A Balance Sheet of Performance of Large dams in India The case of irrigation and flood control

Over the last 51 years of water resources development in Independent India, the nation has spent over Rs. 80,000 crores on irrigation sector alone, mostly on major and medium projects. After constructing over 3300 additional large dams (there were about 300 large dams in India at the time of Independence) and with 700 more large dams in pipeline, the balance sheet of performance of large dams centred water resources development makes a disappointing reading.

We will illustrate the gaps between major claims and actual performance in case of claims regarding irrigation and flood control benefits.

- **Irrigation** to increase agricultural production to satisfy increasing needs of increasing population.
- Ultimate irrigation potential by Major (command area larger than 10,000 ha) and Medium (command area 2000–10,000 ha) Projects in India is estimated at 58 million ha, of which 29.22 m ha (50.4%) is claimed to have been achieved by 1996-97. Ultimate Irrigation Potential from minor surface projects is 17 m ha and by groundwater is 64 m ha. The total ultimate irrigation potential is thus 139 m ha.
- Gross cropped area in India in 1985 was 177.3 m ha, whereas net cropped area has remained stagnant around 141 m ha since last two decades.

Claim: We have overcome drought-famine syndrome completely. Irrigated area and foodgrains production have each gone up by four times.

- It is claimed that between two thirds and three fourths of food production today is dependent on irrigated agriculture. If we are to assure future food security and future increases in food production to keep pace with increases in population and also increases in per capita demands, we will have to build more large dams.

Performance: The gross irrigated area in India in 1951 was 22.6 million ha (20.9 m ha was net irrigated area), comprising of 9.71 m ha (8.0 m ha net) by Major and Medium Projects, 6.4 m ha by tanks and other minor surface waters and 6.5 m ha by groundwater.

At the end of 1996-97, 80.69 m ha was land was irrigated, out of which 28.37 m ha was irrigated through major and medium schemes and 52.32 m ha through minor irrigation, including surface water (11.20 m ha) and groundwater schemes (41.02 m ha).

In terms of relative share of in India's utilised irrigation potential, surface water in canals accounts for 35.5%, groundwater for 50.5% and other water sources for 14%.

However, there are discrepancies in these figures of 1996-97 given out by the Union Ministry of Water Resources and Central Water Commission, as against the figures given by Directorate of Economics and Statistics, Ministry of Agriculture. For example, the difference between gross irrigated areas claimed in 1984-85 by CWC (58.82 m ha) and MOA (54.1 m ha) (The World Bank, 1991) is substantial at 8.02 % of the CWC figure. Such discripancies are not very unusual in India's water resources sector.

Applying that correction to the 1996-97 figures given by CWC, more realistic estimate of gross irrigated in 1996-97 would be 74.22 m ha and gross irrigation by major and medium projects would come to 26.09 m ha.

Thus in last 48 years since 1951, major and medium irrigation projects have added 16.38 m ha to gross irrigated area. This, incidentally, comes to 20.30% of gross irrigated area of the country in 1996-97.

Now let us look at some of the gross consequences of this development.

According to the World Bank estimates, at least 3% of canal irrigation commands are severely affected by waterlogging and salinisation. Thus, at least 0.78 m ha of irrigated is severely affected by waterlogging and salinisation. In reality, the lands affected by waterlogging and salinisation has been much larger, variously estimated between 3 and 6 m ha.

This figure is likely to be gross underestimate, as Sandra Postel (Bio Science, Aug. 1998) says, 20% of command is likely to be affected by salinisation and severe effects with reduction in crop yields have been the result in at least 10% of the commands.

According to a recent estimate, an area of 2.46 m ha is affected by water logging, 3.06 m ha is affected by soil salinity and 0.24 m ha by alkalinity in irrigation commands. According to the World Bank estimates (1991), in Uttar Pradesh alone, there is 2.5 m ha Usar land (saline and sodic soils).

Lands lost to canal and drainage infrastructure under run of the river type schemes typically represent 2-5% of the irrigated command area created. With schemes involving reservoirs, a further 3-8% of land is lost. Total land lost annually to reservoir inundation is estimated at 50,000 ha. (The World Bank, 1991)

Thus going by World Bank estimates, land equal to at least 10-13% of irrigated areas of these projects is lost for either submergence or canals and other

infrastructure. For example, in case of Sardar Sarovar Project, while submergence would take up land equal to about 2.1% of area (39,000 ha) to be irrigated (1.8 m ha), the total canal infrastructure is to take up 1,86,000 ha (land equal to 10.3% of projected command area of the project, as per GOG report). Thus utilisation of this additional 16.38 m ha of irrigation potential would have taken out of production at least 1.97 m ha of land, at 12% of additional irrigation utilised. This figure too seems to be an underestimate, as going by WB figure of land lost due to reservoir inundation has been about 50,000 ha per annum. Over a period of fifty years, thus, reservoir inundation alone would have taken away 2.5 m ha.

In post independence India, due to domination of large dam centered irrigation projects, there has been utter neglect of local rainwater harvesting systems. Thus, the area under tank irrigation has gone *down* from 4.8 m ha in 1962-63 to 3.1 m ha in 1986-87. Thus this loss of 1.7 m ha of actual irrigated area too must go in the account of large irrigation dam projects. Actual figure thus lost from irrigated area is likely to be much larger, but for lack of reliable data, we will assume this loss to be only 1.7 m ha.

Thus, in the process of building up this 16.38 m ha of irrigation potential by 1996-97, at least 0.78 m ha is lost due to severe salinisation, 1.7 m ha is lost out of irrigated area and at least 1.97 m ha of land has gone out of production. Let us assume that tank irrigation is 50% less productive than canal irrigated area (The World Bank, 1991), which in turn is doubly productive compared to unirrigated area. Let us also assume that area lost in inundation and infrastructure built up was unirrigated. Thus, we are left with net additional irrigated area of 14.26 m ha after subtracting the production losses due to the losses mentioned above.

Now land irrigated from groundwater has notably higher productivity than from canals, as following table shows:

Land Productivity Per Net Irrigated Hectare by Sources of Irrigation
(Ton/Ha in foodgrain energy equivalent units)

State	Wells (private)	Canal Irrigation
Andhra Pradesh	5.7 (67.6)	3.4
Tamil Nadu	6.5 (150)	2.6
Punjab	5.5 (71.9)	3.2
Haryana	5.7 (137.5)	2.4
Madhya Pradesh	2.8 (40)	2.0
Karnataka	4.2 (20)	3.5

(% by which productivity in well irrigated area is higher than canal irrigated area)
Source: The World Bank, 1991.

Thus, even if we assume average figures, groundwater irrigated lands have at least 70% higher productivity than canal irrigated areas, 14.26 m ha of canal irrigated land would be equivalent to 8.39 m ha of groundwater irrigated area.

The production of foodgrains in India in 1951 was 51 MT (million tonnes). This has gone up to 198 MT by 1996-97. In this period, net cropped area has gone up by over 21 m ha. This alone would have increased the foodgrains production by 18 MT at least at the average rate of 850 kg/ Ha yield. If we assume that all the rest of the increase in foodgrain production has been made possible by increase in area irrigated, (that this is not very correct assumption we will see latter.) we have a groundwater equivalent of irrigation in a total of 45.5 m ha additional area. Out of this contribution by canal irrigation is 18.44 %. In the total foodgrains production of 198 MT in 1996-97, contribution by the additional canal irrigation potential created in post independent India's 50 years is even less at 12.0 %.

What is important to remember is that while thus adding about 12.0% of additional foodgrain production, we have lost an opportunity of developing our water resources over a much larger area, much more equitably, sustainably, in much more participatory and cost effective manner. The social, environmental and even economic costs incurred would have been much lower. The additional foodgrain production that would have been possible, if we had taken the alternative path, would have been much larger. Unfortunately, it is very difficult to come up figures of what alternative path would have produced, as it was just not tried.

Let us look at some further limitations of the path of large dams centered canal irrigation taken up in last 50 years.

As is well known, presently, India's foodgrain production is concentrated in a big way in the "green revolution" area of Punjab, Haryana and Uttar Pradesh. Irrigation potential created by 1985 in the three green revolution states was as under.

State	Irrigation potential created.	Major and Medium schemes		Groundwater and minor surface schemes	
		Potential created	% of total Potential created.	Potential created	% of total potential created
Punjab	5636	2462	43.7	3174	56.3
Haryana	3316	1939	58.5	1377	41.5
Uttar Pradesh	18803	6813	36.2	11990	63.8
Total	27755 (40.9)	11214 (36.8)	40.4	16541 (44.3)	59.6

The success story in the Northwest was made possible by the major development of surface irrigation in the 19th and early 20th centuries. Other important factors for this success story including the intensive use of other inputs like HYV seeds, fertiliser usage, better infrastructure availability and most importantly, state support for massive groundwater development. It can be seen from the figures above that nearly 60% of area covered by irrigation in this belt was irrigated by groundwater. And groundwater here is at least 70% more productive than canal irrigation.

- That area is already experiencing plataueing and decline in foodgrain production growth rates.
- The large project based WRD has left over 65% of cultivators high and dry.
- 22.7% of the potential created (30.5 m ha) by major and medium projects remained unutilised in 1984-85. The gap in minor and groundwater schemes was only 6%.
- Total irrigation benefits to tribal sub plan areas (133 districts of the country) is 0.37 m ha, which is less than half percent of total area brought under irrigation. As against this, the tribals constitute 6.9 % of country's population. (1984-85 figures.)
- A total of 99 districts in 13 states of the country have been identified as drought prone. These districts cover a total geographical area of 108 m ha (33%) against the country's geographical area of 329 m ha and culturable area of 77 m ha (42%) against the country's culturable area of 184 m ha.
- Some of the large projects have not been able to achieve designed live storage in seventy five percent of the year and some even ninety percent of the years. (The World Bank, 1991.)
- By 1988-89, current expenditures on operations and maintenance on major and medium irrigation projects exceeded revenues from water charges by Rs 23.5 billion annually. Rural electricity subsidies, primarily for pumping water from tubewells, accounted for another Rs. 14.6 billion per year. Subsidies to irrigation grew by 10% per annum in the 1980s and rural electricity subsidies grew by 15% per annum.
- In India as a whole, an average of six families is displaced per 100 families provided with surface irrigation.

- **Flood protection**.

Solution: Govt. flood control measures mainly consist of dams and embankments. Over 400 km of embankments have been built annually since 1954. A total of 16,000 km of new embankments and 32,000 km of drainage channels have been constructed since 1954 when the national programme of flood was announced.

Claim: Over a third of the flood-prone area has been protected. Reasonable flood protection has been provided to about 14 mha of flood prone area out of total

flood prone area of 40 m ha in the country. Total investment in flood control has been Rs. 4000 crores.

Performance: Flood affected area shot up from an average of 6.4 million hectares a year in the 1950s to nine mha a year in 1990s. Flood relief expenditure more than doubled from 230 crore in 1980-81 to Rs. 567 crore in 1985-86. Dams have become an important cause of floods. Embankments have disrupted the natural drainage system in the flood plains.

The flood prone area in Bihar has shot up from 2.5 mha to 6.5 mha between 1954 and 1988.

This year (1998) itself, unprecedented damage occurred due to floods in Uttar Pradesh, Bihar, West Bengal and the north eastern states. A large part of it is attributed to embankments and dams centered flood proofing strategy adopted by the government.

Achievements What have India achieved in the process of spending over Rs. 80,000 crores, 51 years and the various alternative development opportunities that have been lost in the process?

- ✓ Drought prone area has gone up.
- ✓ Flood prone area has gone up.
- ✓ No. of habitations without adequate source of safe drinking water is still very large.
- ✓ Water-logged and salinised areas have gone up.
- ✓ We have managed to convert major areas into grey and dark in terms of groundwater availability.
- ✓ We have managed to destroy a very rich tradition of community technologies and institutions of local water harvesting.
- ✓ Most importantly, we have managed to destroy the very sense of belongingness of the communities to their water resources.

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