GROUND WATER CONCERNS & IRRIGATION SCENARIO

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Groundwater through wells has 60.86 per cent share in total irrigation. Almost 70 per cent of groundwater potential has been utilized. Water table in many regions has been falling at an alarming rate. NASA scientists in the US, using satellites to track groundwater loss in India's north-western grain basket have found annual average 33 cubic km drop in the water table in the region.

As the Prime Minister Sh. Narendra Modi has urged, India must quickly expand its irrigation network and improve water usage to offset the impact of less monsoon rainfall to ensure quick results for farmers by reviewing administrative mechanisms, financial arrangements and technology use in irrigation. There should be intensive efforts to increase the number of farm ponds. Falling groundwater levels in some states could force an urgent shift in crop patterns". This article highlights the current irrigation scenario in India and pinpoints the areas of serious concern.

Irrigation Scenario

The share of agriculture in India's GDP progressively declined from 23.4 per cent in the 9th five year plan to 17.60 per cent in 2014-15 but population depending on agriculture as the main source of livelihood declined to 48.9 per cent from 59.9 per cent between 1999-00 and 2011-12. Agricultural growth rate during 2014-15 is estimated to be 0.2 per cent as against country's 7.3 per cent economic growth rate. Food output in 2014-15 is estimated to be 251.12 million tons [MT] significantly less than 257.13 MT and 265.14 MT in 2012-13 and 2013-14 respectively. Monsoon rain still continue to influence the agricultural growth. About 55 per cent of net cropped area is rain-fed which is critical for security of food, fodder and farm income and even responsible for farmers' distress. About 80 per cent of horticulture-based livelihoods and 100 per cent of forest products are realized without assured irrigation. Yield of food grains in rain-fed areas is almost 50 per cent of that in irrigated areas. India's 44 per cent food grains come from 56 per cent unirrigated land.

Our water scenario is fast changing because of increasing population, rising demand for irrigating agricultural land, rapid urbanization and industrialization, electricity generation, impact of global warming and erratic rainfall.

As against the ultimate irrigation potential of 140 million hectares estimated in 1997, currently irrigation facilities of 102.8 MHA are created and 45 per cent of country's net sown area [63.36 MHA] is irrigated leaving 55 per cent at the mercy of monsoon rains. According to World Development Indicators [1998] in the mid-1990s, the percentage of irrigated area in India was less than that in Bangladesh, Nepal and China and less than half that in Japan and Korea. Crop-yields in India are relatively lower than that in East Asia and have almost stagnated despite a holding size that is larger on an average than in China. Rice yields in India are almost half that in Japan.

Water for Life Decade [2005-15] and the annual World Water Day being held on March 22 every year reminds all stakeholders about the fact that water is finite, scarce, costly and precious and, therefore, should be efficiently managed for country's sustainable development. On March 22 of each year, the electronic and print media are expected to critically discuss and

publish the policy, programs, performance and issues identified during the previous years and present the framework to pursue the unfinished tasks to accomplish the mission.

Groundwater

Groundwater facilitates farmer to source water where and when he wants it. Storing and replenishing groundwater is cost effective than building and maintaining surface irrigation structures. Around 70 per cent of India's irrigation needs and 80 per cent of its domestic water supplies are sourced from groundwater. A large part of agriculture is dependent on non-renewable groundwater. In 1960-61, the share of groundwater which was just 1 per cent of total irrigation resources increased to 30 per cent in 1990-91 and further to 45 per cent in 2011-12. As against this, share of canal irrigation declined from 36 per cent in 1990-91 to 25 per cent in 2011-12. Erratic monsoon affects farmers owning tube-wells compelling them excessive extraction of groundwater whereas most small and marginal farmers [accounting for about 85.9 per cent of the total holdings and cultivating 42.8 per cent land] without their own tube-wells and pump-sets have to buy water at substantial cost.

From time to time, Government introduced several water resources development programmes to increase cropped area under irrigation and significantly enhance water use efficiency, viz. [i] Command Area Development Program [CADP] in 1974-75, to bridge the gap between irrigation potential created and its actual utilization by introducing suitable cropping pattern, strengthening research, extension and training facilities, organizing field demonstrations and supplying inputs [ii] Rural Infrastructure Development Fund [RIDF] in 1995-96 to complete hitherto incomplete irrigation projects mobilizing deposits out of the shortfall in commercial banks' lending targets to agriculture to complete irrigation development projects [iii] Accelerated Irrigation Benefit Program (AIBP) in 1996-97 for extending financial assistance to State Governments to complete incomplete irrigation schemes. From 2004-05 CADP was merged with AIBP and renamed as Command Area Development &Water Management [CAD&WM] with core components of construction of field channels aimed at enhancing water use efficiency.

Micro-irrigation

National Mission on Micro Irrigation was established to increase water-use efficiency by promoting drip and sprinkler irrigation systems. Since mid-1990s use of micro-irrigation comprising Drip and Sprinkler irrigation system has been encouraged as it is the most efficient method to save water and increase water use efficiency as compared to the conventional surface method of irrigation, where water use efficiency is only about 35 to 40 per cent. Water saving due to Drip is between 12 per cent and 84 per cent depending upon crops, sources of lifting water, etc. Studies reveal that water saving including water use efficiency and productivity gains are higher in those crops cultivated under Drip as compared to Sprinkler. Around 80 crops can be cultivated under Drip and Sprinkler. While Drip is most suitable for wide spaced horticulture and other crops, Sprinkler is for closely-spaced crops. Micro-irrigation enhances input use efficiency and crop productivity; reduces energy consumption, weed infestation, soil erosion and cost of cultivation. Researches have established that investment in micro-irrigation is financially/economically viable. The internal rate of return (IRR), which varies across States and categories of farm-sizes, was ranging from 3 per cent to 35 per cent for marginal farmers, 14 per cent to 88 per cent for small farmers and 15 per cent to 128 per cent for large farmers. The IRR was higher among large farmers in Kerala and Maharashtra because of diversified intercropping pattern in orchard/plantation crops. Micro-irrigation promises farmers not to over-

exploit groundwater. The study in nine promising States in 2010 revealed that area covered under Drip and Sprinkler was 14,28,460 hectares[12.25 per cent] and 24,42,430 hectares [7.99 per cent] as against potential of 1,16,59,000 hectares and 3,05,78,000 hectares respectively. Thus, after two decades, total area under Micro-irrigation was only 38,70,860 hectares[9.16 per cent] as compared to potential of 4,22,37,000 hectares. Out of this, about 30 million hectares are suitable for Sprinkler irrigation for crops like cereals, pulses, oilseeds and fodder crops and a potential of around 12 million hectares under Drip for cotton, sugarcane, fruits, vegetables, spices, condiments; and some pulse crops like red gram, etc. Only a few states like Andhra Pradesh, Maharashtra and Tamil Nadu have expanded area under micro-irrigation. Factors attributed to low adoption rate include high investment cost, complex technology and socio-economic issues such as, a large number of small and marginal farmers, fragmented landholdings, cumbersome procedure to access institutional credit and Government subsidies, farmers' limited knowledge in operating and maintaining systems as often the system is facing problems of clogging of filters and drippers, besides the required pressure from the pumps not being maintained due to the poor conditions of the pump sets resulting in low pump discharge. The 12th five year plan targets bringing about 10.1 million hectares under macro-irrigation [4.8 MHA under drip and 5.3 MHA under sprinkler systems]

Areas of Serious Concern

While the Government has invested significant resources to develop irrigation facilities, following are the issues that have substantially constrained the harnessing of full potential of irrigation resources, full utilization of water, increase in irrigated cropped area and water use efficiency impacting on crop productivity per unit of water resources, farmer's income and employment generation. The program implementers need to consider these issues seriously and demonstrate their administrative skill, capability and commitment to formulate and implement a time-bound program to achieve the mandated tasks in five years.

- **Delayed implementation:** Reports indicate that despite the Central Government providing more than Rs.530 billion between 2004 and 2014 to State Governments for completion of irrigation projects, implementation of 163 out of 297 projects was delayed, including some projects for over 20 years.
- **Incomplete projects:** Between 500 and 600 projects have remained incomplete since 1969-74. Currently, 557 projects are yet to be completed. Andhra Pradesh has completed only 17 out of 105 projects, followed by Karnataka [33/305], Maharashtra [94/186] and Madhya Pradesh [90/242] projects.
- **Time and cost overrun:** Worst impact of the inordinate delays in completion of projects has been the time and cost overruns. A study on cost overruns revealed that cost escalation was 138 per cent for 12 projects, 500 per cent or more for 24 medium projects and 1000 per cent and more for 24 out of 151 major projects approved earlier than 1980. Average cost escalation was 200 per cent for major projects starting from 1985.
- **Under utilization:** The gap between the irrigation potential created [IPC] and the irrigation potential utilized [IPU] has been steadily widening from the first plan [1951-56]. IPU is 80 MHA [77.82 per cent] of 102.80 MHA of IPC. Factors responsible for low utilization of irrigation as studied by Indian Institute of Management [Ahmedabad, Bangalore, Kolkata and Lucknow] focus on lack of proper operation and maintenance, incomplete distribution systems, non-completion of Command Area Development works, changes from the initially designed cropping pattern and diversion of land for other purposes. Besides, inadequate provision of budget for operation and maintenance of the irrigation system is significantly responsible for underutilization followed by non-completion of distributaries, minors, field channels and on-farm development.
- **Groundwater depletion:** Groundwater through wells has 60.86 per cent share in total irrigation. Almost 70 per cent of groundwater potential has been utilized. Water table in many regions has been falling at an alarming rate. For decades, farmers in agriculturally-predominant regions of Punjab, Haryana, Uttar

Pradesh and Rajasthan were encouraged to sink tube wells to get free water for agricultural purpose. Electricity for pumping out water was supplied virtually free or at heavily subsidized rates. This led to over-exploitation of groundwater and even encouraged farmers to flood crops like rice, wheat and fruit trees with water indiscriminately which impacted on soil and environmental degradation and low crop productivity. Rate of groundwater depletion raced faster than the rate of replenishment in many States. **NASA scientists in the US, using satellites to track groundwater loss in India's north-western grain basket have found annual average 33 cubic km drop in the water table in the region. The satellite study has revealed a loss of 109 cubic km groundwater in Punjab, Haryana and Rajasthan between August 2002 and October 2008, twice the capacity of India's largest surface water reservoir, the Upper Wainganga in Madhya Pradesh.**

- **Food insecurity:** Water required to meet the food deficit in India eventually has to be searched in water-scarce regions, which have good endowment of arable land. This puts additional pressure on the water scarce-regions for freshwater. Hence, food crisis is as much a crisis of land in water-rich regions, as crisis of water in semi-arid and arid water-scarce regions. Problem of over-exploitation of groundwater in the water-scarce regions increases the magnitude of the crisis. In nutshell, problem of groundwater over-exploitation is more serious than we realize. If unchecked, its impacts on national food security are likely to be severe as the regions that are experiencing over-exploitation are also the regions producing surplus cereals that are transferred to land-starved water-surplus regions. The alluvial areas of Punjab, Rajasthan and Haryana that experience decline in water levels are the largest contributors to India's wheat stock and the hard rock regions of Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Chattisgarh and Karnataka are the largest contributors to India's rice stock. The food security impacts would be aggravated in the light of issues, viz. [i] depletion shrinks the area under cereals irrigated by wells [ii] when water becomes scarce, and cost of irrigation water rises, the farmers move away from traditional cereal crops that give low returns per unit of water and cultivate cash crops. This can lead to decline in food production impacting national food security. This calls for researches and implementing strategies to [a] improve the surface irrigation in intensively irrigated areas facing over-exploitation [b] improve the efficiency of utilization of green water and the rainwater held in the soil profile [c] reduce the soil water depletion, through reduction in the amount of residual moisture held in soils after harvesting[d] reduce the consumptive use of water (Evaporation Transpiration) through shift to low water consuming crops that are economically more efficient, i.e. crops that give higher net returns per unit of water consumed. But, under the current pricing regime followed in canal water, and the electricity pricing policy for farm sector followed by many states, the marginal cost of using water and electricity is almost zero, except when the supply of energy and water is extremely limited. This necessitates the policy and programs to incentivize farmers of these regions that can encourage them to adopt measures to improve the efficiency of water use and also improves the returns per unit of land. Therefore, what is most important is to introduce reforms in water and energy sector, including volumetric pricing of canal water and consumption based pricing of electricity used in groundwater.

Conclusion: Over the years, there has been a manifested lack of attention to water legislation, water conservation, water use efficiency, water harvesting and recycling and infrastructure. Current scenario exhibiting number of incomplete projects accompanied by low utilization of irrigation potential already created shows that return on capital invested in creating irrigation facilities is inordinately delayed or almost lost. All incomplete projects need to be completed by 2020 by drawing a suitable road map indicating specifically the role, responsibility and accountability of officials, department and ministry concerned.

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