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Water Resource Development in Arid Western Region: Impact of Development on Irrigation

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ABSTRACT: Water is one of the most critical inputs for development. It plays a vital role not only in fulfilling basic human need for life and health but in socio-economic development also. On the basis of climatic conditions and agricultural produce, the region fall in Arid Western Region. The economic growth of arid western region mainly depends on availability of water, more specifically the groundwater. The water availability at 75% dependability is only 14.12 BCM. The non agricultural demands of water to increase from 2.66 MAF/year to 4.09 MAF in the year 2015 and 6.541 MAF/year in the year 2045. High priority should be given to the introduction of water saving devices and practices. Agriculture sector is the largest water user sector using more than 90% of the water and it is assessed that the present efficiency of utilisation in medium and minor surface water irrigation project commands is less than 30%. It has been assessed that mean annual natural replenishable ground water is 6.01 MAF against which the utilization /drawl is 8.756 MAF. There is immediate need to control over exploitation of groundwater in dark and gray zones and to increase abstraction in areas where water table is rising through legislation or incentives/disincentives. The IGNP has come as a great boon to the inhabitants of the area. The canal has eased drinking water problem for both human beings and animal population in the area. With the introduction of irrigation water in such a large quantities to such a large area and the associated influx of large numbers of people and animals into what was a very sparsely populated region, the fragile desert eco-system was bound to be negatively affected in terms of loss of xeric species and increased utilisation pressures on both soils and vegetation. The government should launch a campaign to recharge groundwater and harvest the surface run-off in areas with untapped potential on a war footing; Locally available surface water sources may be utilised for water supply after the on-set of monsoon till its end. Traditional practices of roof-top rain water harvesting and storage need to be encouraged through appropriate incentives and regulations with the involvement of NGOs; Groundwater regulation and control is needed in over-exploited and critical blocks. Action may be initiated to enact the pending Rajasthan Groundwater (Regulation) Bill 1997 in the light of present groundwater scenario and knowledge.

INTRODUCTION

"Water is one of the most critical inputs for development. It was very rightly said in the 'vedas' that water is one of the five elements. There can be no subject more important for human kind than water. A well managed society is one that knows how to treat its water with care, with prudence and with respect, above all with sense of it being a universal asset."

Shri K.R.Narayanan,former President of India

Water is universally accepted as a symbol of life as it is the most crucial for maintaining an environment and ecosystem conducive to sustaining all forms of life. It plays a vital role not only in fulfilling basic human need for life and health but in socio-economic development also. The demands for drinking, domestic activities, livestock, agriculture, industries, power generation and other uses are all increasing to meet the requirements of increasing population and also to cater for the enhanced per capita requirement due to rise in living standard. Irrigation, the largest water user sector, is feeling the pressure of increasing demands of other user sectors all over the world because of limited fresh water availability. On the other hand the need to increase agricultural production, for which also water is the most critical input, to meet the food and fiber requirement of increasing population is equally important.

Agro Climatic Zones of Rajasthan

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On the basis of climatic conditions and agricultural produce, Rajasthan has been divided into 9 agro-climatic zones; the region comprises all tehsils of Bikaner, Jaisalmer and Barmer districts, Phalodi, Shergarh, Osian and Jodhpur tehsils of Jodhpur district and Sujangarh, Ratangarh and Sardarshahar tehsils of Churu district fall in Arid Western Region. This is the most arid part of the state where the annual rainfall varies from 10 to 40 cm, quite often erratic, so much so, that the entire rainfall of the year may fall on a single day and the rest of the year may be dry.

Summer temperatures are always high and the diurnal range exceeds even 20^{o} C. During the day, the summer temperatures may be as high as 49^{o} C but in the night, the temperatures may fall, to less than 20^{o} C. In winters, the day temperatures are higher but the night temperatures may be near freezing point. Winters are of short duration, not exceeding two months - December and January.

This is an area of not-so-developed drainage system where there are no flowing streams. Owing to poor rainfall, surface water resources do not exist while ground water resources are often deep and brackish. Natural vegetation is therefore, only seasonal.

Mostly rainfed crops like bajra, kharif pulses, guar etc. are own during the kharif season. Rabi crops like wheat, rape-seed and mustard are grown only in areas where irrigation water is available.

The economic growth of Rajasthan particularly north western desert region mainly depends on availability of water, more specifically the groundwater. According to a report- about 71% of irrigation and 90% of the drinking water supply source is ground water

PRESENT STATUS OF DEVELOPMENT OF IRRIGATION AND CHALLENGES FOR WATER SECTOR

"Irrigation is everything in India, water is more valuable than gold because when water is applied to land, it increases its productivity at least six fold and barren land becomes productive, which otherwise would produce nothing or next to nothing."

Sir Charlse Trevelgan.

Irrigation, no doubt, is a very important input by itself which enhances the effectiveness of all other agricultural inputs like fertilizers, improved seeds etc.

Irrigation facilities were limited at the time of independence, and there were 1 major, 43 medium and 2272 minor projects in the State with irrigation potential of only 4 lac ha. At present there are 104 major and medium irrigation projects and 4786 minor irrigation projects in the State and the irrigation potential created has increased to 28.12 lac ha.But in spite of this it has not been possible to keep pace with population growth, increasing requirements, and technological changes.

WATER AVAILABILITY

The area west of Aravali, mainly forms part of the Great Thar Desert with average rainfall of 318.7 mm (designated as basin no. 15). According to the simulation studies carried out for the basin the total internal surface water resources in the State have been estimated as 21.71 BCM at 50% dependability as against 19.56 BCM estimated earlier. The water availability at 75% dependability is only 14.12 BCM. However, the economically utilisable surface water as per present situation at 50% dependability is estimated as 16.05 BCM. Apart from this, the total external surface water resources from other States, under various inter-state agreements, are 17.88 BCM .

WATER DEMANDS

The study got carried out for State Water Plan has projected the non agricultural demands of water to increase from 2.66 MAF/year (at 1995 level) to 4.09 MAF in the year 2015 and 6.541 MAF/year in the year 2045. If all the 136 Lac ha of irrigable land is irrigated the agricultural water requirement will be about 81.07 MAF, which obviously is not available. Considering the water availability and proposed projects irrigation in 51.25 lac ha. of CCA has been planned and proposed in the State Water Plan.

IMPROVEMENT IN WATER USE EFFICIENCIES

Low efficiency of water utilisation is prevalent in the agricultural as well as the domestic and industrial water consumption sectors also. High priority should be given to the introduction of water saving devices and practices. Agriculture sector is the largest water user sector using more than 90% of the water and it is assessed that the present efficiency of utilisation in medium and minor surface water irrigation project commands is less than 30%. With modern irrigation techniques like sprinkler and drip, which have efficiencies as high as 70-75% and above 90% respectively, the over all efficiency can be easily increased significantly.

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MANAGEMENT AND CONTROL OF GROUNDWATER

It has been assessed that mean annual natural replenishable ground water is 6.01 MAF against which the utilization /drawl is 8.756 MAF. Though total 8.18 MAF of ground water including return flows from irrigated areas, urban and other water utilisation sectors is available but still the exploitation is highly imbalanced. In some areas, especially in irrigation project commands, the water table is rising and even causing water logging. Simultaneously in other areas the water table is falling and threatening the groundwater quality. In the areas where groundwater is the main source of water for irrigation the impact of irrigation is the significant drop in water level in the area it has been noted in Nokha and Dungargarh tehsils of Bikaner where the blocks converted into grey zone

There is immediate need to control over exploitation of groundwater in dark and gray zones and to increase abstraction in areas where water table is rising through legislation or incentives/disincentives. Special attention will be given to areas identified under critical, semi-critical and over exploited categories.

Efforts will be made to develop control of society on groundwater abstraction and management for safe-guarding their own interest and future. Conjunctive use of ground and surface water in canal command areas needs to be practiced to prevent water-logging of productive lands and also for sustainability of groundwater.
Artificial recharge of ground water through all possible methods, to be identified for different areas where groundwater is being overexploited, will be taken up on priority.

INDIRA GANDHI NAHAR PARIYOJNA- MAJOR SOURCE OF IRRIGATION

Indira Gandhi Nahar Pariyojna (IGNP) is an engineering miracle through which the water of Satluj and Bias rivers are brought down to transform the vast waste sandy tract of the great Indian Desert - the Thar into a prosperous fully developed region humming with agriculture, industry and commerce by irrigating an area of north western Rajasthan. The IGNP being a very large sized project, having CCA of 1.537 M.ha, it was decided to take up the construction work in two stages. The areas of Ganganagar, Hanumangarh and Bikaner districts lies in stage I, is divided into seven command areas, comprising six branches. It covers 189 kms of Indira Gandhi main Canal, which was completed in 1975. The area has distribution system of 2618 kms flows and 332 kms in lift command respectively. By March 1990, 3075 kms long Canal distribution in stage-I was completed and actual irrigation facilities were provided in 5.24 lakh ha area. In fact 11.5% of total water of the canal system was for drinking and Industrial purpose.
IGNP Stage -II covers an area of about 7000 sq.km in parts of Jaisalmer, Jodhpur, Bikaner districts of Rajasthan.

IMPACT OF IGNP IN THE ARID WESTERN REGION

(A) **BENEFICIAL IMPACTS: -**Some of the important beneficial impacts are as under:
(1) Greatly increased agriculture activity
(2) Greatly increased scope for settlement and land ownership with associated employment opportunities and income generation allowing large number of formerly land less people to become land- owners.
(3) Significant poverty alleviation, with income-generating opportunities associated with on-farm activities and many supporting services. Supply industries and marketing enterprises.
(4) Reduction in desertification influences, notably by stabilisation of large tracts of sandy soils and sand dunes, both by irrigation development and by afforestation measures and considerable increase in overall vegetation cover.
(5) Establishment of agricultural and general social support services and improved means of access with further improvements in general quality of life.
(6) Establishment of suitable conditions for improving human and animal nutrition and drinking water quality and therefore, for improving general health.
(7) Infra-structural development of the entire region The canal is changing the whole geographical structure of this region. The desolate area is thriving into big towns and mandies with crowded activities and growing industrialization possibilities.

(B) NEGATIVE IMPACTS OF IRRIGATION THROUGH IGNP:
(a) Land clearance for farming and settlement which affects the plan and inter dune vegetation particularly;
(b) Elimination of natural species, which do not survive well in the wetter soil condition prevailing irrigation.
(c) Unfavourable soil condition (and even standing water) in the low lying areas

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(d) Over exploitation of plants by the increased population of people and animals for uses such as timber, fuel and for grazing.
(e) The development of a rising regional ground water table, resulting in surface water logging and soil salinity to the extent that a few locations agricultural activities have ceased and settlements have had to be abandoned.
(2) The long-term accumulation of salts from the irrigation water, because there are no proven natural drainage outlets and hence there is likely to be an eventual build up of the salts.
(3) Increased potential for the spread of water- related disease.
(4) Destruction of traditional rangelands (locally known as Orans) and livestock passageways and consequent destruction of the associated nomadic ways of life.
(5) Damage to archaeological sites owing to water logging and high ground water levels. (e.g. RangMahal, Badopal, Munda etc.)
(6) Increased potential for the influx and development of agricultural pests and diseases.
(7) The impact of water logging on population has been extremely negative as the water levels have rises, they had to change from crop production to pasture and livestock development, after which the soils have become unusable and the farmer have lost their livelihood from the land – a devastating impact for a small holder with no immediate alternative source of income.
(8) The water logged area is estimated as 513 sq.km. , further, it is estimated that 24% of the project area is likely to be water logged, if the rise of water level is allowed at the present rate. These damages occurred due to seepage from the big manmade escape water reservoirs. In 1991, out of CCA of 5.25 lakh ha, 1.56 lakh ha area was water logged i.e. 34% of the command area. It was observed that the water table has risen at the alarming rate of 1 m per year, which was 20% higher than the Bhakra canal area.

A detailed study on Water logging was carried out in the total CCA of 5.25 lakh ha. of IGNP. Stage-I, the areas falling under different categories are as follows:

Class	**Area in ha**	**% of total area**
A). Potentially Sensitive area. Water level 1.5 to 6 mbgl	2,02,960	39.0
B).CriticalAreas		
(i) Waterlevel 1.0to1.5mbgl	22,000	4.18
(ii) Marshy land/stagnant water level 0.0 to 1.0 mbgl	13,750	2.60
and total loss of crop	2,38,710	

CONCLUSIONS

The problems faced by the water sector in the arid western region are many, acute and serious. The implementation of the envisioned action plan will enable the department to meet the challenges, present in future, and achieve the objective of integrated, efficient, environmentally and financially sustainable development and the management of the scarce water resources of the State and at the same time ensure optimal utilization of every drop of water, through water conservation, increased distribution efficiency and use of water saving devices and practices leading to an efficient, scientific, innovative, transparent and responsive irrigation department. The water sector would then be able to accelerate economic growth of the state.

RECOMMENDATIONS

1. Mass awareness about the impending crisis of water scarcity and the necessity of conservation and judicious utilisation of water must be urgently created. This job is better done by NGOs than government agencies;
2. The government should launch a campaign to recharge groundwater and harvest the surface run-off in areas with untapped potential on a war footing;
3. Water distribution systems should be improved so as to minimise conveyance losses and leakages.
4. Salt-contaminated water in areas suffering from acute water scarcity may be desalinated using RO or Electro-dialysis or Flash Distillation techniques to make it potable;
5. The government must formulate a comprehensive plan for treatment of urban sewage water and industrial wastewater and its utilisation for irrigation of crops and lawns, and eco-system maintenance including filling in of dry lakes, ponds, and tanks;

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6. Water-intensive industries or activities should not be permitted in overexploited and critical blocks. Major/medium industries should adopt recycling/reuse of water to minimise their fresh water requirement;
7. Locally available surface water sources may be utilised for water supply after the on-set of monsoon till its end. Use of groundwater during this period may be minimised and be stepped up thereafter. This will conserve precious groundwater resource for use in the lean period;
10. Traditional practices of roof-top rain water harvesting and storage need to be encouraged through appropriate incentives and regulations with the involvement of NGOs;
11. Groundwater regulation and control is needed in over-exploited and critical blocks. Action to implement restrictions on installation of new wells in notified areas should be initiated. A State Groundwater Development Authority may be set up soon for regulation and monitoring of groundwater extraction;
12. All the tube wells and all the owners of drilling rigs in the state must be registered with the State Groundwater Development Authority and no new tube wells should be permitted in over-exploited and critical blocks except by community-based organisations and PRIs for drinking water purposes only;
13. Action may be initiated to enact the pending Rajasthan Groundwater (Regulation) Bill 1997 in the light of present groundwater scenario and knowledge. This should be preceded by creating a mass awareness among the people about the need for regulation of extraction of groundwater.

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