An Introduction to Water Management

P Nair* and Deepak Kumar**

This article discusses the present water scenario in the world, drinking water scenario in India, water management and agriculture, challenges in marketing water, ecological affairs, administrative control of water and provides some international examples.

"We shall not finally defeat AIDS, tuberculosis, malaria, or any of the other infectious diseases that plague the developing world until we have also won the battle for safe drinking water, sanitation and basic healthcare."

— Kofi Annan, Secretary-General of the United Nations.

1. Present Water Scenario in the World

The UN has declared 2005-15 as "Water for Life" period. This means how to use available water and find out the alternative measures for future. This states the urgency to come out of thinking that water is a "free resource" on this planet as for millennia, this has been true. The population of human beings was well below the level the planet could support. But once the advancements of science and technology have enabled this race of Homo sapiens to weather the "vicissitudes of nature" at least to a greater extent than before, the population and standard of living have begun to rise. This has been particularly so over the last 300 years, starting with the Industrial revolution in the West. In case of India and China, the need of water is increasing with burgeoning population that needs more water for domestic consumption than ever. The crisis of water in the cities of India during summer season is the live example of such a situation. Apart from domestic consumption, water is very much needed for industrial and agricultural purposes.

Water has become an essential and precious resource, one which human beings cannot do without. Therefore, there have been attempts by various local communities and the governments to get control of water and pressurize the rival community. A classic example of this is the battle for water in the Negev Desert and along the banks of the river Jordan between Israel and Palestine. Israel is basically a dry country and therefore,water is a scarce resource. Five million Israelis need the waters of the Jordan river to live on. This has been well understood by the Palestinians, who have tried to use this tool for political purposes. This has resulted in the Israeli Armed Forces keeping a tight control of the same. Back home,

* Consulting Editor, *The ICFAI Journal of Infrastructure*.
** Associate Consultant, The ICFAI University Press, Hyderabad.

© 2005 The ICFAI University. All Rights Reserved.

a similar type of activity has taken place on the commercial front, over the last two decades. Once it was realized that "water is wealth" and "water is power", many large water management companies have tried in various ways to exert control over the world's fresh water resources. Here, the moves are not political—they are purely commercial. Various reports of international agencies hint at a level of greed and the attempts to create an oligarchy of sorts, in the management of water,

In India, water has been the subject of fierce local and regional disputes. There is a very clear historical perspective regarding this. Prior to Independence, 200 small kingdoms managed their local water issues. There was generally so much water around that nobody bothered about this.

With the advent of Independence, things changed somewhat, but slowly water was very much at the bottom of the agenda, as were natural resources in general. There was no question of management of natural resources or the environment .It was somehow assumed that it would "be there". This state of affairs continued till the early and mid-60s, when irrigation suddenly came into focus, due to the Green Revolution. Then the *mantra* became 'irrigation management'. Various task forces were set up, which basically focused on the building of large dams. Little was done to enhance the management of urban water. The strength of the civil society was too weak to raise the issue. There were hardly any Non-Governmental Organizations (NGOs) around. The question of any infrastructure work (other than pure construction) being given to the private sector did not exist. This was an era when even private industries were being regulated on a licensed basis.

This is the stage at which many developing countries, especially those of the Far East and Japan began to widen the gap between themselves and India. While India was quibbling about dam construction, countries like Malaysia, Korea and even the Philippines began to approach the private sector by offering various Government guarantees for the same. End user fees were still an issue, and many people in these countries still regarded water as a free public resource, but by the mid-'80s, the management of water truly began.

And what about the developed countries? The US allowed the private sector to have greater involvement with infrastructure projects. Water was not an exception. But it was in Britain and France where the great private water management companies emerged, but water still continued to be regarded as a public resource.

Many cities, counties and townships are turning to giant conglomerates that promise to pick up the tab for renovating and/or operating outdated water utilities in exchange for a guaranteed profit under monopoly authority. These arrangements are called "build-own-transfer" or "build-own-operate" contracts.[1]

When a local government cannot provide clean and safe water to its citizens, outside help is welcomed. But with large foreign-based multinational corporations increasingly acquiring the US utilities, there is concern that Americans might find themselves dependent

[1] www.greatlakesdirectory.org/zarticles/083002_great_lakes.htm

on foreign ownership of water as they are on foreign oil. And critics of utility privatization charge that multinationals that win utility concessions sometimes transfer debt burdens from other subsidiaries to their utility divisions and then on to the utility customers.

Moreover, even the World Bank is singing the multinationals' tune. A World Bank White Paper[2]—"Private Capital in Water and Sanitation"—puts in writing the new emphasis of the World Bank and the International Monetary Fund (IMF) on utility privatization as a condition of badly needed financial assistance for developing countries. As critics have noted that these entities tend to favor government rather than private solutions, it is surprising that the Paper "Private Capital in Water and Sanitation" by the World Bank and the International Monetary Fund (IMF) asserts as follows:

"Private capital and initiative can help accomplish operational efficiency and investment objectives if two stringent requirements are met:

(1) Projects must generate revenues that cover operating costs and debt-service payments, and earn a competitive rate of return on equity, and

(2) Risks that are internal (for example, construction and operation) and external (for example, regulatory and foreign exchange) to a project must be identified and clearly allocated to the parties that are in the best position to mitigate them. With their own capital at risk, lenders and investors have strong financial incentives to ensure that a project is built on time and within budget, and is operationally efficient."

2. Drinking Water Scenario in India

Table 1 shows that In India, the majority of people get drinking water by tubewells and handpumps, while the significant contribution by taps and wells can't be ignored. Still we wonder to notice that 18% of Indians are dependent on wells, which belong to individual(s) or the community.

Table 1: The Percentage of People Using Different Water Resources in India

	Tube-wells and Handpumps	Taps	Wells	Other Sources
Source of drinking water in rural households	51%	27%	18%	3%

Source: www.mospi.nic.in, Year: 2002.

While talking about rural areas, the case is not different from urban areas and people of different states are still dependent on tube-wells and handpumps but the users are more in number in this case than in urban areas. The rural people are also dependent on village ponds for bathing, washing clothes, etc. There are several Self Help Groups (SHGs) and community development water projects in action, which try to give rural people a better life.

Table 3 clears the fact that in case of urban areas, majority of people get drinking water from taps, tube-wells and handpumps but the percentage of people using a well is much

[2] www.imf.org/external/pubs/ft/fandd/1997/03/pdf/haarmeye.pdf

Table 2: Tube-Wells and Handpumps in Rural India Households (for Drinking Water)	
Karnataka	60%
Gujarat	58%
Tamil Nadu	77%
Madhya Pradesh	60%
Orissa	63%
Uttar Pradesh	86%
Andhra Pradesh	54%
West Bengal	78%
Punjab and Chhattisgarh	76%
Bihar	89%
Source: www.mospi.nic.in, Year: 2002.	

Table 3: The Proportions of Urban India Using Different Water Resources	
Taps	74% households (80% in urban slums)
Tube-wells and handpumps	20%
Wells	5%
Source: www.mospi.nic.in, Year: 2002.	

lesser as there is always a space problem in urban area. The urban people also use mineral water, but majority of urban people still don't want to spend money on mineral water.

3. Water Management and Agriculture

By far the most important issue on water management lies with the harvesting of water for agriculture. While large scale irrigation does help, they often have a problem with the "last mile" approach. When large irrigation and river valley projects come up, the farm land around the major canals get huge benefits. But those which are far away do not even get the benefit of the natural seepage and moisture, particularly if they are on a hilly slope and the like. These people are best served by making their own arrangements for the management of water resources and then working towards the creation of linkages between the main water sources and their own. When the time comes to link up the water sources, they find that the job is half done already, which makes it much easier. It is also extremely important that water management gets synchronized with the cropping patterns of the state or region involved, and for this, the Government has to get involved.

Rain falls equally on all, whether rich or poor, rural or urban areas. But is this precious natural resource being captured and used properly? Studies have shown that rainwater harvesting is the cheapest form of water management, particularly in a developing country with abundant rainfall.

However, there is also need to utilize the available resources. For this, the Government has also announced a package of Rs. 7600 cr during the year 2005-06 for micro-irrigation projects. Such projects are essential especially in case of drought-prone areas or where there is less rainfall. Under micro-irrigation, drip and sprinkler irrigations come. This helps in coming out of the Government's promises to give free power to its farmers, which not only deplete the water levels but also creates the unnecessary burden on the government. There is no other option than managing the available water better.

In this scarce water scenario, especially in case of agriculture, a proper matching between the cropping pattern and the water availability is very essential. Too much water is as bad as too little. The nature of the crop should be matched to the water availability. For example, the pulse crops or oil seeds crop may be grown after paddy crops, which need less water. After paddy cropping, the soil contains sufficient water moisture for pulse/oil seed/millet crops. Such a cropping pattern not only helps in proper utilization of scarce water but also

helps in producing sufficient food for poor farmers and other beneficiaries**.** Such plannings greatly help in managing the water resources and increasing the overall yield.

4. Challenges in Marketing Water

Having said all this about the privatization of water management, we find that it is still necessary for private parties to get involved, especially in urban areas. However, it is found that there are still many formidable challenges involved in the marketing of water. The challenges are:

- **Collection of user charges:** The mechanism of collection is a difficult one, particularly in the slums and poorer urban neighborhoods where the local mafia tend to get involved. This is where the community-based organization could play a major role.
- **Proper legal framework:** Legal mechanisms also pose a major hurdle in the management of water. Unlike South Africa, Malaysia, Korea and even China, India has not developed the necessary legal infrastructure to make private water management a viable business. There needs to be policy in place and legislative development should take place at the Central, State and local levels. Effective legislation flows from policy and therefore it is the development of policy that is most urgently needed. In this matter, water management lags way behind Telecom, IT infrastructure or even Power (See Box).
- **Exploitation of groundwater:** Many critics opine that groundwater will be depleted if private bodies handle this resource, as they are highly commercially oriented and invest

Box: The International Financial Institution and Water Sector

The World financing institutions favor the giant multinationals. In many of these cases the IMF loans were negotiated under the Poverty Reduction and Growth Facility (PRGF) introduced in 1999. As a report last year on afrol.com shows, these heavily indebted countries would be unable to gain access to loans from many other international creditors unless agreed to the IMF measures.

Among the countries involved were:

- *Angola, which, in return for loans, had to adjust water tariffs to increase cost recovery.*
- *Benin, which had to privatize its water and electricity distribution company.*
- *Guinea-Bissau, where water and electricity utilities management was transferred to a private company.*
- *Niger, where water, telecommunications, electricity and petroleum government enterprises were to be privatized in a World Bank deal with proceeds used to payoff debts.*
- *Tanzania, which was told to assign Dar es Salaam Water and Sewage Authority assets to private management companies.*

As a result of the IMF directives, countries already heavily indebted to Western banks have to borrow more to finance water privatization. For example, in Tanzania, the first phase of the Dar es Saalam project will mean the Government has to take out loans of $145 mn for "infrastructure rehabilitation and improvement". The company winning the bid for the contract will only have to pay $6.5 mn "to cover meters and standpipes."

Given this dubious record, it is clear that to put the control of precious natural resources in the hands of giant multinationals is a strategy full of danger. At the same time, the expertise of the private sector is needed to manage the water resources of the planet intelligently. This is where the need for appropriate models comes, both for the urban and rural areas.

Source: www.wsws.org/articles/2002/sep2002/wate-s07.shtml

a huge amount in drilling, land, tankers, marketing, laborers, etc. The issue of "equality to all" must be catered by policymakers and regulators.

Despite all these issues, efforts are on to develop man-made structures in the field of water harvesting. Tata Steel recently announced an MOU with Vivendi Water, a leader in water and wastewater management services, for setting up of an operational joint venture to deliver a sustainable water service to the city of Jamshedpur. Vivendi Water entered India in 1999 and has since then undertaken several pioneering projects, including a detailed study of the urban water supply and wastewater-treatment facilities in India. It is currently working with the Kolkata Municipal Corporation to improve the city's water supply system. Vivendi Water is also a consultant to the Chennai Water Board for the entire water management cycle, water supply and wastewater, for the city of Chennai. Many other water majors are in an exploratory phase, but without the proper framework, they would basically be limited to one-off situations. (*The Weekly Economic Bulletin*, issued by the Investment & Technology Promotion Division, Ministry of External Affairs, Government of India. Period: Upto – November 25, 2002). The issue always is how to market the water and make it available to the beneficiaries and at the same time, earn a reasonable return for oneself.

5. Ecological Affairs

Because of commercialization of water resource, we must remember that they can severely damage the environment, silt up the river estuaries and get large tracts of forest land depleted. The local projects tend to have less harmful environmental effects and this is why effective legislation and policy making needs to be developed to manage their own water resources effectively. This kind of approach builds skills at the local level and does not make things complicated. This can be possible because of the development of watershed and water harvesting activities which control and conserve the rainwater and other run-off waters.

Table 4 shows the need for recycling of wastewater and an attempt to treat waste management as part of water management. Otherwise, water may be available, but polluted.

Table 4: Estimated Quantity of Waste Generated in India

Waste	Quantity
Municipal solid waste	27.4 million tons/year
Municipal liquid waste	12145 million liters/day
Distillery	8057 kilo liters/day
Press mud	9 million tons/year
Food and fruit processing waste	4.5 million tons/year
Willow dust	30000 tons/year
Dairy industry waste	50-60 million liters/day
Paper and pulp industry waste	1600 m3 wastewater/day
Tannery	52500 m3 wastewater/day

Source: Mayank Bhatt, Commercial Specialist (CS), Mumbai, 'Water Resources (WRE)—Wastewater Treatment'.

This makes it unfit for human consumption and even for the flora and fauna connected with the said water source. There are numerous instances where all of the fish have died in a lake. The live example of the Yamuna in New Delhi is known to all of us.

6. Administrative Control

The Central Water Commission is functioning as the advisory body to the Ministry of Water Resources. The Commission has the general responsibilities of initiating, coordinating and furthering schemes, in consultation with the State Governments concerned, for control, conservation and utilization of water resources throughout the country, for the purpose of flood control, irrigation, navigation, drinking water supply and water power development[3]. They have tried rather unsuccessfully to develop the inter-river basin aspects, which has for four decades got bogged down in a slew of committees and red tape. The government has also announced that it is committed to interlink the river projects, whose initiatives were taken by the earlier government but not at the cost of the ecological imbalances. Plenty of studies that have been conducted show that while the linking of the main rivers is a huge task, the linking of tributaries is a feasible option.

Of late, the Ministry of Water Resources has started looking at issues such as rainwater harvesting and many private parties such as the Tata Group have been helping them on the same. The National Institute of Hydrology studies the soil projects. The Nagarjuna Sagar Dam is one of the largest dams in the world. However, rehabilitation, because of such projects, is always a matter of concern and people's sentiment belonging to these project areas must be taken in account. There must be prior preparation of rehabilitation of the people out there and then start up the project otherwise, the gestation period to complete such irrigation projects are more. Another issue is the ecological clearance of the water project, as it also takes some time. Therefore, there must be clear-cut and automatic legality in action such as, deforestation may be done at the water project area, proper rehabilitation of the people out there, etc. The government must take preventive and proactive decisions while implementing such large water projects.

In India, the Central Water and Power Research Station came up in pre-Independence days, again with a focus on irrigation and power generation. Several dams and river valley projects came up. The current mandate of the institution encompasses undertaking specific research studies supported by necessary basic research to comprehensively offer R&D support to a variety of projects dealing with irrigation, power and water-borne transport, offering consultancy and advisory services to the government within the sphere of its activities, disseminating expertise and research findings amongst hydel research fraternity, aiding and promoting research activities at various institutions and carrying out training of research manpower. As the premier research institution and the national apex body, CWPRS is responsible for coordinating Government-sponsored hydel research at the national level.[4]

---

[3] www.unesco.org

[4] vigyanprasar.com/comcom/develop46.htm - Supplemental Result.

7. International Examples

By and large, water is viewed as a common resource, even in the developed countries. However, relatively speaking, some of the developing countries have made a certain effort to develop enabling structures to allow the people's initiative to flourish. One such country is South Africa, which has a fairly comprehensive framework in place, at the central, state and local levels. The country has been divided into 19 catchments and these are looked after by individual catchments management agencies. They have water service institutions, community institutions, and plenty of legislative efforts to streamline them. Although the attempts may not be perfect, there is still a clear realization that water management is something more than an irrigation and power project.

Korea is establishing an integrated water management system focused on water-utilization and flood control. This project will construct three water management systems.

- Firstly, there will be a water management center for the integrated management of water quantity, water quality, and electricity generation.
- Secondly, a water management system will be set up to collect real-time information on the operations of water systems, and to make possible the linking and operation of dams.
- Thirdly, they will construct an operation system for the remote control operation of electricity generation facilities. When this integrated water management system is constructed, the development of multi-purpose dams and the operation of water gates throughout the nation will be under the remote control at the head office, and various information on the operations of water systems will be collected using real-time methods and analyzed for the efficient management of dams and rivers.[5]

In addition to this, they have developed an integrated water supply system, in which they have developed structures for the last mile process, which is often so much neglected and a world-class water quality management center. This will continuously work on water quality inspection and systematic training in the latest methods of water management and waste management. The activities of Korea Water Resources Corporation (KOWACO) are given in Table 4. It gives us a fair idea of what is really needed to have a truly integrated water management system. It is estimated that India would take 10-15 years to reach this stage, from our current level of water management.

The Government has presented two bills to the Parliament, namely the Water Industry Bill and the National Water Services Commission (SPAN) Bill, which have been referred to a select committee. These bills, if eventually passed by Parliament, will set the stage for the full-fledged privatization of water supply in the country. The National Water Services Commission regulates the water industry including licensing, tariffs, and the capital expenditure of water treatment and supply firms. However, Malaysia does have several private utilities, operating in various capacities in the country such as Halcrow. While the complete privatization of water resources has met with violent opposition, the very fact that two Bills are pending in the Parliament suggest that the issue is "hot" and therefore, there is a sufficient

[5] english.kowaco.or.kr/EngUser/Info/Menu_Html.aspx?menuid=000003&id=000042&depth=3&order=1

Table 4: An Example from Korea	
Development of technology to ensure a sustainable water resources	• Technology for development of alternation water resources· • Reuse of waster water, water conservation, reuse of rainfall, high efficiency desalinization. Technology of integrated water resources management· • Optimum operation technology of water resources, Technology to overcome drought.
Water Supply Systems	• Operation/Maintenance system of water distribution systems· • Expert system for water distribution systems assessment· • Investigation of biological regrowth in water distribution systems· • Optimal operation of water transmission systems (Seoul Regional Water Supply System)
Conventional Water Treatment	• Assessment of water treatment plants (CPE and CCP)· • Direct filtration· • Dual-media and deep coarse-sand filtrations Control of coagulation/flocculation processes with SCD· • Inclined tube settling basins and Dissolved Air Flotation (DAF)· • Reuse, dewatering and thickening of sludge
Advanced Water Treatment	• Membrane process (micro-and ultra-filtrations) Ozone and Biological Activated Carbon (BAC) processes· • Sea water desalination (RO membrane)
Water Quality Analysis	• Investigation of Giardia and Crypto in raw and treated water· • Analysis of algal toxins (microcystin and anatoxin)· • Analysis of endocrine disruptors (43 disruptors) Investigation of THMEP and HAAFP for water sources.
Wastewater Treatment	• Wastewater treatment for reuse· • Advanced wastewater treatment (Removal of N and P)
Water Treatment Equipment and Facilities	• Design of rapid mixing basin and impellers using CFD· • Calibration of flow meters· • Standardization of power control circuits.
Source: http://english.kowaco.or.kr/EngUser/Info/ Menu_Html.aspx?menuid=000003&id=000042&depth=3&order=1	

critical mass of people who think it is appropriate to privatize the water supply system (or certain functions thereof) in a suitable way: The suitability is the issue. The Government has set up a select committee to look into this matter. But there is no doubt that privatization is on its way, at least to some extent, as in Malaysia also.

In all these examples, it is really the state which is running things and calling the shots. In no case (in the abovementioned three examples) has the role of a state as a regulatory body been diminished. What has been recognized, however, is the ability of the private sector, citizens' communities, NGOs and the like to make a substantial contribution, particularly in delivery and billing. None is making a case for the blanket privatization of water. Water management needs to be tackled as a multi-disciplinary problem.

8. Conclusion

To summarize, we would submit that water management is not just the development of irrigation and power projects. It represents a lot of things, not least of which is the involvement of waste management. We do not just want water, we want water which is fit for human consumption. In addition to this, there is the need to involve the private sector in the management of water resources, without in anyway allowing them an oligopoly on the same. To do this in a manner which also gives them a decent operating return requires the most careful thought and structuring. Therefore, water management research and consultancy becomes an issue of critical importance. Legislative development at all levels needs to be done.

Community Centers and NGOs need to be encouraged to take up water management projects. Only then can our nation say with pride that we have a properly managed water economy. Many countries, such as South Africa, Korea and Malaysia are far advanced along the scale of development as regards water and waste management, without actually privatizing water.

Reference # 27J-2005-12-05-01

References

1. www.greatlakesdirectory.org/zarticles/083002_great_lakes.htm
2. www.imf.org/external/pubs/ft/fandd/1997/03/pdf/haarmeye.pdf
3. www.unesco.org
4. vigyanprasar.com/comcom/develop46.htm - Supplemental Result
5. english.kowaco.or.kr/EngUser/Info/Menu_Html.aspx?menuid=000003&id=000042&depth=3&order=1
6. www.wsws.org/articles/2002/sep2002/wate-s07.shtml
7. *The Weekly Economic Bulletin, issued by the Investment & Technology Promotion Division, Ministry of External Affairs, Government of India. Period: Upto – November 25, '02.*