

Future Trends in Water Resource Development in India to Strengthen Rural Economy Through Development of Irrigated Agriculture

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Large reservoir based multipurpose irrigation projects became a reality in India only after Independence. Besides providing the much needed water input to agriculture it facilitated hydroelectricity generation that led to extensive use of pump sets in agriculture. Opposition against large dams started when people evicted from dam area could not be properly rehabilitated and the height of the dams posed a threat to the environment and increased the probability of earthquakes etc. A report on Dams and Development prepared by World Commission on Dams and released in 2000 came out heavily against the construction of large dams. In the present paper the author argues that large dams are a necessity in India and they have to be continued. Small dams and micro irrigation schemes should also be given a try.

Despite the efforts to bring wasteland under agriculture, total land under the plough in the country had continually been on the decline because of various pressures on the agricultural land for its nonagricultural use. During the last 50 years, productivity and therefore, labour employment potential per hectare of rainfed land has not increased noticeably. Most of the rural economy and additional employment generation has been borne directly or indirectly by the growth of irrigated agriculture. The scope of development of water resources to promote irrigated agriculture in the country has been constrained by the magnitude of precipitation and its characteristics, topography, geology and geomorphology of the state/region/valley.

Rainfed cultivation had been and is still being practiced at the subsistence level. Despite advancements in agriculture by way of improved seeds, chemical fertilizers, insecticides, better cultural practices etc. there has not been much improvement in the productivity of rainfed cultivation and, therefore, in the net returns to the farmers. The very same inputs could, however, be very effective in improving land productivity and net income to the farmer when associated with an input of assured water for the crop. Increase in the land under irrigated agriculture by means of surface and sub-surface water exploiting schemes have helped in meeting food grain demands of a rising population and in achieving food grain self-sufficiency in the sixties. Labour requirement per hectare of irrigated land is much more than that required for rainfed cultivation and employment is sustained over a larger portion of the year. The possibility of setting up agro-based processing industries in semi-urban areas because of increased productivity has the potential to create many job opportunities for semi-skilled and skilled labour. Irrigation projects thus form the nuclei of development in the rural sector and initiate the multiplier effect by promoting secondary and tertiary industries/trading/ business etc, thereby creating further more job opportunities. It also curbs the tendency of rural population to migrate to cities in search of livelihood. Migration of rural population to cities increases the location-specific domestic water demand, making construction of large captive/multipurpose reservoirs obligatory. Large reservoirs have exploited water resources in the valley optimally and economically. Small reservoirs and groundwater

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development schemes have dispersed the irrigation benefits and brought about more social equity in the development process. Very high efficiency of well water irrigation (when compared with surface irrigation), flexibility in the choice of crops that could be cultivated and a lower dependence on government investment are the points in favour of private/cooperative groundwater development schemes.

It would be interesting to examine the scope & limitations of the role played by irrigated agriculture in the rural economy in the past and present. On geomorphological considerations, the country could be broadly divided in two parts i.e., the Indo-gangetic plain of alluvial soils in the North India and the hard rock region of central and peninsular India. Many surface irrigation schemes, by simply diverting perennial flow of snow-fed Himalayan rivers, have brought sizeable area under irrigation in North India, even during the pre-independence period. In Central and Southern India, even though very few reservoir-based surface irrigation schemes existed before independence, some river diversion schemes existed for centuries and irrigated extensive area in the deltaic region of the main rivers along the East coast. About 8 to 10 lakh small tanks were constructed, operated & managed by the people during the last 2-3 centuries to provide productive irrigation to the paddy crop in the eastern part of Peninsular India right from West Bengal to Tamil Nadu. Extensive alluvial tracts in the Sindhu-Ganga-Brahmaputra basin constituted one of the largest and most potential ground water reservoirs in the world. Central and peninsular India, formed predominantly by hard rocks, had the top soils formed by in-situ decomposition of parent rock by the action of water, heat and weathering. Rugged and rolling topography, compact and fissured nature of rock formations combined to give rise to discontinuous aquifers having limited to moderate ground-water potential. Exploitation of groundwater in the entire country was on a very low key before independence.

After independence, many large reservoir based multipurpose projects were taken up by many states in the country. The activity of harnessing the surface and sub-surface water resources, however, gained momentum only after the acute foodgrain shortage endured by the country in the fifties. Extensive area was brought under irrigated agriculture due to the completion of several large reservoir based irrigation projects. Cheaper electricity generated by means of hydroelectric projects enabled energisation of pumps, which gave impetus to exploitation of groundwater. Many tube wells in North India and dug wells in the hard rock area of peninsular India dispersed the benefits of irrigated agriculture extensively in the rural areas. Because of the social pressure exercised by the people and their representatives several medium and minor irrigation projects were also taken up by the State Governments after the sixties, in addition to large projects. These developments, besides attempting at optimum development of water resources in the river valley, ensured dispersal of irrigation benefits and could be reckoned as a step towards bringing about more social equity in the distribution of irrigation benefits in the rural area.

Current status of Water Resources Development

Exploitation of groundwater by tubewells for irrigation in North India has brought extensive area under irrigated agriculture, which has increased productivity of the land appreciably. However, in its wake, it has given rise to the problem of damage to irrigated land because of water logging and salinity. The problem of water logging and salinity was also observed in the commands of many major projects in hard rock areas, where water intensive crops like sugar cane were cultivated and where soils were deep and non-drainable, Indiscriminate exploitation of groundwater in the hard rock area resulted in

many wells going dry, resulting in additional expenditure. Construction of many reservoirs in hard rock areas and application of the stored water for irrigation in the command area also helped in increasing groundwater recharge, which sustained many dug wells and augmented use of ground water in conjunction with surface water.

The monsoon season, being limited to only 3-3 1/2 months in major area of the country, supported only the *kharif* crop, necessitating construction of reservoirs to store floodwater of the rivers. This facilitated irrigation of hot weather perennial and winter (*rabi*) crops. Man-made reservoirs provided assured and dependable water for drinking, domestic and industrial use and for perennial irrigation. Because of the environmental and social impacts caused by large reservoirs, however, efficacy of this development alternative was debated and questioned in many a forum the world over during the last 2-3 decades. To examine this issue in its totality the 'World Commission on Dams' was set up in February 1998. Based on analysis of exhaustive data about past performance of large dams in catering to the needs of water supply, irrigation and hydropower generation and effects of adverse environmental and social impacts of construction of large reservoirs, the Report 'Dams and Development - A new framework for decision-making' was released in November 2000. It incorporated certain recommendations about the framework under which the large dam development alternative should continue to exist and indicated possible alternatives to large dams. The long term impact of these recommendations are likely to be very severe for our country and other developing countries, in meeting water demand for the rising population in the next 25 years and hence have to be examined very carefully before taking any policy decision on this issue. Policies suitable for developed countries having temperate climate & snow-fed rivers cannot be applied to a developing country like India, where monsoon is limited to 3 1/2 months & climate is tropical.

Future Trends of Development

As per the estimates prepared for India Water Vision, 2025, projections of water requirement are expected to be as below:

Year	Irrigated area(Mha)	Surface Irrigation (Mha)	Ground water irrigation (Mha)	Surface water required (BCM/Cum m)	Ground water required (BCM/Cum m)	Total water Required (BCM/Cum m)
1994-95	71	33	38	228	200	428
2025	118-140	65-77	53-63	455 - 539	276 - 328	731 -867

Water requirements by 2025 computed as above show the range of values for different expected alternative scenarios. It is seen that water demand would increase by 70 to 100% during the 30 years between 1995 to 2025. The following are the options available to meet this challenge. Enabling policies would have to be decided with a view to developing the water resources so as to increase the area under irrigated agriculture and to give a boost to the rural economy.

Large Dams

Projected water demand, as above, cannot be satisfied unless a number of large reservoirs are created in the country. The first measure would be to mitigate adverse environmental impacts and the second would be to enact enabling laws and to implement them effectively so as to ensure not only physical but also economic rehabilitation of project affected people. Affected people should be the first beneficiaries of the project. Saying 'No' to large dams because of the adverse environmental and social impacts would not be an affordable and sustainable solution (in view of the huge demand for water) but taking mitigation measures as suggested above would be a workable alternative. Based on the guidelines suggested in the WCD report, policies compatible to the social structure and climatic conditions prevailing in our country would have to be evolved. This development alternative would have to play a vital role in stabilizing the rural economy and to meet non-irrigation demands in the next 25 years.

Small Dams

Concurrent with the large dams the tempo of construction of small dams should be kept up so as to disperse irrigation benefits in rural areas and to meet drinking water demand. Small dams are not possible in the alluvial plains of North India. But in the rest of the country there is good scope to take up these schemes. Though these schemes are costlier than large dams they provide seasonal irrigation over rainfed areas and recharge the groundwater to sustain some well irrigation.

Water User's Co-operative Societies

Till recently, surface irrigation in most of the States was being managed by the State Govts. During the last 2 decades, some States have been able to set up Water User's Co-operative Societies to purchase canal water on a volumetric basis from State Govts and to make efficient distribution of the same amongst the cultivators in the command area. Flexibility in the type of crops that can be grown promoting conjunctive use of ground and surface water, better maintenance of conveyance infrastructure and effective recovery of water rates are the arguments in favour of this system. This transformation of water management from the State Govt. to the User's Cooperative Societies is expected to take place on a large scale during the next 25 years. It would increase the area under irrigation because of improvement in water use efficiency, net water rate revenue to the State Govt, productivity of land and the net income to the beneficiaries. It has the potential to transform surface irrigation schemes into better productive units maintained, operated and managed by the beneficiaries.

Groundwater Development

There has now remained limited scope for exploiting ground water in North India. Ground water level had been depleting each year due to over exploitation causing increase in salinity, and at places, pollution by arsenic, fluoride, iron etc.

The problem of over exploitation is observed in some watersheds in the hard rock area. Watershed development activity has been catching up in many States such as Orissa, Madhya Pradesh, Gujarat, Maharashtra, Karnataka, Andhra Pradesh etc. during the last decade. This activity would achieve additional recharge of groundwater and would promote development of irrigated agriculture in the rainfed areas where surface irrigation is not likely to reach. It would conserve soil so as to improve fertility of land, and would

meet fuel and fodder demand through bio-measures. This activity would be the main-stay of rural development in the next 2-3 decades. If implemented and managed properly through active co-operation and involvement of beneficiaries, it has the potential to transform the condition of rural population.

Water Markets

A new trend, which has been catching up in the alluvial belt of North India and alluvial flood plains of some rivers in peninsular India, is the development of groundwater markets. Even though groundwater is a common property until it is extracted, it instantly gets privatised on its extraction. This situation had led to exploitation and sale of surplus water to the neighbouring needy cultivators for mutual benefit. With the optimum exploitation of groundwater resource and fair competition amongst the well owners, water rates are expected to be reasonably competitive and should help in increasing productivity of the land and farm income of the individual cultivator.

Micro Irrigation Systems

Conventional measures of improvement in overall efficiency of surface irrigation systems by providing lining to conveyance infrastructure, providing better regulating structures, introducing canal automation, land leveling etc. were capital intensive and had some limitations in achieving expected improvement in efficiency. Low field water application efficiency (ratio of water quantum the crop theoretically requires and what is actually supplied at the field level) is inherent with the conventional flow irrigation method.

Application of water daily exactly as per water requirement of the crop by Drip irrigation or sprinkler irrigation is the principle of Micro Irrigation Systems (MIS). It dispenses with water stress on crop, avoids wasteful use of water, enables economical application of liquid fertilizer with the water, improves quality of produce and increases productivity. On wells facing shortage of water due to over-exploitation, MIS could be introduced to maintain or possibly increase area under irrigation. Because of the high initial investment, MIS could be best used with pipe distribution network and for growing high value cash crops (grapes, horticulture, floriculture, vegetables, sugar cane etc.). MIS becomes obligatory for high value crops grown in green houses.

Because of the limitations in availability of water through surface and groundwater schemes in some States/river valleys, use of MIS could be on the increase and substantial area under high value cash crops could be brought under MIS during the next 25 years.

Conclusion

Irrigated agriculture plays the role of sheet - anchor in the rural economy. Creating an infrastructure, which would make optimum use of available water resources in the river valley without sacrificing the basic requirement of achieving social equity through dispersal of irrigation benefits, is what any Govt. should aim at. Because of the multiplier effect that it generates, it increases employment generation potential for landless labourers, besides increasing income levels and purchasing power of the beneficiary cultivators. Increased productivity ensures self-sufficiency in food-grains. Measures such as formation of Water User's Societies, introducing Micro Irrigation Systems, promoting water markets etc. would improve water use efficiency of the irrigation systems and bring additional area under irrigation, without much financial burden to the Govt.

Sustainable development aims at meeting the needs of present generation without sacrificing the needs of future generations. Our aim should be to create assets and

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infrastructure (duly mitigating adverse impacts of their creation) which would make optimum use of scarce water resource, would assist in achieving a self-sustaining rural economy and would meet water needs of the society in the coming decades.