POLICY BRIEF 15

Sustaining India's Irrigation Infrastructure

Water, as an input to agriculture, is critical for sustaining the food security. India faces the daunting task of increasing its food grain production by over 50 per cent in the next two decades.[1] Increasing competition for water in agriculture, industry, domestic and environment uses is already manifested in inter- and intra-sector, basin, state, district and village level conflicts.

These will escalate further as India's annual per capita water availability goes below water scarce threshold level of 1700 cubic meter within the next two decades. In six of the country's 20 major river basins (with less than 1000 cubic meter of annual per capita availability), water resources are under stress and depleting. By the year 2025, five more basins will become water scarce and by 2050, only three basins in India will remain water sufficient[2]. Supply expansion, to meet expanding needs, is constrained by availability and rising economic and environmental costs associated with its development and use. The status of irrigation infrastructure and prospects for its sustainability, both physical and financial, for future water-food security is the issue under focus.

Irrigation Infrastructure

Existing status

Since 1950, India has made direct public investment of Rs 88100 crore in providing major, medium and minor irrigation infrastructure with an irrigation potential of 91 MHa. India Water Vision, 2025 estimated the gross water demand for multiple uses to double in 25 years from now with corresponding investment needs of Rs 20000 crore per year[3]. As of now, India's irrigation infrastructure is expanding by 1.8 Mha of irrigation potential with a public outlay of Rs 7000 crore per annum. Current annual expansion is one-third less than the maximum growth achieved in the past. Deceleration in irrigation potential created through major and medium schemes started during 1980s as a consequence of declining real government expenditure on this sector[4]

Amidst competition from non-agricultural uses in households, industry and environment, supply of irrigation will have to keep pace with the targeted annual agricultural growth rate of over 4% in the Tenth Five Year Plan. To achieve this growth rate, irrigation sector should grow by at least 5% per annum, given 1% growth in rainfed sector, Demand-supply management in water sector and efficiency in its every use is critical for providing sustainable water-food security to the country.

More importantly, existing and expanding irrigation infrastructure has to be physically and financially sustained for improving their efficiency. Yet concerns are emerging on the physical condition of the irrigation infrastructure created so far.

Vicious cycle

India's irrigation sector is caught in a vicious cycle (Fig.1). Inadequate funding for O&M over years has resulted in the neglect of maintenance and upkeep of the irrigation system leading to deterioration in the quality of irrigation service. Physically, the irrigation and drainage system is not able to receive and deliver the planned quantity of water matching with the demand pattern. Poor irrigation service, often not matching with the crop water requirements over space and time, results in low productivity of crops and income to the irrigators. Resultant dissatisfaction coupled with weak institutional linkage leads to under assessment of demand for water rates as well as low recovery of whatever is assessed. Progressive fall in the cost recovery increases revenue deficit causing adverse impact on O&M funding for maintenance works.

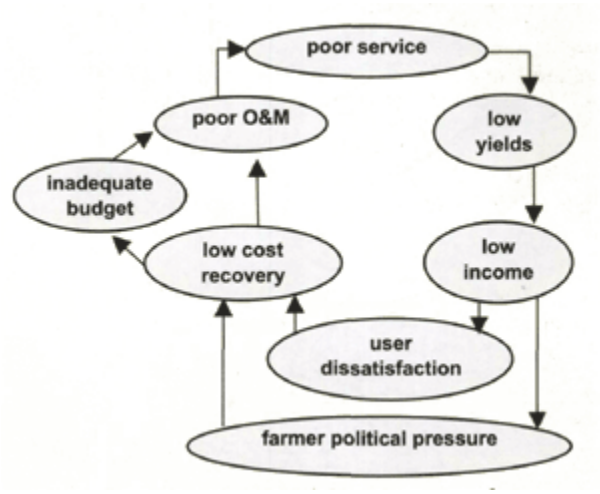

Fig. 1 Vicious cycle of India's irrigation sector[5]

Deferred maintenance of surface irrigation infrastructure over years has led to further deterioration of its physical service. This is witnessed by stagnating or falling irrigation coverage affecting agricultural growth in several regions. Surely, with future expansion in food production growth critically depending on the performance of irrigation sector, what is happening to the physical status of existing and expanding irrigation infrastructure does not augur well for India's future food security and agriculture performance.

Canal irrigation system

Despite annual expansion in the created potential and capital investments in irrigation sector, the area irrigated by the major, medium and minor irrigation systems has been either stagnating or declining from mid-1980s or during 1990s, as witnessed in some major states (Fig 2).

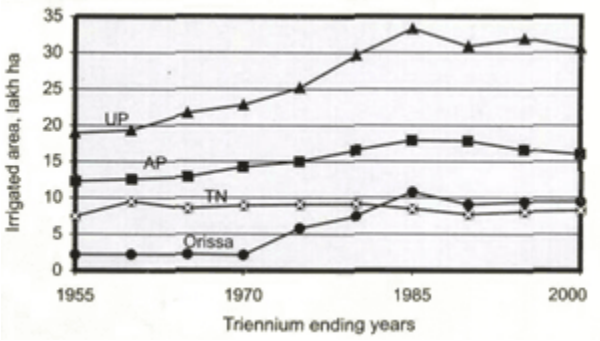

Fig. 2 Performance of canal irrigation system

For instance, currently in Uttar Pradesh canals are irrigating 30.6 lakh ha in TE 2000 as against 33.3 lakh ha in TE 1985[6]. Similarly, in Andhra Pradesh, canals now irrigate 11% less area than what was irrigated 15 years back[7]. Bihar, Orissa and Tamil Nadu also recorded similar decline in the canal irrigated area[7]. These five states together account for 50% of irrigation potential created and 45% of net area irrigated in the country. In many irrigation commands, effective irrigated area has declined due to deterioration in the distribution infrastructure. Official estimates reckon the loss of about 3 to 4 Mha command area due to water logging and salinity. Yet another study estimated that 7 Mha have gone out of farm production while 6 Mha are under increasing threat. Declining quality of irrigation service is reflected in slowing down of agricultural growth (Box. 1).

Ground water

Ground water, supported by 12 million energized wells, contributing more than 50% of total irrigated area in the country has

become a critical source for agriculture growth. Rapid depletion, salinization and pollution related problems threaten regions with sustainable ground water balance, whose area is continuously shrinking. Administrative blocks categorized as 'dark' or critical increased at the rate of 5.5% per annum during mid-1980s to mid-1990s. If such a trend continues then one-third of the blocks in the country would come in the 'grey' category within two decades. Groundwater mining has resulted in fluoride contamination in north Gujarat and Rajasthan and arsenic contamination in southern West Bengal endangering the sustainable livelihood of the poor. One estimate puts a quarter of India's harvest at risk from ground water depletion.[9] In 1995, over 50% of dark blocks were located in six states namely Gujarat, Haryana, Punjab, Tamil Nadu, Karnataka arid Rajasthan (Table. 1).

Box.1 Irrigation and agriculture performance in Orissa

Annual investments in irrigation sector remained consistently high as compared to many other states during the past, accounting for 20 to 25% of the state's plan outlay. Canals are the dominating source of irrigation in Orissa. Low irrigation coverage and rice dominated cropping pattern are unique features of Orissa agriculture. Poor water management resulting in low fertilizer consumption coupled with inadequate infrastructure and tenancy problems severely constrain the productivity growth in irrigated agriculture.

Scaled against ten major Indian canal commands by output impact per ha of irrigated area, Mahanadi command of Orissa ranked last. Also, in output per unit of water in the above canal commands, Orissa is at the bottom of the list with 14 kg per ha cm. This compares poorly even with the second lowest productivity (26 kg per ha cm), recorded in the Jayakwadi command of Maharashtra. This trend remained similar for different crop groups namely cereals, pulses, oilseeds and vegetables[8]. Baseline survey conducted in selected projects in Orissa revealed that 30 to 60%of the canal command farmers cannot get adequate and timely water supplies. In fact, agricultural growth in Orissa averaged just over 1% per annum over the last two decades. Future growth in agriculture depends critically on better performance of irrigation infrastructure.

Table.1
Status of ground water exploitation[10]

States	Blocks, 1989		Blocks, 1995	
	Total	**Dark (%)**	**Total**	**Dark & Over exploited (%)**
Gujarat	183	3	184	14
Haryana	95	33	108	47
Karnataka	175	2	175	10
Punjab	118	54	118	59
Rajasthan	227	9	236	24
Tamil Nadu	375	16	384	25
Total (6 states)	**1173**	**16**	**1205**	**26**

Blocks are categorized, based on the exploitation of utilizable ground water resources, as dark (85 to 100%) and overexploited (over 100%).

These states, accounted for 90% of the over exploited blocks in the country. Again, in these states alone, number of blocks exploiting more than 85% (dark and over exploited category) of the utilizable ground water resources has gone up from 16% to 26% during 1989-95. The magnitude and spread of overexploited blocks poses serious equity concern warranting comprehensive development and management policies encompassing all uses and sources of water. Like surface water, here too, abysmally low price regime for power neither facilitated efficiency in the use of power nor in the use of ground water for agriculture. At all India level, average power tariff for agriculture in 1998 was Rs 0.22 per kWh, which is one-tenth of the unit

cost of power supply during the same year.

Tank irrigation system

The popular method of community-based maintenance system of tanks, existed historically, is disintegrated. Paucity of funds and meager budgetary allocations in the past resulted in continued neglect of tank irrigation infrastructure in south India, which has equity and sustainability implications. Gap ayacut (no irrigation) and stabilization areas (partial irrigation) constitute 2/3rd of the registered ayacut in Andhra Pradesh. Within the state, only 20% of registered ayacut get assured irrigation in Rayalseema and Telengana regions (Fig.3). These regions are drought prone and account for 4/5th of 'dark' mandals categorized by more than 85% ground water exploitation.

The linkage between tank storage and well yield in tank commands is well established. Neglected management of tank systems leads to declining storage and recharging of ground water. These factors underscore sustainability implications of deteriorating irrigation infrastructure, more so in semiarid and deficit rainfall conditions.

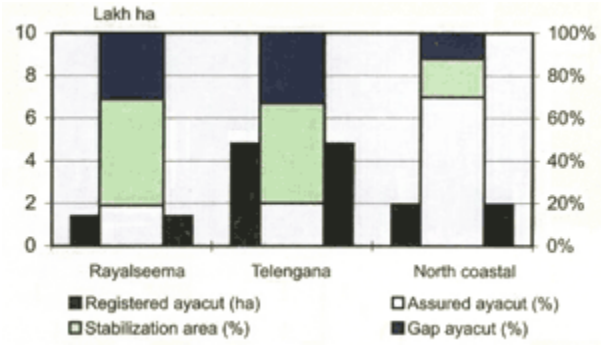

Fig. 3 Tank irrigation infrastructure, Andhra Pradesh, 1991s

Tank water deficits occurs over 50% of the time period due to inadequate rainfall. Only 15% of the farms in the tank command own wells to provide supplemental source of water supply[11]. Farms in tank commands in south India are predominantly small in size; 40% in less than 0.5 ha category, 60% in less than 1 ha size, and 80% in less than 2 ha size. Majority of the farms in the tank command being marginal holdings with tanks as the only source for irrigation and rural livelihood, deteriorating tank system has equity implications particularly in deficit rainfall situations. Currently, all 12351 minor irrigation sources taken together irrigate only 44% of the registered ayacut as against 82% in early 1950s. Loss in tank irrigated area has reached 1/4th of the net irrigated area in the state.

Similar evidences with tank irrigation systems are emerging in other major states (Fig.4). States of Andhra Pradesh, Tamil Nadu, Karnataka and Orissa, together accounting for 60% of the India's tank irrigated area have lost about 37% of the area irrigated by tanks during 1965-2000.

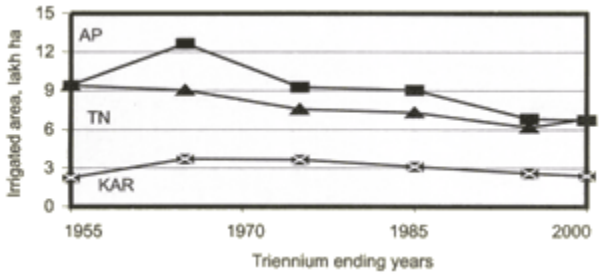

Fig. 4 Decilining performance of tank system in south India

There is an urgent need for rehabilitating tank irrigation system infrastructure. Physical strengthening and improvements in the inflow, storage and distribution system are needed. Water users in tank commands need to be involved in planning and implementing the rehabilitation strategies. Tanks' performance as traditional water harvesting structures, conservation and recharging of ground water besides irrigation and several other ecological functions within the villages have to be restored and

their maintenance sustained.

Physical and Financial Sustainability

Providing water supplies at subsidized rates for irrigation remained the state's policy to enable secure food supplies. Currently, irrigation accounts for more than 1/3rd of states' revenue deficits. In many states, O&M expenditure was just enough for staff salaries with little for works. Low water charges and poor cost recovery resulted in secular decline in funding for maintaining water infrastructure, inefficient water allocation and sharpening conflicts over sharing of water in many regions. Current status of O&M expenditure and cost recovery in some major states (Table.2), viewed in conjunction with the physical condition of the irrigation system points towards unsustainable scenario evolving in water sector, both physically and financially.

Table.2
O&M cost recovery, TE 2000'2

Particulars	Unit	Orissa	A.P
Potential created	Lakh ha	25	48
Gross irrigated area	Lakh ha	16	22
Average annual plan outlay	Crore Rs	619	893
Average O&M expenditure	Crore Rs	60	265
Weighted water rate	Rs/ha	104	398
Current water rate demand	Crore Rs	19	116
Receipts, current account	Crore Rs	15	69
Cost recovery, current account	Per cent	25	26

In Orissa, gross irrigated area from surface irrigation sources accounts for 64% of irrigation potential created. Average O&M expenditure remained low at 30% of the desired level. Weighted water rate, based on revised water tariff in 1998, was low at Rs 104/ha. Current water rate demand from irrigation charges is 50% of potential demand. All these factors culminate in poor cost recovery of 25%. Similar trends exist in other surface irrigation systems of states like Andhra Pradesh, Haryana and Gujarat. In Gujarat, actual O&M expenditure is one-fourth of the requirement.[13] With average water charge remaining at Rs 165/ha, cost recovery is only 33%. Similarly, Andhra Pradesh and Haryana .have registered low cost recovery of 26 and 41% respectively under current account.

Physical sustainability of the irrigation infrastructure calls for need based O&M funding. This requires systematic maintenance and monitoring of the physical assets of the irrigation system and their current status on a continuous basis. Financial sustainability calls for generating the needed O&M funding from the users. And more importantly, both need to be linked. That calls for a paradigm shift in the management of water resources. Water user groups need to be empowered with the management responsibilities as well. Several states are indeed in the process of finalizing state water plans, institutionalizing farmer organizations in irrigation management and periodic review of water charges, improving assessment and collection procedures and prioritizing irrigation expenditures. Experiences so far are however mixed and the pace of progress is slow. For instance, performance of participatory irrigation management (PIM) in Gujarat indicates improved operational performance of water distribution and management. Impact on system related issues, however, is yet to be addressed.

Low water rates, under assessment of irrigated area and water rate demand, and poor collection rate continue to deprive the irrigation sector from realizing potential revenue, critical for system's financial sustainability. Sustained efforts are needed for rehabilitating the irrigation infrastructure and initiating institutional reforms in water sector. Only then irrigation management transfer will become effective with system wide impacts to provide water security needed for sustainable food security.

Summing up

Vicious cycle in irrigation sector needs to be broken by empowering the stakeholders to maintain and manage the scarce water resource. Stakes are high for the users to collectively use, account and pay for it and claim their due share for system maintenance. Existing system offers no scope to integrate this process. This has implications for the sustainability of irrigation infrastructure created and added upon annually. Policy directions are needed as follows before the available options further narrow down.

- Irrigation systems (major, medium and minor) need to be restored to the satisfaction of users along with simultaneous institutional development for effective transfer of the irrigation management14. Donor driven institutional initiatives obviously cannot sustain for long.
- Farmer Organizations need to be empowered to assess the irrigation coverage, revise water charges, raise water rate demand and collect receipts. Streamlining of accounting procedure to link cost recovery and O&M funding in the budgeting process is essential.
- Irrigation department should be legally empowered to identify all water user categories for broadening the revenue base and enforce quantitative measurement of water supply, charging and collection from bulk users to start with, for realizing full cost recovery.
- Any funding for irrigation development with Central assistance should be linked with mandatory institutional development as above for smooth turning over of the system to the users.

Development of institutional frameworks for an efficient use of existing and expanding supplies is central to enhance and sustain the economic and welfare contributions of scarce water resources in India. Policies to reform irrigation sector are already evolving in different states. How quickly and genuinely the institutional reforms are pursued to cover all sources and uses of water will determine India's future water and food security.

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