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WATER RESOURCES IN INDIA: CRITICAL ISSUES AND STRATEGIC OPTIONS

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ABSTRACT

Availability of safe drinking water is inadequate. Severe water shortages have already led to a growing number of conflicts between users (agriculture, industry, domestic), intra-state and inter-state. Emerging challenges include management of existing infrastructure and of the water resource itself. Water reform in India mostly focuses on organizational issues rather than the instruments that govern the relationship between the regulator and the user. Provision of canal irrigation and water supply services in India has largely remained with the government agencies. Absence of enforceable water entitlements at all levels is at the root of service shortcomings, water use inefficiency, un-regulated groundwater extraction, negligence of traditional and low-cost water bodies, financial problems and conflicts which plague the water sector. Faced with poor water supply services, farmers and urban dwellers have resorted to helping themselves by pumping out groundwater, which has led to rapidly declining water tables; in coastal areas this trend has led to salinity ingress. Financial crunch has also led to an enormous backlog of maintenance and thereby, inadequate performance levels of irrigation projects. India requires proper design and effective execution of suitable strategic options. Water is emerging as a national challenge and its most efficient management has to be given top priority in order to meet the future demands of food grains for a fast growing population. Managing water resources is more important than managing material wealth.

INTRODUCTION

In India, the total utilizable water resource is assessed as 1123 BCM. Keeping a provision of about 71 BCM/yr out of 433 BCM of groundwater, 362 BCM/yr of the resource is estimated to be available for irrigation. The net draft of groundwater for irrigation is around 150 BCM/yr. The

per capita availability of water at national level has been reduced from about 5177 cubic meters in 1951 to the estimated level of 1,820 cubic meters in 2001 with variation in water availability in different river basins. Given the projected increase in population by the year 2025, the per capita availability is likely to drop to below 1,000 cubic metres, which could be labeled as a situation of water scarcity (Revathi.K.2011).

BACKGROUND OF THE STUDY

India has a highly seasonal pattern of rainfall, with 50% of precipitation falling in just 15 days and over 90 per cent of river flows occurring in just four months. A total storage capacity of 212.78 Billion Cum (BCM) has been created in the country through major and medium projects. The projects under construction will contribute to an additional 76.26 BCM, while the contribution expected from projects under consideration is 107.54 BCM. The total availability of water in the 76 major reservoirs was 109.77 BCM at the end of the monsoon of 2005 (Manzoor.K.P.2011). The irrigation potential of the country has been estimated at around 139.9 mha without inter-basin sharing of water and 175 mha with inter-basin sharing. The Central Ground Water Board (CGWB) has estimated that it is possible to increase the groundwater availability by about 36 BCM, by taking up rainwater harvesting and artificial recharge over an area of 45 mha through surplus monsoon runoff. Thus, the groundwater availability may correspondingly increase. The recent estimates (GOI, 2010) on water demand are made by Standing Sub-Committee of the Ministry of Water Resources (MoWR) and the National Commission for Integrated Water Resources Development (NCIWRD); for the period till 2050's their estimates (shown in Table 1) . Both of them have triggered warning bells on the intensity of the problem. The estimates by MoWR indicates that, by year 2050, India needs to increase by 5 times more water supplies to industries, and 16 times more for energy production, while its drinking water demand will double, and irrigation demand will raise by 50 per cent.

TABLE - 1

WATER DEMAND (IN BCM) FOR VARIOUS SECTORS

Sector	Standing Sub-Committee of MoWR			NCIWRD		
Year	2010	2025	2050	2010	2025	2050
Irrigation	688	910	1072	557	611	807
Drinking Water	56	73	102	43	62	111
Industry	12	23	63	37	67	81
Energy	5	15	130	19	33	70
Others	52	72	80	54	70	111
Total,	813	1093	1447	710	843	1180

Source: Ministry of Water Resources (2010).

GROUNDWATER DEVELOPMENT

The total annual replenishable groundwater resources of the country have been assessed as 433 Billion Cubic meters (BCM) and the net annual groundwater availability is estimated at 399 BCM (GOI, 2010). The groundwater development level is 58 per cent. The development of groundwater in different areas of the country has not been uniform. Highly intensive development of ground water in certain areas in the country has resulted in over exploitation leading to decline in the levels of groundwater and sea water intrusion in coastal areas. There is a continuous growth in 'dark' and 'overexploited' areas in the country. Out of 5723 assessment units (Blocks/Mandals/Talukas) in the country, 839 units in various States have been categorized as 'Over exploited'. In addition 226 units are 'Critical'. There are 550 semi-critical units, where the stage of ground water development is between 70 per cent and 100 per cent (MoWR, 2010). The Central Ground Water Authority (CGWA) has notified 20 severely critical/over exploited areas in the country for regulation of groundwater development and management. Over the last two decades, 84 per cent of the total addition to net irrigated area came from groundwater, and only 16 per cent from canals. By the year 2000, the net area irrigated by private tubewells is about double the area irrigated by canals. Groundwater supplies support 70 per cent of the irrigated area, about 80 per cent of domestic water supplies (World Bank, 2010). According to the Planning Commission, while the agriculture sector accounts for nearly one-third of the sales of the State Electricity Boards, the revenues from farmers account for only 3 per cent of total revenue. The World Bank (2010) estimates that subsidies to farmers account for about 10 per cent of the total cost of supply, or about Rs 240 billion a year, which is equivalent to about 25 per cent of India's fiscal deficit and two and a half times the annual expenditure on canal irrigation, with large impacts on fiscal deficits at the state level. In addition, sustainability of groundwater resource itself is a major concern. Many of the most highly productive localities are already under severe groundwater stress. This is undoubtedly a crucial challenge facing India in the coming decades.

11TH FIVE YEAR PLAN FOCUS

The 11th Five Year Plan (2007-12) lays down provisions for efficient management of water resources in the country. The main objectives of the XI Plan, as pointed out in the MoWR working group report are

a) Creation of additional potential of around 16 mha;

b) Reducing gap between potential created & its utilization;

c)) Mitigation of flood damages;

d) Promotion of mass awareness on water related issues. In order to achieve these objectives, the group recommends a few strategies viz., completion of ongoing irrigation projects and extension, renovation & modernisation of old schemes; improvement in the efficiency of irrigation system: Command Area Development and Water Management; Participatory Irrigation Management; sustainable groundwater development and management; research and development activities on priority areas; establishment of River Basin Organizations; information, education and communication for mass awareness. The plan emphasizes the creation of irrigation potentials and

thereby highlights the need to close the gap between irrigation potential created and irrigation potential utilized so as to ensure effective 'development' and 'management'.

IRRIGATION DEVELOPMENT

In an agrarian economy like India, irrigation has played a major role in the agricultural production process. Irrigation development in the country has been taken up in a big way through Major, Medium and Minor irrigation schemes since independence. The irrigation potential has gone up from 22.6 Mha (9.76 Mha through Major and Medium and 12.84 Mha through Minor) prior to Plan period to 93.95 Mha by the end of IX Plan and further to 97.15 Mha (38.87 Mha through Major & Medium and 58.23 Mha through Minor) up to March 2004 against the Ultimate Irrigation Potential of 139.91 Mha (58.49 Mha through Major & Medium and 81.42 Mha through Minor). This development of irrigation facilities has largely contributed to country's self sufficiency in food grains which has gone up from 51 Million tons in 1950 to 210 million tons in 2000. A total number of about 1248 Major, Medium and ERM (Extension, Renovation and Modernisation) projects have been completed up to March 2004 and another 471 (169 Major, 219 Medium & 83 ERM) projects, which have spilled over from IX Plan with a balance cost of about Rupees One lakh crore, are on-going. In addition, 300 new projects (78 Major, 136 Medium & 86 ERM) are being taken up during the X Plan period. Additional Irrigation Potential of 10.50 Mha (6.5 through Major and Medium and 4.00 Mha. through Minor) is planned to be created during the X Plan (also see Table 2), totaling to 104.45 Mha by the end of the current Plan (MoWR, 2007).

TABLE- 2

MAJOR AND MEDIUM IRRIGATION PROJECT OF DURING X PLAN

	Major	Medium	ERM
Projects spilled into X Plan	171	233	86
New projects taken up in X Plan	49	84	46
Projects likely to be completed in X Plan	48	91	39
No. of projects deferred/merged/reclassified etc.	- 6	-4	- 4
Spillover projects into XI Plan	166	222	89

Source: Ministry of Water Resources (2010).

POTENTIAL CREATION

Expansion of Irrigation facilities, along with consolidation of the existing systems, has been the main part of the strategy for increasing production of food grains. With sustained and systematic development of irrigation, the irrigation potential through major, medium and minor irrigation projects has increased from 22.6 million hectares (mha.) in 1951, when the process of planning began in India, to about 98.84 mha. at the end of the year 2004-05. Plan-wise irrigati n

potential created and utilised through major, medium and minor irrigation projects in the country is shown in Table 3.

TABLE- 3

IRRIGATION POTENTIAL CREATED AND UTILIZED DURING PLAN PERIODS IN INDIA

Plan period	Potential (cumulative) created (mha)	Potential (cumulative) utilized (mha)
Pre plan period)	22.60	22.60
I plan (1951-56)	26.26	25.04
II plan (1956-61)	29.08	27.80
III plan (1961-66)	33.57	32.17
Annual plans(1966-69)	37.10	35.75
IV plan (1969-74)	44.20	42.19
V plan (1974-78)	52.02	48.46
Annul plans (1978-80)	56.61	52.64
VI plan (1980-85)	65.22	58.82
VII plan (1985-90)	76.53	68.59
Annual plans (1990-92)	81.09	72.86
VIII plan (1992-97)	86.26	77.24
IX plan (1997-2002)	93.95	80.06
X plan(2002- 2007)	98.84	83.56

Source: Ministry of Water Resources, 2010

A milestone in water resources development in India is creation of a huge storage capability. Because of these created storage works it has now become possible to provide assured irrigation in the command area, to ensure supply for hydropower and thermal power plants located at different places and to meet requirement for various other uses. Flood moderation could be effected in flood prone basins, where storage has been provided. Besides, supply of drinking water in remote places throughout the year has become possible in different parts of the country.

PLANNED INVESTMENTS

The expenditure incurred on major and medium projects and the irrigation potential created during the various plan periods are shown in Table 4.

TABLE- 4
MAJOR AND MEDIUM IRRIGATION PROJECTS (EXPENDITURE INCURRED AND POTENTIAL CREATED)

Period	Outlay/expenditure (Rupees in crores)	Potential created (mha)	Cumulative (mha)
Pre-Plan period	Not available	9.70	9.70
First Plan (1951-56)	376	2.50	12.20
Second Plan (1956-61)	380	2.13	14.33
Third Plan (1961-66)	576	2.24	16.57
Annual Plans (1966-69)	430	1.53	18.10
Fourth Plan (1969-74)	1,242	2.60	20.70
Fifth Plan (1974-78)	2,516	4.02	24.72
Annual Plans (1978-80)	2,079	1.89	26.61
Sixth Plan (1980-85)	7,369	1.09	27.70
Seventh Plan (1985-90)	11,107	2.22	29.92
Annual Plans (1990-92)	5,459	0.82	30.74
Eighth Plan (1992-97)	21,669	2.22	32.96
Ninth Plan (1997-2002)	42,968	4.10	37.06
Tenth Plan outlay (2002-07)	71,213	6.50	43.56

Source: Ministry of Water Resources, Government of India, 2010.

At the beginning of the Tenth Five Year Plan, there were 162 major projects with a spill over cost of Rs. 140968 crore, 221 medium projects with a spillover cost of Rs. 12786 crore, and 85 Extension, Renovation and Modernisation projects, with a spillover cost of Rs. 21256 crore.

India is currently facing a daunting set of water-related challenges. The next two sections deals with key issues followed by strategic options to address them.

KEY ISSUES IN WATER RESOURCE MANAGEMENT

1. ACCESS TO AND ADEQUACY OF SAFE WATER

The per capita water availability at national level has declined over the years. Deteriorating water quality, pollution problems and seasonal water shortages are increasingly making water unsuitable and inadequate for basic human needs. Key challenge is providing safe and adequate water to all. In rural areas burden of fetching water from distant sources falls on women and yet women (who are the providers and managers of water in the household) have little or no voice in 'water resources planning'. As for the urban areas, most large cities are chronically short of water.

2. INSTITUTIONAL CHALLENGES

By far the most serious challenges are those of management of the existing infrastructure and of the water resource itself. Over the past few years several high-level commissions have been appointed to deal with water management issues and also new national/state policies have been promulgated. However, not much of it has been implemented effectively. This divide between the problem and practice has led to extensive loss of credibility of the state apparatus for water development and management. Problem is balancing between service providers and users of all kind. For example, well-functioning water systems often separate the providers of services from the overall water resources management authority.

3. SERVICE PROVISION

The provision of formal irrigation and water supply services in India is the virtual exclusive monopoly of government agencies, which often do not provide services to many (especially the poor) or provide poor quality services to those who do have access. On the contrary, market competition could correctly be argued to improve efficiency. Absence of clear, enforceable water entitlements at all levels is also at the root of service shortcomings such as, water use inefficiency, corruption, financial problems and conflicts which plague the water sector in India currently. Importantly, partnerships between public and private entities have proven a record for raising project financing and bringing in technical expertise for infrastructure projects, including water and sanitation. They can accelerate solutions and enhance operations and service.

4. Over-extraction of Groundwater and Quality Problems

Problems related to groundwater governance include high extraction rates, fluctuating water tables, groundwater pollution, and reduced agricultural production and equity issues. Complexities such as the existence of millions of wells across the country, unhindered public access to groundwater and often poorly understood character of the system dependent on groundwater, pose a serious challenge to the groundwater managers. Although the CGWB has classified areas as safe, semi-critical, critical and unsafe based on units of groundwater availability for its development, there is general lack of vision about the development and recharge of groundwater resources.

4. GROWING FINANCIAL CRUNCH

Currently, India's water sector is in severe financial distress and there is enormous liability from deferred maintenance. There is shortage of substantial funds to deal with the needs for the development of water resources infrastructure, maintenance and management. Funds are required not only for annual maintenance and rehabilitation of the sector but also for providing services to those who do not have them. In short, inadequate cost recovery and lack of direct linkages between both revenue and expenditure are at the root of these problems. Therefore, there is an urgent need to formulate appropriate water policies, institutions, strategies and technologies to address these issues.

5. EXPANDING WATER CONFLICTS

Allocation of water between users (agriculture, industry, domestic supplies, hydro-power, etc.) and between areas within river basins (e.g. catchment areas versus flood plains) is often uncontrolled, and inequitable. Severe water shortages have already led to a growing number of conflicts across the country. Some 90 percent of India's territory is drained by inter-state rivers. The lack of clear allocation rules and uncertainty about how much water each state has a right to, impose high economic and environmental costs. Such growing water conflicts between different users, areas and States (inter-state disputes on sharing of river water) and inequities in distribution of the available water resources are some of the crucial concerns currently faced by the country's water-sector.

6. ABSENCE OF AFFECTED PEOPLE'S INVOLVEMENT

There are serious issues about how the affected people are dealt with in major water infrastructure projects. In coming decades planned infrastructure projects include hydropower that generates large revenues and involves substantial resettlement of people. Infrastructure developers need to see the economic and social development of local communities to be as important as the technical aspects. There are important issues of responsibility which need to be worked out between project developers and state governments (to whom non-state developers pay massive royalties of 12% of the gross value of the power generated).

7. INADEQUATE TRANSPARENCY

A central feature of modern water management in a liberalized economy and democratic environment is that of openness and transparency. In most countries now all relevant information – hydrological, performance, planning – is available publicly, on the web and in real time. Unfortunately, India has been slow in adapting to this changed information environment. However, recently there has been some modest progress. This change would undoubtedly stimulate a chain reaction of accountability, participation and demand for more and better data which would transform the culture of water management in the country. Importantly, there is a powerful feedback loop between data availability, quality and support for data collection activities. Global experience shows that hydrology data systems will be maintained only when there are users who can get easy access to the information, who find the data they need in a user friendly way, and who then become a pressure group on government to commit the necessary funding to the data collection activities.

STRATEGIC OPTIONS

1. FROM 'WATER RESOURCES DEVELOPMENT' TO 'WATER RESOURCES MANAGEMENT'

India needs to shift its focus from 'water resources development' to 'water resources management' by restructuring and strengthening existing institutions for better service delivery and resource sustainability. Planning for big water resources projects should be interdisciplinary with all environmental, ecological and human concerns internalized and thereby assessing the impacts by a concrete statute. At the national level, a number of national commissions have been

constituted by the central government to review specific water policy issues as well as plan for a long-term development of the water sector.

1. PROMOTE RIVER BASIN ORGANIZATIONS

Despite the legal provisions16, not a single River Board has been constituted under this Act (Iyer, 1994; Naqvi, 2006). None of the state governments has so far made any such "request" to establish River Basin Organisations. The origin of River Basin Boards in India can be seen from two perspectives: a) functions vested upon the board by certain policies, b) legal considerations for its formation. However, there are impediments to the formation of River Basin Organizations based on formal rules, laws and procedures. Leaving those aside there are also other impediments originating from the political, economic, and institutional environment.

2. ENSURE INTEGRATED WATER RESOURCE MANAGEMENT

Coordinated and conjunctive use of all water - by location (surface, ground), by users (rural, urban, semi-urban), or by use (domestic, irrigation, industrial and institutional) - is a working definition of integrated water resource management (IWRM). In the absence of demand management (inducing water conservation through prices or other incentives) in urban as well as rural India, supply augmentation alone is not likely to bring supply in line with demand. Another major conundrum is how to make 'demand-responsive' water development in rural India match with the technical requirements of watershed-wide management under IWRM. India depends to a large extent on groundwater resources, which are an intrinsic component of basin hydrologic units. The increased focus on integrated surface and groundwater management, which has been advancing significantly in India, will likely reduce the perception of India's groundwater dependence as an obstacle to IRBM.

3. SUPPORT GROUNDWATER GOVERNANCE

The issue of regulation is important in groundwater management. Introducing a groundwater management system that ensures balance between abstractions and recharge is a rather difficult. Also, command and control type of approaches to prohibit more abstractions simply do not work. Groundwater management essentially requires a legal framework which constrains the rights of people to pump as much water as they wish from their land; the separation of land rights and water entitlements, with the latter usually based on historical use; strong government presence to give legal backing for the development of participatory aquifer management associations and to provide the decision-support systems which enable aquifer associations to monitor their resource; and, above all, clarity that the primary responsibility for the maintenance of the resource on which they depend is with those who have entitlements to use water from a particular aquifer.

4. SCALE-UP COMMUNITY-BASED TANKS REJUVENATION

India has some 580,000 tanks of various sizes spread over across the country. Most of them were managed by local communities for several centuries. In the post-independence era, they collapsed owing to poor maintenance and lack of interest from the government. Community based tank rejuvenation is of critical importance for a country like India. With growing water

scarcity, tank rejuvenation is an important way in which water can be conserved for both surface and groundwater irrigation. High performing tank institutions have well-defined norms, evolved over a long period of time, about allocation of water to various segments and special rules in times of scarcity. Tanks are common property of the village, and whether the institution makes provisions during a scarcity situation to enable economically weaker sections and the landless to sustain their livelihood, is an important factor in obtaining cooperation from all villagers. Though based on custom and tradition, they are clear, specific, detailed and accepted by all command area farmers as fair. There are a wide range of allocating rules, which focus on ensuring livelihood to the marginal and poor.

5. PROVIDE WATER FOR ALL

The National Water Policy – 2002, has assigned the highest priority to drinking water. However, it is important to note that despite five decades of planning and over a decade of 'Drinking Water Missions' there are large numbers of 'no source' villages, i.e., those with no identified source of safe drinking water. Interestingly, although the targets for covering such 'no source' villages are repeatedly achieved, their numbers grow, which in turn mean that some 'covered' villages are lapsing back into the uncovered category, and that newer villages are being added to this class. India needs to revamp its model of drinking water provision. The country needs to tap assured sources and link them within the river basin, if required. This would enable within a river basin, guaranteed domestic supplies both in terms of quantity and quality. For this, investments have to be focused on creating effective infrastructure and mechanisms to operate them efficiently. If required, supply links need to be provided across the basins. Since, provision of drinking water is prime concern, both states and central governments and all stakeholders would support such venture. All this would enable to provision of adequate safe drinking water for all in the country.

6. PROMOTE PUBLIC-PRIVATE-PANCHAYAT-PARTNERSHIP (PPPP)

The National Water Policy 2002 also encourages private sector participation in planning, development and management of water resources project for diverse uses, which might help in generating financial resources and introducing corporate management and improving service efficiency and accountability to users. The public sector should play an expanded role in financing and provision of public services (such as flood control and sewage treatment) and the government should develop a set of laws, policies, capacities and organizations for defining and delivering an enabling environment, with special emphasis on the establishment and management of water entitlements, and the regulation of services and resources.

CONCLUSION

India continues to struggle with growing financial crunch to complete its water sector infrastructure and its operation and maintenance cost. On the other hand, inadequate institutional reforms and effective implementation has affected its performance level. In recent years, the Government of India has initiated several steps to improve investment and management of water management sector. Availability of safe drinking water is inadequate. Severe water shortages have already led to a growing number of conflicts between users (agriculture, industry, domestic), intra-state and inter-state. Emerging challenges include management of existing

infrastructure and of the water resource itself. Water reform in India mostly focuses on organizational issues rather than the instruments that govern the relationship between the regulator and the user. Provision of canal irrigation and water supply services in India has largely remained with the government agencies. Absence of enforceable water entitlements at all levels is at the root of service shortcomings, water use inefficiency, un-regulated groundwater extraction, negligence of traditional and low-cost water bodies, financial problems and conflicts which plague the water sector. Faced with poor water supply services, farmers and urban dwellers have resorted to helping themselves by pumping out groundwater, which has led to rapidly declining water tables; in coastal areas this trend has led to salinity ingress. Financial crunch has also led to an enormous backlog of maintenance and thereby, inadequate performance levels of irrigation projects. India requires proper design and effective execution of suitable strategic options. Water is emerging as a national challenge and its most efficient management has to be given top priority in order to meet the future demands of food grains for a fast growing population. Managing water resources is more important than managing material wealth.

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