

## **Sustainable Development of Water Resources in India**

**Dr. Madhukar R. Gitte,**

*Associate Professor, Dept. of Economics, Elphinstone College, Mumbai-32*

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**Abstract:** *Irrigation is the basic input for the development of agriculture from subsistence to the commercial one. The progress made by the country in respect of creation of irrigation potential and its utilisation is very dismal. The actual utilisation of the available potential is less than 80 per cent, leaving a huge gap between creation and utilisation of the irrigation potential. The main causes of under utilisation of irrigation potential include incomplete land development works, non-maintenance of distribution system, heavy transit and seepage losses, water logging and salinity, unrealistic cropping pattern, and inadequate supply of credit and other farm inputs.*

*There are various measures suggested for conjunctive and judicious use of irrigation water such as lining of canal and distribution system, reduction in transit and seepage losses, use of micro irrigation methods, implementation of rotational water supply system, and harvesting of rain water.*

**Keywords:** *Irrigation potential, potential created, irrigated area, transit losses, seepages, micro irrigation, and rotational water supply system.*

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### **I. Introduction**

Agriculture provides livelihood to fifty five per cent population, employs over fifty two per cent of the labour force and contributes about 16 per cent of the national income. Since the available cultivable area has almost been utilised for agricultural purpose, the scope for bringing additional area under cultivation is thus very limited. Further, additional areas could be brought under crops only by encroaching upon country's valuable but already depleted forest resources. About 23 per cent of the geographical area of the country was under forest, whereas the National Forest Policy has recommended one-third area under forest.<sup>1</sup> If the requirement like food and fibre of an ever increasing population of the country are to be met, there is no other alternative but to increase the productivity of the land and irrigation is one of the basic inputs to augment agricultural productivity.

About 326 talukas in 61 districts are chronically drought prone areas and comprise 16 per cent area and 11 per cent population of the country.<sup>2</sup> As a result of severe droughts like 1965-66 and 1972-73, not only a substantial quantity of food grain production in lakh hectares of cropped area was lost but crores of people and cattle head suffered due to wide-spread severe droughts in the country. As irrigation averts famine conditions, the first priority must unquestionably be assigned to irrigation development to protect the country directly from droughts and scarcity conditions.

#### **Objectives of the Study**

- To study water resources and ultimate irrigation potential of the country.
- To evaluate the development of irrigation potential during the planning period.
- To find out the extent of utilisation of created irrigation potential in the country.
- To investigate various reasons for under-utilisation of created irrigation potential.

### **II. Methodology**

The present paper is primarily based on secondary sources of data such as published reports of various irrigation commissions and committees, Five year and annual plan documents, economic survey, government publications, and other publications. Simple statistical techniques like tabulation, calculation of average and percentage are used in this paper.

#### **Review of Literature**

The surface water resources potential of the country is estimated to be around 1869 km<sup>3</sup>, whereas only about 1123 km<sup>3</sup> can be used.<sup>3</sup> The Maharashtra State Irrigation Commission<sup>3</sup> (1962) stated that it is absolutely necessary to complete the work of full exploiting the irrigation potential of the state by 1980. The 'Phad' system of irrigation in Dhule district was the oldest irrigation system in the Maharashtra. There were 45 diversion bandharas across the river Panzra, irrigating about 3035 hectares area.<sup>4</sup> A detailed evaluation study of Mula Irrigation Project carried out by the Water and Land Management Institute, Aurangabad<sup>5</sup> (1982) showed that the utilization on this project was about 52 per cent of the potential created. The lag in utilization was attributed

to delayed work of the canals and distribution system and cultivation of higher percentage of sugarcane, summer groundnut and higher seepage losses.

Ashok Mitra<sup>6</sup> studied of the planning and implementation of Mula Project and the management of water distribution with a view to ascertain the factors responsible for long gestation period and of underutilization of irrigation potential. The work of this project was much delayed on account of problems of foundation and the completion of distribution network, frequent changes and modification in the original project proposal. The underutilization of created irrigation potential was due to slow progress of the construction of distribution system and outlets. The evaluation study undertaken by the Directorate of Economics and Statistics<sup>7</sup> (1994) reveals that the extent of utilisation of irrigation water on Jayakwadi, Girna, Pench and Khadakwasla was about 56 per cent due to reasons such as inadequate rainfall and storage of water, non-completion of distributaries and field channels, incomplete land development works, silting/ damage of field channels and no water to tail-end farmers. In respect of speedy utilisation of available irrigation potential, the Kasbekar Study Group<sup>8</sup> (1986) recommended that all the three agencies, viz., water management, land development and irrigation extension, should be placed under irrigation department. Different departments have to work together, separately but not independently, having synchronised action to achieve the common goal of full utilisation of irrigation water.

### **Water Resources of the Country**

India has very copious water resources as it is endowed with 14 major and 44 medium river basins with catchment areas more than 22000 km.,<sup>9</sup> which contribute to over 90 per cent of the total run-off in the country. The average rainfall is about 120 cm. and the average annual precipitation is 400 Mham. The total water resources of the country are assessed at 185 Mham. comprising 135 Mham. of surface water and 50 Mham. of groundwater resources. However, only a part of this can be utilised for irrigation because of the limitations of topography, physiography, geology and dependability. The aggregate utilisable water resources of the country have been assessed at 105 Mham. of which 70 Mham. are surface flows and 35 Mham. as underground water resources.<sup>10</sup> All this water would not be available for irrigation alone since it has to be utilised for other purposes such as domestic, industrial and hydro-electric power generation.

### **Future Water Requirement**

Apart from irrigation, the demand for water has been increasing rapidly for various purposes such as domestic use, energy and industrial use. The recent study made by the Ministry of Water Resources estimated the future water requirements for various sectors as given below.

**Table 1: Projection for Water Requirements for Various Purposes**

Sr. No.	Purpose	Demand (Km3) in the Year		
		1990	2000	2025
1	Domestic Use	25	33	52
2	Irrigation	460	630	770
3	Energy	19	27	71
4	Industrial Use	15	30	120
5	Others	33	30	37
Total:		552	750	1050
1	Surface Water	362	500	700
2	Ground Water	190	250	350

**Source:** Y.K.Murthy, Development of Water Resources in India, MIT Journal, Vol.III, No.9-

10, Feb.-July 1994, pune, p.21.

It reveals from the above data that about 85 per cent of the total water will be required for agriculture and rest 15 per cent for other non-irrigation uses.

### **Ultimate Irrigation Potential**

The Ultimate irrigation potential of the country is estimated at 113.5 million hectares, 73.5 million hectares from surface water and 40 million hectares through ground water. This UIP of 113.5 Mham. comprises 58.5 from major and medium projects and the rest 55 Mham. from minor projects.

### **Magnitude and Composition of Investment**

The magnitude and investment in irrigation through plan periods indicates that over 60 years, the direct investment in irrigation sector has increased steadily from Rs. 446 crores in the First Plan to Rs. 211700 crores at the end of Eleventh Plan. The average annual outlay on major and medium projects including CADA increased from Rs. 75 crores in the First Plan to Rs. 32000 crores in the Eleventh Plan. Similarly, the average

cost per hectare of potential created has risen steeply around Rs. 1060 in the First Plan to over Rs, 75000 in the Eleventh Plan. This increase in cost of completion attributed to delays in completion of irrigation projects within stipulated period, non-availability of better sites for construction, inadequate preparatory surveys and investigations resulting in substantial modifications, thin spreading of financial resources due to taking of too many of projects, extension of distribution system from 200 hectares block to 5-6 hectares block at project cost, larger provision for rehabilitation of project affected people as well as environmental and ecological preservation and adoption of more sophisticated but expensive technology for irrigation projects.

**Table 2: Magnitude and Composition of Investment in irrigation Sector ( Rs. in Crores )**

Sr. No.	Plans	Major and Medium Irrigation	Minor Irrigation	CADA	Total
1	First (1951-56)	380	66	--	446
2	Second (1956-61)	380	161	--	541
3	Third (1961-66)	581	443	--	1024
4	Fourth (1969-74)	1237	1174	--	2411
5	Fifth (1974-78)	2442	1411	122	3975
6	Sixth (1980-85)	7516	3239	520	11275
7	Seventh (1985-90)	11107	6427	1427	18961
8	Eighth (1990-95)	21072	13885*	2510	34957
9	Ninth (1995-2000)	49289	13760*	--	83049
19	Tenth (2002-07)	83647	16458*	--	100106
11	Eleventh (2007-12)	165350	46350*	--	211700

\*Include CADA outlays

**Source:** XI Five Year Plan, 2007-2012, Planning Commission, GOI, New Delhi, Vol.II p.47 and Working Group, Ministry of Water Resources, GOI, New Delhi, p.19.

### Irrigation Potential Created and Its Utilisation

Development of irrigation potential by major, medium and state sector minor irrigation projects during different five year plans indicates that the cumulative irrigation potential created has increased from 22.60 million ha. to 109.77 million ha. during the period from 1951-52 to 2011-12. The irrigation potential created from major and medium projects increased from 9.70 ha.in the First Plan to 47 Mha. and the rest 63 Mha. from minor projects.

The gap between the potential created and its utilisation has continuously been widening and therefore, the underutilisation of created irrigation potential has now become a serious problem particularly in respect of major and medium irrigation projects. For instance, by the end of Eleventh Plan, utilisation was 90.42 million ha. against a created potential of 109.77 million ha. . These leaves a gap of 20 mha. of underutilised potential. The pace of utilisation has been far too slow as the rate of utilisation declined from 100 per cent in 1951-52 to 82 per cent in 2011-12. This underutilisation has been attributed to delays in construction of distribution network like field channels and water courses, development of on-farm works, adoption of ‘Warabandi’ system of water distribution and also long time taken by farmers in switching over to from rain fed farming to irrigated farming and new cropping pattern.

**Table 3: Development of Irrigation Potential and Its Utilised ( Million Hectare**

Sr. No	Plan	Major & Medium Projects		Minor Projects		Total Potential		% Utili- sation
		Potential	Utilisation	Potential	Utilisation	Created	Utilised	
1.	Pre-Plan	9.70	9.70	12.90	12.90	22.60	22.60	100.00
1	First (1951-56)	12.19	11.00	14.06	14.06	26.25	25.06	95.47
2	Second (1956-61)	14.33	13.30	14.79	14.75	29.09	28.05	96.46
3	Third (1961-66)	16.57	15.20	17.00	17.00	33.57	32.20	95.92
4	Fourth (1969-74)	20.71	18.70	23.50	23.50	44.21	42.20	95.45
5	Fifth (1974-78)	24.72	21.20	27.30	27.30	52.02	48.50	93.23

6	Sixth (1980-85)	30.01	25.33	37.52	35.25	67.53	60.58	89.71
7	Seventh (1985-90)	31.52	27.77	46.60	43.12	78.12	70.89	90.74
8	Eighth (1990-95)	35.59	32.02	53.31	52.48	92.90	84.52	90.87
9	Ninth (1995-00)	37.05	31.01	56.90	49.99	93.95	81.00	86.22
10	Tenth (2002-07)	42.35	33.74	60.42	52.81	102.77	87.23	84.88
11	Eleventh (2007-12)	46.95	35.10	62.82	55.32	109.77	90.42	82.37*

**Source:** Report of the Working Group on Major and Medium Irrigation and CADA for the XII Five Year Plan, 2012-17, Ministry of Water Resources, GOI, New Delhi, p. 18.

### **Command Area Development Authorities ( CADA )**

Problems of major and medium project in the country are delayed schedules and completion, cost escalation, and underutilisation of created potential. Therefore, a centrally sponsored CADA programme was launched in 1974-75 with the basic objective of reducing the gap between the irrigation potential created and utilised on major irrigation projects.<sup>11</sup> This programme envisages construction and lining of field channels and water courses, construction of field drains, introduction of Warabandi/RWSS, on farm development, adoption of suitable cropping pattern, conjunctive use of available water, education, extension and training for farmers, timely supply of inputs and credit. At present, all the major and medium irrigation projects are covered under this programme to achieve fuller utilisation of irrigation water.

### **Causes of Under-Utilisation of Irrigation Potential**

The study conducted by the Indian institute of Management, Bangalore<sup>12</sup> shows that the created irrigation potential was not fully utilized on account of inadequate water storage in the dam due to scanty rain fall, cultivation of sugarcane and banana, inadequate demand for irrigation water during kharif season, increased demand for water from urban areas, incomplete works of distribution system, non-maintenance or ill-maintained distribution system, water logging, salinity and lack of drainage system, heavy transmission losses and seepages, inadequate participation of farmers in the management and distribution of water, and decrease in the water storage capacity of projects due to siltation.

## **III. Conclusion**

Agriculture still occupies a pre-dominant place in India's economic development. The flood-drought-flood syndrome still haunts a large part of the country and brings in heavy destruction of crops, wealth and life. About 60 per cent of the country's cropped area is exclusively dependent on the mercy of rainfall, this makes the Indian agriculture extremely vulnerable- a gamble in rain. Even where annual precipitation is high and sufficient, residual moisture do not support multiple cropping in winter and summer. Hence, irrigation is the only remedy to eradicate the drought menace and to sustain the economy in general and the agriculture in particular.

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