analysis – B:C Ratio and IRR
  - Covering direct and indirect costs and benefits

Impacts

- Economic Benefits
  - Net returns from
    - Agriculture (65 to 134 crore/year @varying extraction of GWT)
    - Milk Production (1.2 crores)
    - Agricultural Labourers (109 crores)
  - Net present Value, Internal Rate of Return, Benefit-cost Ratio
- Social Benefits
  - Reduced migration
  - Higher incomes

Summary of Cost Benefit Analysis

- 100 days with inlets running
  - Existing cropping pattern – Economically non viable under all scenarios
  - Drip Irrigation – Economically viable
- 100 days without inlets running
  - Drip Irrigation viable
- 210 days with inlets running
  - Drip Irrigation – Economically viable
- 210 days without inlets running
  - Economically viable under drip irrigation considering both direct and indirect costs and returns

Thank you