Redefining Reform
New Paradigm of Water Governance in India

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The Foundation Day of the Centre is celebrated during the month of October every year. It was on the 19th of October 1970 that the Centre for Development Studies (CDS) was established as an autonomous social science research institute.

It was the leadership and vision of Shri C. Achutha Menon, Chief Minister of Kerala that led to the creation of several research centres in Kerala in different disciplines related to the development of the State. He was able to persuade legendary development economist Professor K. N. Raj to set up the Centre and provide intellectual leadership. Professor Raj continued to remain the driving force behind all academic activities of CDS for over two decades.

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Foundation Day Lectures at a Glance

1. **Social Science in a Post-national World:**
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   Dr. Satish Deshpande,
   Professor of Sociology, University of Delhi
   October 19, 2012.

2. **The Novice Superpower**
   Dr. Ashok Desai,
   Consultant Editor of The Telegraph
   October 23, 2013

3. **Rise of East Asia and Kerala: Along the Path of K. N. Raj**
   Prof. Amiya Kumar Bagchi,
   Emeritus Professor, Institute of Development Studies Kolkata
   October 20, 2014

4. **Development by Dispossession**
   Prof. Amit Bhaduri,
   Professor Emeritus at JNU, New Delhi & Honorary Fellow CDS
   December 7, 2015

5. **On Globalisation After Brexit and Donald Trump**
   Dr. C. Rammanohar Reddy,
   Former Editor, Economic & Political Weekly
   26 October 2016

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The New Meaning of "Reform"

Over the last 30 years, not just in India but all over the globe, reform has acquired a very specific meaning. It is generally used to connote a policy shift in the direction of privatisation and reducing the role of the state in the economy. In many respects, this has been a welcome move as the state has handed over sectors of the economy to the private sector and greater competition has led to increases in efficiency and cheaper availability of many goods and services to the consumer, at higher quality.

At the same time, however, the tragic fallout of this blind and dogmatic change in policy has been to further worsen access to basic services to the large mass of the population. Whether it is access to quality health and education or water, sanitation, nutrition, credit etc, a massive reform deficit has afflicted these sectors. For the reform required here was not the one being proposed under the "Washington Consensus". Indeed, it is not the private sector that is the panacea for these sectors, which suffer from massive market failure. What is required in each of these cases, is reform of government, which would make state systems more efficient and accountable to the people.

It is clear, for example, that falling ill is perhaps the single biggest cause of people slipping below the poverty line. Health care in India remains predominantly private, with India spending among the lowest percentage of GDP globally on public health provision. Unprecedented farmers' suicides and recent farmers' agitations point to continued failure of state intervention in a situation of humongous market failure. We need to expand procurement operations to a much wider array of crops such as millets and pulses to incentivise farmers to diversify their cropping patterns. The functioning of the ICDS and MDMS, the flagship nutrition programs, remains highly unsatisfactory in the north Indian Hindi heartland, where malnutrition levels remain among the highest in the world. Adopting more participatory approaches to their implementation is the key reform required. Learning outcomes in government schools remain abysmally poor as revealed by the ASER reports. Overall, one can say that depending on the specific challenges of each sector, the desired direction of reform could be collectivization (as in agri-marketing), nationalisation (as in banking) or reform of functioning of government programs (such as MGNREGA). Reform can, of course, include a greater role for the private sector and liberalisation but this must be examined and decided upon on a case-by-case basis.

Today I want to focus on the question of governance reform in the water sector to illustrate how critical it is for us to understand precisely the kinds of reforms we need in key sectors of the Indian economy and not to be blinded by a dogmatic adherence to the Washington Consensus. There is no simple quick-fix that this conception of reforms can offer. What we need to recognise is that the role of the state is critical but this role itself needs profound reform. What we also need to urgently understand is that each sector of the economy has some very specific features and reform needs to be defined with reference to these *differentia specifica* of each sector. To put it in a word, it is not a question of larger or smaller government: the way forward lies in the maxim "better government is better". When it comes to the question of a natural resource like water, a key specific element of the reforms needed is the recognition that the economy is but a small part of the larger eco-system and that proceeding with a narrow notion of economic development without an adequate recognition of this huge fact, can only lead to disastrous outcomes as evidenced by the fate of the planet currently in this age of the Anthropocene.[1]

Why has it become necessary to focus on reforming water governance in India today? What is it about the nature of the water crisis facing the country that necessitates such an emphasis? What are the dimensions that water governance reform needs to cover? And in which broad direction must this change occur? These are the questions that I will try and address in the lecture today.

Water Crisis of Unprecedented Proportions

India faces a major crisis of water as we move into the 21st century. This crisis threatens the basic right to drinking water of our people; it also puts the livelihoods of millions at risk.[2]

The demands of a rapidly industrialising economy and urbanizing society come at a time when the potential for augmenting supply is limited, water tables are falling and water quality issues have increasingly come to the fore. As we drill deeper for water, our groundwater gets contaminated with fluoride, arsenic, mercury and even uranium. Our rivers and our groundwater are polluted by untreated effluents and sewage. Many urban stretches of rivers and lakes are overstrained and overburdened by industrial waste, sewage and agricultural runoff. These wastewaters are overloading rivers and lakes with toxic chemicals and wastes, consequently poisoning water resources and supplies. These toxins are finding their way into plants and animals, causing severe ecological toxicity at various trophic levels.

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[1] See *Beyond the Anthropocene,* a talk by one of the world's leading climate scientists, Johan Rockström (www.stockholmresilience.org/ research/ research-news /2017-02-16-wef-2017-beyond-the-anthropocene.html)

[2] Mihir Shah (2013): 'Water: Towards a Paradigm Shift in the 12th Plan', *Economic and Political Weekly*, January 19

In India, cities produce nearly 40,000 million litres of sewage every day and barely 20 percent of it is treated. Central Pollution Control Board's 2011 survey states that only 2% towns have both sewerage systems and sewage treatment plants.[3]

Climate change poses fresh challenges with its impacts on the hydrologic cycle. More extreme rates of precipitation and evapo-transpiration will exacerbate impacts of floods and droughts. More intense, extreme and variable rainfall, combined with lack of proper drainage, will mean that every spell of rain becomes an urban nightmare, as roads flood and dirty water enters homes and adds to filth and disease. Our flood management strategies no longer seem to provide an adequate answer to growing flood frequency and intensity. It is no wonder then that conflicts across competing uses and users of water are growing by the day.

Water use efficiency in agriculture, which consumes around 80% of our water resources, continues to be among the lowest in the world. At 25-35 percent, this compares poorly with 40-45 percent in Malaysia and Morocco and 50-60 percent in Israel, Japan, China and Taiwan.

The two main sources of irrigation are canals and groundwater. The relative contribution of canal irrigation has been steadily declining over time while groundwater, especially that extracted through tubewells, has rapidly grown in significance over the last 30 years. But the alarming fact is that both these sources of water are now beginning to hit an upper limit.

India has, in recent years, been suffering successive droughts causing great misery to millions of people, even resulting in suicides by farmers. At the epicentre of the present drought is Maharashtra, the

[3] Mihir Shah and Himanshu Kulkarni (2015): 'Urban Water Systems in India', *Economic and Political Weekly*, July 25

State with the highest number of dams in India. Intervening in a debate in the State Assembly on July 21, 2015, the Chief Minister of Maharashtra remarked that the State has 40 per cent of the country's large dams, "but 82 per cent area of the state is rainfed. Till the time you don't give water to a farmer's fields, you can't save him from suicide. We have moved away from our vision of watershed and conservation. We did not think about hydrology, geology and topography of a region before pushing large dams everywhere. We pushed large dams, not irrigation. But this has to change."

Governance Reform at the Heart of Change Needed

It is my contention that this crisis that I have just briefly summarised has a very close link with the prevailing paradigm of governance of water in India. Before explicating these links and also suggesting the changes required, let me first summarise the key *features, dimensions and principles* that characterise the existing paradigm, each of which need to undergo urgent transformation:

1. **Command-and-control**: Whether it be rivers or groundwater, the dominant paradigm is of command-and-control. There is no understanding of river systems or their interconnections with the health of catchment areas or groundwater
2. **Bureaucratic Governance**: Large, centralised, decaying bureaucracies are charged with administering water throughout the length and breadth of India
3. **No reference to Hydrological entities such as Aquifers or River Systems**: When I joined the Planning Commission in 2009, the word aquifer could hardly be found within government discourse and the integrity of river systems is still not understood
4. **Uni-disciplinarity**: Since the goal is command-and-control through dam construction and groundwater extraction, the only disciplines evoked are engineering and hydrogeology, that too in

their narrowest versions. Water cannot be understood with this narrow disciplinary focus

5. **Uni-dimensionality**: Since the focus is extraction and development, all dimensions of water, other than economic resource use, are ignored. These various other dimensions are however of critical importance to the primary stakeholders of water in India
6. **Water in Silos**: We have divided water into silos of groundwater and surface water, as also irrigation and domestic use, with little dialogue across silos, leading to "hydro-schizophrenia"[4], where the left hand of drinking water does not know what the right hand of irrigation is doing; and the left foot of surface water does not know what the right foot of groundwater is doing
7. **Instrumental View of Water, especially Rivers**: The way we look at our rivers is as water resources to be exploited, ignoring completely the numerous eco-system services provided by living river systems, as also the intrinsic value of rivers for our people and other forms of life.
8. **Supply-side focus**: The entire focus has been on augmenting supplies, with little attention being paid on demand-management of water
9. **No reference to Sustainability**: In the preoccupation with extraction and development, there has generally been an absence of considerations of sustainability, endangering the future of both groundwater and river flows.
10. **Discrimination and Lack of Equity in Access to Water**: Historical forms of discrimination, combine with the impact of growing economic inequalities in the country, to create severe

[4] Jarvis, T et al (2005): "International Borders, Ground Water Flow and Hydroschizophrenia", Ground Water, Vol 43, No 5

discrimination in access to water on grounds of caste, class, gender, location and community

11. **Lack of Transparency and Access to Water Information:** Over the years, there has been needless secrecy in access to water data and information for researchers and stakeholders that has only meant that the quality of water management has suffered and conflicts have got exacerbated
12. **British Common Law**: The legal framework governing water belongs to the 19th century British common law, which legitimizes and perpetuates inequity in access to water by giving unlimited powers of drawal of water to owners of land

My central argument in the lecture is that the present crisis of water in India is a direct consequence of this 12-fold paradigm of governance that needs urgent reform, if we are to find effective solutions to India's multiple water problems.

CWC: Engineering Command-and-Control over Rivers

The biggest example of centralised command-and control is the construction of large dams on our rivers. Even if we put aside the humongous human and environmental costs of these structures, the benefits of this kind of engineering supply-centred effort have been underwhelming.

Huge public investments over the last 60 years have meant that the irrigation potential created through major and medium irrigation projects has increased nearly five-fold from 9.72 mha in the pre-Plan period to around 46 mha by the 11th Plan. But how much of this water has actually benefitted the farmers for whom it was meant is not clear.

At the same time, there is incontrovertible evidence that these projects have suffered from massive time and cost overruns.[5]

The worst offenders are the major irrigation projects where the average cost overrun is as high as 1382 per cent. 28 out of the 151 major projects analyzed witnessed cost overruns of over 1000 per cent. Of these, nine had cost overruns of over 5000 per cent. The cost overruns were relatively lower for medium projects but still unacceptably high, the average being 325 per cent. 23 out of 132 medium projects had cost overruns of over 500 per cent and 10 had cost overruns of over 1000 per cent.

The number of projects awaiting completion peaked in 1980 to 600; then there was decline till 1992 (460), after which it has again risen to 571, almost touching the 1980 figure. Major irrigation projects are expected to have a gestation period of 15–20 years while medium projects should take 5–10 years for completion. Against these norms, a large number of major as well as medium projects are continuing for 30–40 years or even more. This reflects poor project preparation and implementation as well as thin spreading of available resources.

Recent scholarship points to definite limits to the role new large dam projects can play in providing economically viable additional water storage (Ackerman, 2011)[6]. A World Bank study shows that "there is little value to additional storage in most of the peninsular river basins (the Kaveri, Krishna and Godavari) and in the Narmada and Tapti" (Briscoe and Malik, 2006, p.32)[7]. Similarly, a study by the International Water Management Institute (IWMI) (Amarsinghe *et al*, 2007)[8], suggests that Krishna and Kaveri have reached full or partial closure. Another IWMI study shows that in the Krishna river basin, the storage capacity

[5] This section is heavily drawn from the Twelfth Plan chapter on Water

[6] R. Ackerman (2011): *New Directions for Water Management in Indian Agriculture*

[7] J. Briscoe and RPS Malik (2006): *India's Water Economy: Bracing for a Turbulent Future*, The World Bank

[8] UA Amarasinghe *et al* (2007): *India's Water Future to 2025-2050: Business-as-usual Scenario and Deviations*, IWMI

of major and medium reservoirs has reached total water yield (Venot *et al* 2007)[9], with virtually no water reaching the sea in low rainfall years. Concern has also been expressed that "the capture of so much water within the basin and the evaporation of an additional 36 BCM of water has changed the regional climate, increasing humidity and changing temperature regimes, aggravating saline ground water intrusion, and putting at risk the delicate wetland and estuarine ecology which is important not only for aquatic habitats and fisheries, but also for preventing shore erosion" (Ackerman, 2011, p.6).

Given these constraints, the trend increasingly is to locate new projects in relatively flat topography that multiplies disproportionately the areas to be flooded and the people to be evicted. It also tends to aggravate already contentious relations between States, as witnessed in the Polavaram dam in Andhra Pradesh, strongly opposed by both Orissa and Chhattisgarh.

Water flow in the Himalayan Rivers, particularly the Ganga is, of course, far greater than in Peninsular Rivers but here there are other constraints. In the Ganga Plains, the topography is completely flat and storages cannot be located here. In a study for the Asian Development Bank, Blackmore (2010)[10] has argued that surface irrigation through dams in the Ganga river basin is of low value since water tables are already high. Similarly for the Indus, Blackmore shows that "the next major dam (at a cost of USD 12 billion) will yield less than 1.5 per cent increase in regulated flow" (ibid).

There is also the problem that further up in the Himalayas we confront one of the most fragile ecosystems in the world. The Himalayas are comparatively young mountains with high rates of erosion. Their

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[9] JP Venot *et al* (2007): *Shifting Waterscapes: Explaining Basin Closure in the Lower Krishna Basin,* IWMI

[10] D. Blackmore (2010): *River Basin Management: Opportunities and Risks*, Asian Development Bank

upper catchments have little vegetation to bind soil. Deforestation has aggravated the problem. Rivers descending from the Himalayas, therefore, tend to have high sediment loads. A 1986 study found that 40 per cent of hydro-dams built in Tibet in the 1940s had become unusable due to siltation of reservoirs (K. Pomeranz, 2009)[11]. Studies by engineering geologists with the Geological Survey of India record many cases of power turbines becoming dysfunctional following massive siltation in run-of-the-river schemes.

Climate change is making predictability of river flows extremely uncertain. This will rise exponentially as more and more dams are built in the region. Diverting rivers will also create large dry regions with adverse impact on local livelihoods (fisheries and agriculture).

Dam building enthusiasts also often overlook the fact that the rapid rise of the Himalayas (from 500 to 8000 metres) gives rise to an unmatched range of ecosystems, a biodiversity that is as enormous as it is fragile. The north-east of India is one of just 25 bio-diversity hotspots in the world [Myers *et al* 2000][12].

According to Valdiya (1999)[13], as also Goswami and Das (2002)[14], the neo-tectonism of the Brahmaputra valley and its surrounding highlands in the eastern Himalayas means that modifying topography by excavation or creating water and sediment loads in river impoundments can be dangerous. Quake-induced changes in the river system can adversely impact the viability of dams as several basic parameters of the regime of rivers and the morphology and behaviour of channels may change. "The last two major earthquakes in the region

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[11] K. Pomeranz (2009): 'The Great Himalayan Watershed: Agrarian Crisis, Mega-Dams and the Environment', *New Left Review*, No.58, July-August 2009

[12] N Myers *et al* (2000): 'Biodiversity Hotspots for Conservation Priorities', *Nature*, 403

[13] KS Valdiya (1999): 'A Geodynamic Perspective of Arunachal Pradesh', Keynote Address at Workshop organised by the GB Pant Institute of Himalayan Environment and Development

[14] DC Goswami and P J Das (2002): 'Hydrological Impact of Earthquakes on the Brahmaputra River Regime', Proceedings of the 18th National Convention of Civil Engineers, Guwahati

(1897 and 1950) caused landslides on the hill slopes and led to the blockage of river courses, flash floods due to sudden bursting of landslide induced temporary dams, raising of riverbeds due to heavy siltation, fissuring and sand venting, subsidence or elevation of existing river and lake bottoms and margins and the creation of new water bodies and waterfalls due to faulting" [Menon *et al* 2003][15]. Even more recent research published in *Science* (Kerr and Stone, 2009)[16] on Zipingpu reservoir-induced seismicity as a trigger for the massive Sichuan earthquake in 2008, raises doubts about the wisdom of extensive dam-building in a seismically active region.

The ambitious scheme for interlinking of rivers also presents major problems. The comprehensive proposal to link Himalayan with the Peninsular rivers for inter-basin transfer of water was estimated to cost around Rs. 5,60,000 crores in 2001 (the cost is officially stated to have risen to Rs. 11 lakh crore today). Land submergence and R&R packages would be additional to this cost. There are no firm estimates available for running costs of the scheme, such as the cost of power required to lift water. There is also the problem that because of our dependence on the monsoons, the periods when rivers have "surplus" water are generally synchronous across the subcontinent. A recent study further indicates that deficit rainfall years are growing in river basins with surplus water and falling in those with shortages.[17] A major problem in planning inter-basin transfers is how to take into account the reasonable needs of the basin states, which will grow over time. Further, given the topography of India and the way links are envisaged, they might totally bypass the core dryland areas of Central and Western

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[15] M Menon *et al* (2003): 'Large Dams in the Northeast: A Bright Future?' *The Ecologist Asia*, Vol 11, No 1

[16] R.A. Kerr and R. Stone (2009): 'A Human Trigger for the Great Quake of Sichuan?', *Science*, 16 January 2009, Vol. 323, No. 5912

[17] Subimal Ghosh, H. Vittal, Tarul Sharma, Subhankar Karmakar, K. S. Kasiviswanathan, Y. Dhanesh, K. P. Sudheer, S. S. Gunthe (2016): 'Indian Summer Monsoon Rainfall: Implications of Contrasting Trends in the Spatial Variability of Means and Extremes', PLOS

India, which are located on elevations of 300+ metres above MSL. It is also feared that linking rivers could affect the natural supply of nutrients through curtailing flooding of the downstream areas. Along the east coast of India, all major peninsular rivers have extensive deltas. Damming the rivers for linking will cut down the sediment supply and cause coastal and delta erosion, destroying the fragile coastal eco-systems.

It has also been pointed out that the scheme could affect the monsoon system significantly (Rajamani *et al*, 2006)[18]. The presence of a low salinity layer of water with low density is a reason for maintenance of high sea-surface temperatures (greater than 28 degrees C) in the Bay of Bengal, creating low pressure areas and intensification of monsoon activity. Rainfall over much of the sub-continent is controlled by this layer of low saline water. A disruption in this layer could have serious long-term consequences for climate and rainfall in the subcontinent, endangering the livelihoods of a vast population.

Given the emerging limits to further development in the major and medium irrigation sector, we urgently need to move away from a narrowly engineering-construction-centric approach to a more multi-disciplinary, participatory management perspective, with central emphasis on command area development and a sustained effort at improving water use efficiency, which continues to languish at a very low level. Given that nearly 80% of our water resources are consumed by irrigation, an increase in water use efficiency of irrigation projects by 20% will have a major impact on the overall availability of water not only for agriculture but also for other sectors of the economy.

[18] V. Rajamani, U.C. Mohanty, R. Ramesh, G.S. Bhat, P.N. Vinayachandran, D. Sengupta, Prasanna Kumar and R.K. Kolli (2006): 'Linking Indian Rivers vs Bay of Bengal monsoon activity', *Current Science*, Vol.90, 12-13

Need for Irrigation Management Transfer

The Government of India needs to both incentivise and facilitate States to ensure that they undertake reforms required to ensure that the trillions of litres of water stored in our large dam command areas actually reaches the farmers for whom it is meant. India's irrigation potential created is 113 mha and the potential utilized is 89 mha. This gap is growing by the year. This gap of 24 mha is massive low hanging fruit. By focusing our efforts on bridging this gap we could add millions of hectares to irrigation at half the cost involved in irrigating through new dams.

The way to do this is to move towards Participatory Irrigation Management (PIM), which has been successfully adopted in countries across the globe. This includes advanced nations such as the US, France, Germany, Japan and Australia; East and South Asian countries like China, Sri Lanka, Pakistan, Philippines, Indonesia, Vietnam and Malaysia; Uzbekistan and Kyrgyzstan in Central Asia; Turkey and Iran in the Middle East; African nations such as Mali, Niger, Tanzania and Egypt, as also Mexico, Peru, Colombia and Chile in Latin America.

But even more significant are the successful examples of PIM pioneered by States in India such as Dharoi and Hathuka in Gujarat, Waghad in Maharashtra, Satak, Man and Jobat in Madhya Pradesh, Paliganj in Bihar and Shri Ram Sagar in Andhra Pradesh. PIM implies that the States only concentrate on technically and financially complex structures, such as main systems up to secondary canals and structures at that level. Tertiary level canals and below, minor structures and field channels are handed over to Water Users Associations of farmers, which enables the transformation of last-mile connectivity through innovative command area development.

What the Centre needs to do is to set up a non-lapsable fund that reimburses to State irrigation departments a matching contribution of their Irrigation Service Feed (ISF) collection from farmers on a 1:1 ratio. In order to generate competition among Major and Medium Irrigation (MMI) staff across commands, States would allocate the central grant to MMI systems in proportion to their respective ISF collection. To encourage Participatory Irrigation Management (PIM), the Centre should provide a bonus on that portion of each State's ISF collection, which has been collected through Water User Associations (WUAs). And this will be on condition that WUAs and their federations are allowed to retain definite proportions of the ISF, which would not only enable them to undertake repair and maintenance of distribution systems but also increase their stakes in water management. Similarly, to encourage volumetric water deliveries, an additional bonus should be provided on that portion of a State's ISF collection, which accrues through volumetric water supply to WUAs at the outlet level. The clear understanding is that empowering WUAs is the key to making the process of pricing of water and ISF collection more transparent and participatory.

Our huge investments in irrigation have yielded much less than what they should have mainly because command area development (CAD) has been consistently neglected and divorced from building of irrigation capacities. The Centre must stipulate that all irrigation project proposals (major, medium or small) will henceforth include CAD works from the very beginning as an integral part of the project. Thus, each proposal will plan for irrigation water from the reservoir to the farm gate and not just the outlet as at present. No investment clearance will be provided to any irrigation project devoid of CAD integration. There will be *pari passu* action in each irrigation command wherein works in the distributary network and software activities of CAD will be undertaken simultaneously with head works and main canal work, leading to a seamless integration of work in the head-reaches and tail-end of the command. Recognition of potential creation at the outlet of distributary will be discontinued. Potential creation will be recognised only after complete hydraulic connectivity is achieved from reservoir to farm-gate. In this manner, creation of irrigation capacities will be better matched by their utilisation, farmers will truly benefit from these investments and water use efficiency will improve.

It has been estimated that even without building a single new large dam project, by simply completing ongoing projects we could create new MMI irrigation potential of 7.9 million ha. Again, by simply closing the gap between IPC and IPU we could add 10 million ha by prioritizing investments in Command Area Development and Management (CAD&M) projects. And we could also restore an additional 2.2 million ha of lost irrigated potential through Extension, Renovation and Modernisation (ERM) works in old MMI projects.

Sadly, in its current state the Central Water Commission (CWC) is ill-equipped to undertake these kinds of radical reforms. More on that a little later.

CGWB: Unlimited Extraction of Groundwater

As far as the possibilities of further groundwater development are concerned, the situation is perhaps even more difficult in large parts of the country. Unfortunately the growing dependence on groundwater has taken the form of unsustainable over-extraction, which is lowering the water table and adversely impacting drinking water security. While public investments since Independence have focused largely on surface water, over the last three decades, groundwater has emerged as the main source of both drinking water and irrigation, based almost entirely on private investments by millions of atomistic decision-makers.[19]

[19] Of course, it must be acknowledged that the massive investments in public electrification hugely contributed to groundwater development

The relative ease and convenience of its decentralised access has meant that groundwater is the backbone of India's agriculture and drinking water security. Groundwater is used by millions of farmers across the country. Over the last four decades, around 84 per cent of the total addition to the net irrigated area has come from groundwater. India is by far the largest and fastest growing consumer of groundwater in the world. But groundwater is being exploited beyond sustainable levels and with an estimated 30-million groundwater structures in play, India may be hurtling towards a serious crisis of groundwater over-extraction and quality deterioration.

Recent work based on data from NASA's Gravity Recovery and Climate Experiment (GRACE) satellites[20] reveals significant rates of non-renewable depletion of groundwater levels over large areas. The declines were at an alarming rate of as much as one foot per year over the past decade. During the study period of August 2002 to October 2008, groundwater depletion in Rajasthan, Punjab, Haryana and Delhi was equivalent to a net loss of 109 cubic km. of water, which is double the capacity of India's largest surface-water reservoir. Annual rainfall was close to normal throughout the period and the study shows that other terrestrial water storage components (soil moisture, surface waters, snow, glaciers and biomass) did not contribute significantly to the observed decline in total water levels. The study concludes that unsustainable consumption of groundwater for irrigation and other anthropogenic uses is likely to be the cause.

When the annual withdrawal rate of ground water is compared with the annual recharge of ground water the picture that emerges is not very rosy. The withdrawal rate expressed as a percentage of the net ground water available per year (termed level of Ground water

[20]Rodell, M., Velicogna, I., and J.S. Famiglietti (2009): 'Satellite-based Estimates of Groundwater Depletion in India', *Nature,* dci10.1038

development) exceeds 100 % in some states and is far from satisfactory in other states. A major contributor to this rapid depletion in water tables is the overwhelming dependence on deep drilling of groundwater through tubewells, which at over 40 per cent is today the single largest source of irrigation. Indeed, we are close to entering a vicious infinite regress scenario where an attempt to solve a problem re-introduces the same problem in the proposed solution. If one continues along the same lines, the initial problem will recur infinitely and will never be solved. This regress appears as a natural corollary of what has been termed "hydroschizophrenia",[21] which entails taking schizophrenic view of an indivisible resource like water, failing to recognize the unity and integrity of the hydrologic cycle. The most striking example of this in India is increased reliance on tubewells both for irrigation and drinking water, not recognising that one can potentially jeopardize the other.

Indeed, the problem of "slippage" in rural drinking water has become a recurrent and serious one. The portents have been visible for some time now. Issues related to water quality have also emerged as a major new concern over the last decade or so. Till the 1970s, quality issues were to do with biological contamination of the main surface water sources due to poor sanitation and waste disposal, leading to repeated incidence of water-borne diseases. But today this has been supplemented by the serious issue of chemical pollution of groundwater, with arsenic, fluoride, iron, nitrate and salinity as the major contaminants. This is directly connected with falling water tables and extraction of water from deeper levels. States continually report an increasing number of habitations affected with quality problems.

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[21] Llamas, R. and P. Martinez-Santos (2005): 'Intensive Groundwater Use: Silent Revolution and Potential Source of Water Conflicts", *American Society of Civil Engineers Journal of Water Resources Planning and Management*, 131, no.4; Jarvis, T. et al (2005): 'International Borders, Ground Water Flow and Hydroschizophrenia', *Ground Water*, Vol.43, No.5

According to the Ministry of Drinking Water Supply and Sanitation, out of 593 districts from which data is available, we have problems from high Fluoride in 203 districts, Iron in 206 districts, Salinity in 137 districts, Nitrate in 109 districts and Arsenic in 35 districts. Biological contamination problems causing Enteretic disorders are present throughout the country and are a major concern, being linked with infant mortality, maternal health and related issues. Estimates made for some of these water quality related health problems suggest a massive endemic nature – Fluorosis (65 million (Susheela 2001)[22] and Arsenicosis [5 million in West Bengal (WHO 2002)[23] and several magnitudes more, though unestimated from Assam and Bihar]. Fluorosis caused by high Fluoride in groundwater leads to crippling, skeletal problems and severe bone deformities. On the other hand, Arsenicosis leads to skin lesions and develops into cancer of lung and the bladder.[24]

A recent assessment by NASA showed that during 2002 to 2008, India lost about 109 cu.km. of water, leading to a decline in water table to the extent of 3-5 cm per annum (Tiwari et al, 2009)[25]. In addition to depletion, many parts of India report severe water quality problems, causing drinking water vulnerability. *The result is that nearly 60% of all districts in India have problems related to either the quantity or quality of groundwater or both.*

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[22] Susheela AK, 2001, *A Treatise on Fluorosis*, Fluorosis Research and Rural Development Foundation, Delhi

[23] *WHO, 2002, An overview: Gaps in health research on Arsenic Poisoning,* 27th Session of WHO South-East Asia Advisory Committee on Health Research 15-18 April 2002, Dhaka, Bangladesh

[24] S. Krishnan (2009): *The Silently Accepted Menace of Disease Burden from Drinking Water Quality Problems*, Submission to the Planning Commission

[25] VM Tiwari *et al* (2009):'Dwindling groundwater resources in northern Indian region, from satellite gravity observations', *Geoph. Res. Lett.*, 36, L18401, doi:10.1029/2009GL039401.

Sustainable and Equitable Management of Groundwater, the CPR, based on Partnerships

While its decentralised character enables easier last-mile connectivity of groundwater, the problem arises in the inequitable distribution and unsustainable extraction of this common pool resource (CPR). While groundwater resources are perceived as a part of a specific cadastre—watersheds, landscapes, river basins, villages, blocks, districts, states—aquifers are seldom considered. Aquifers are rock formations capable of storing and transmitting groundwater. A complete understanding of groundwater resources is possible only through a proper understanding of such aquifers. As the work of Nobel Laureate Elinor Ostrom shows, the first design principle in management of a CPR is the clear delineation and demarcation of its boundaries. And an understanding of its essential features, which in the case of groundwater includes its storage and transmission characteristics. About 54 percent of India (comprising mainly the continental shield) is underlain by formations usually referred to as "hard rocks". 'Hard rock' is a generic term applied to igneous and metamorphic rocks with aquifers of low primary inter-granular porosity (e.g., granites, basalts, gneisses and schists). Groundwater in hard rocks is characterised by limited productivity of individual wells, unpredictable variations in productivity of wells over relatively short distances and poor water quality in some areas.

Initially, the expansion of tubewells following the Green Revolution was restricted to India's 30 per cent alluvial areas, which are generally characterized by relatively more pervious geological strata. From the late 1980s, tubewell drilling was extended to hard rock regions where the groundwater flow regimes are extremely complex. Deeper seated aquifers often have good initial yields, but a tubewell drilled here may be tapping groundwater accumulated over hundreds or even thousands of years. Once groundwater has been extracted from a deeper aquifer, its replenishment depends upon the inflow from the shallow system or from the surface several hundred metres above it. In general the rate of groundwater recharge is much lower. This poses a severe limit to expansion of tubewell technology in areas underlain by these strata.

Similarly in the mountain systems, which comprise 17 per cent of India's land area, effects of groundwater overuse do not take very long to appear. As the processes of groundwater accumulation and movement are vastly different in different geological types, the implications of any level of groundwater development (GD) will vary significantly across types of geological settings. However, even in the alluvial heartlands of the Green Revolution for which tubewell technology is relatively more appropriate, we are moving into crisis zone. Three states, Punjab, Rajasthan and Haryana, have reached a stage where even their current level of groundwater extraction exceeds recharge and is therefore unsustainable. Three other states, Tamil Nadu, Gujarat and UP, seem to be fast approaching that stage.

Participatory, sustainable groundwater management, recognising its CPR character is the need of the hour, where management strategies are duly attuned to the specific requirements of each hydrogeological setting, which need to be carefully mapped at a scale that makes possible such participatory management by the primary stakeholders. It is not possible to police 30 million groundwater structures through a licence-quota-permit raj. The challenge of groundwater management arises from the fact that a fugitive, common pool resource is currently being extracted by individuals, millions of farmers in particular, with no effective mechanism to ensure that the rate of extraction is sustainable. We need a participatory approach to sustainable and equitable groundwater management based on a knowledge of the underlying aquifers.

It is this understanding that underpins the National Aquifer Management Programme (NAQUIM) initiated recently by the Government of India in the 12th Plan with a budgetary allocation of Rs. 3,539 crore. This is the largest such program ever initiated in human history. Nothing of this scale has been attempted before: the term scale is used in two senses – one, the *extensiveness* of scale and two, the *fineness* of scale (resolution of the maps). The aquifer mapping programme is not an academic exercise and must seamlessly flow into a participatory groundwater management endeavour. This demands strong partnerships among government departments, research institutes, gram panchayats/urban local bodies, industrial units, civil society organizations and the local community. The interface of civil society and research institutes with government needs to be encouraged across all aspects of the programme, ranging from mapping India's aquifers, large-scale capacity building of professionals at different levels, action-research interface with implementation programmes and development of social-regulation norms around groundwater.

Tragically, so far the programme has failed to take off with the requisite momentum. The major reason for this is the huge lack of capacities in the CGWB and the state ground water boards. Effective management of groundwater requires changes in the nature of coordination among the government ministries related to groundwater (water resources/irrigation, drinking water, rural development, agriculture, environment and forests, urban development, pollution control and industrial effluents). These agencies must be required to assess the impact of their decisions on groundwater and report to CGWB, on issues concerning groundwater. For this to be effective, the institutional mandate of CGWB should be strengthened to enable it to perform its role as the manager of groundwater resource, including hiring from the fields of community institutions, participatory management of resource, political economy and economics, water markets, regulatory systems, alternative uses, opportunity cost of groundwater extraction, energy management and so on.

River Basins as Focus of Water Governance

For some time now, policy-makers and scholars alike have emphasised the need to integrate our interventions on surface and groundwater given that the ultimate source of all water on land is precipitation as rain, snow or hail. The need to focus on river basins as the appropriate unit of intervention is evident in the watershed programmes initiated by the government over the last 40 years. River Basin Organisations have also been set up.

However, it remains true that progress on integrating surface and groundwater has been slow in actual work done on the ground. In recognition of this fact, the recent National Water Framework Law (NWFL) drafted by the Ministry of Water Resources, River Development and Ganga Rejuvenation has placed special emphasis on integrated river basin development and management, as also on river rejuvenation as central pillars of national policy.

The draft bill emphasises the integral relationship between surface and groundwater. The NWFL recognises that "water in all its forms constitutes a hydrological unity, so that human interventions in any one form are likely to have effects on others; and that "ground water and surface water interact throughout all landscapes from the mountains to the oceans". This is evident in the fact that "over-extraction of groundwater in the immediate vicinity of a river, destruction of catchment areas and river flood-plains have very negatively impacted river flows in India; such a decrease in river flows, in turn, negatively impacts groundwater recharge in riparian aquifers in the vicinity of the river"

And because "the fall in water tables and water quality, as also the drying up of rivers, has serious negative impacts on drinking water and livelihood security of the people of India, as also the prospects for economic growth and human development in the country", it is vitally important that "each river basin, including associated aquifers, needs to be considered as the basic hydrological unit for planning, development and management of water, empowered with adequate authority to do the same"

The NWFL places central emphasis on river rejuvenation and enjoins the appropriate government to "strive towards rejuvenating river systems with community participation, ensuring:

(a) 'Aviral Dhara'- continuous flow in time and space including maintenance of connectivity of flow in each river system;

(b) 'Nirmal Dhara'- unpolluted flow so that the quality of river waters is not adversely affected by human activities; and

(c) 'Swachh Kinara' – clean and aesthetic river banks"

The entire area from which the precipitation is directed into a river until it meets another river (and ultimately the ocean), is referred to as its basin or watershed. A common feature of all river basins is the topography that influences the pattern of stream network forming a river. Steep slopes such as in the mountains cause rapid runoff and erosion and allow lesser infiltration into groundwater. In the plains as the slope decreases considerably, the runoff exceeding the capacity of the river channel periodically spills over the river-banks into areas lying laterally to them. These periodically flooded areas – the floodplains – play a vital role in the groundwater recharge, water quality of the river, biodiversity and several other benefits to humans.

River basins differ in their water resources depending upon a variety of factors such as the climate (precipitation and temperature), geology, soils, vegetation cover and even their size. A river basin may however cover several different geologies and climate zones. The river flowing downslope may pass through dry deserts (e.g., Indus) or high rainfall regions (e.g., Ganga). A large river basin comprises of several sub-basins of their tributaries which often differ in many respects of soil, geology, climate, vegetation, human interaction and these tributaries do influence the rivers they join (downstream of their confluence). In case of such large river basins, it maybe necessary to treat sub-basins separately keeping in view their distinctive characteristics.

Why we need the National Water Commission[26]

The CWC and CGWB were created in a very different era, with a mandate appropriate for that era. The challenge today is for us to restructure these agencies so that they can

(a) work on the new mandate that the nation has placed before them and
(b) work in a manner that overcomes the schism between groundwater and surface water
(c) work with greater presence on the ground at the river basin level

The Committee on Restructuring CWC and CGWB has proposed that the CWC and CGWB be restructured in a manner that brings unity of purpose to their functioning. It proposes the creation of a National Water Commission that unifies these two apex bodies.

The institutional architecture of the proposed National Water Commission needs to be informed by the discussion among organization theorists about the relationship between structure and strategy. Strategy, in this context, refers to the sum total of what an organization does to work towards its objectives[27]; and structure means, besides the

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[26] This section draws upon the *Report of the Committee on Restructuring CWC and CGWB* that I handed over to the Government of India in July 2016

[27] Chandler (1962), who led this debate, defined strategy is the determination of the basic long term goals of an enterprise and the adoption of courses of actions and the allocation of resources necessary to carry out these goals. http://www.ukessays.com/essays/business/study-the-relationship-between-structure-and-strategy-business-essay.php#ixzz41dHGzNaF

organogram showing hierarchy and reporting relations, people, skills and capacities, groupings of people and relationship between groupings, culture and internal task environment. Some argue that once a structure is created, the strategy follows. Others argue that successful organizations evolve the strategy first and design a structure appropriate to the strategy. In the ultimate analysis, a good 'fit' between strategy and structure is critical for an organization to deliver on its goals. In market driven businesses, misfit between organization strategy and structure results in loss of competitive advantage and the organization withers away. In bureaucracies, organisations with such a misfit may survive for long but remain out of sync with their operating environment and become insignificant. Unless they reinvent themselves, these may gradually be reduced to a skeleton by starving them of resources. Irrigation and groundwater bureaucracies in India are themselves a case in point.

The history of state irrigation departments (IDs) in many states illustrates this. These were created and staffed with civil engineers when the key objective was construction of irrigation projects, which is largely what IDs did. Once construction was over, IDs proved a misfit for management of irrigation systems, which required a different set of skills and operating culture. In many states, IDs still survive but only in name; most states have not recruited irrigation engineers in 20-25 years. In Gujarat, the last ID engineer will likely retire next year.

The same is the story with groundwater departments. These were created to construct public tubewells. But the current situation on ground water in India is different from that of 60 years ago. For that matter, it is quite different from the situation 30 years ago. India today is facing a severe groundwater crisis even as our dependency on groundwater has significantly grown. Some parts of India are underlain by aquifers that are stressed from the exploitation of groundwater. Others face serious challenges from groundwater contamination, of both geogenic and anthropogenic nature. There are a few areas in India that suffer from challenges of both exploitation and contamination. India therefore needs to manage groundwater resources at various scales, ranging from regional – river basin scales to more macro and local scales, particularly in the context of groundwater exploitation and contamination.

CWC and CGWB have followed a somewhat similar trajectory; but GoI is less resource-constrained than state governments; therefore these have not only survived but even grown. However, they are already facing reduced budgets and today require urgent restructuring. Both the CWC as well as CGWB have useful and formidable capabilities for water resource exploration, assessment and monitoring, and planning of infrastructure projects; these must be preserved, nurtured and built upon. These capabilities are no doubt important even today and will remain so in future, too. However, technologies available today are so advanced that these tasks can be performed better and in more cost effective manner than is being done now. The need of the hour is to significantly enhance the effectiveness of assessment, monitoring and planning capabilities and their effective deployment.

Several State Governments have testified that the huge delays in the techno-economic appraisal by the CWC had become a matter of concern for them. To quote the Government of Madhya Pradesh:

"CWC in particular has been playing the role of a regulator for long. MOWR has made vetting of all medium and major irrigation projects by CWC mandatory. CWC has more than 15 directorates to examine a major project and examination takes years. State Governments have to deploy project engineers to chase their projects for months and do considerable liaison work with CWC engineers. Consequently, most state governments have ended up with posting of resident engineers and opening their offices in Delhi. The time taken for project examination is at times equal or more than the time taken to complete the project."

There is a need to address this concern and make appraisal a demand-based exercise, done through a partnership between the central and state governments. This is a common concern of many states. Thus, project appraisal can become a truly collaborative process, with expertise flowing on demand from the best institutions of the country.

The CGWB grew out of a small organization with a narrow, specific purpose, viz., drill exploration wells to assess groundwater resource. The CWC even today views itself as "an apex *technical* organisation in the field of water resources development". Neither agency ever viewed itself as a water governance organization.

India has embarked upon an ambitious plan of mapping aquifers with clear meaning, messages and direction to managing quantities and quality of groundwater resources across a diverse socio-ecological typology. However, even the early aquifer-mapping pilots have revealed that mapping and managing India's aquifers requires strategic skills that require going beyond merely map-producing skills. Such mapping and management of groundwater resources in India involves three important and sometimes competing objectives. These objectives include:

1. The social dimension of securing domestic – drinking water –from aquifers across both the rural and urban landscapes, even while the same aquifers are stressed to ensure water security to our farmers and to the industry in order to propel growth on both the fronts.
2. Hence, the second dimension involves ensuring food-security through various forms of irrigation – ranging from protective irrigation to secure the kharif crop from climate vagaries to ensuring good produce during the dry seasons of rabi and summer, when groundwater is the only means of water for farm lands in large parts of the country. The economic dimension also involves industrial water use, often in regions

where agriculture and industry co-exist and source water from the same set of aquifers.

3. The usage of water for domestic, irrigation and industrial needs has a significant bearing on the ecologic dimension of groundwater, mainly on the base-flows that feed streams, rivers and keep our wetlands intact. Some groundwater must eventually flow to the sea or ocean, by way of base flows, for ecological integrity of coastal systems.

Doing justice to such a perspective requires interdisciplinary skills that will enable a transition from an organization that spent much of its time in the exploration and drilling for groundwater to an organization that has the capacity to lead and anchor a national programme on aquifer management from different parts of India. The aquifer mapping effort must also be increasingly backed by more frequent assessments in real-time – annual assessments must become available at least once every year – and based on aquifer information including groundwater levels and groundwater quality. At the same time, this information can become even more effective if data on the profiles of users and uses is also available along with information and data on economics, social indices, ecosystem and energy so that a much better understanding emerges on the nexus between groundwater, agriculture, industry and energy. This information can then be more fruitfully used in the planning and management of our river basins. Most significantly, the reform must include steps whereby data and information improve in terms of accuracy, representativeness and scale, at the same time being backed by simple data-analytics that have a high degree of applicability in developing and implementing groundwater management plans that emerge out of the aquifer mapping exercise. The crucial task is of managing aquifers through a participatory process involving various stakeholders across a diverse and variable socio-ecological landscape requiring an increasingly proactive role not just in the mapping of but also in the management and governance of India's aquifers.

India's water strategy has so far concentrated on public investment in infrastructure. This has undoubtedly played a significant role in meeting the goal of national food security. We have paid much lip service to, but in reality placed very little emphasis on, management improvements, governance reforms and institutional innovations. This is why returns to public investments in water infrastructure in India have been poor; and water projects have suffered from the build-neglect-rebuild syndrome. The country can make rapid strides in water security by emphasizing management improvements and institutional reforms rather than just public investment in water infrastructure. This shift of emphasis is the key challenge to be met by the National Water Commission.

A few States have, in fact, taken the lead in charting out a path of reform in some of their command areas. But overall, the discourse on policy reform in key infrastructure sectors in India has generally given water a go by. It could actually be argued that India's growth prospects in the medium- and long-term will depend critically on how fast we can reform our water sector by moving away from an engineering-centred, command-and-control approach towards a people-centred, sustainable and equitable demand management of water.

In the new water resource governance scenario facing the country, we need to envisage a high level central organization that is forward looking, strategic, agile and trans-disciplinary in its skill set. This has to be conceived of as an action organization rather than merely an assessment and monitoring organization, although these too will remain aspects of its mandate.

It is true that all the action in the water sector lies with the state governments. Yet a well-designed central organization can deploy and use funds as well as scientific and knowledge resources to influence and support what states do in water governance. This organization should have a compact leadership with a broad range of expertise related to water. Moreover, it has to have a culture of cross-disciplinary team-work rather than different disciplines operating in silos. The need of the hour is a new organizational culture, new skill-mix and new operating style.

Both CWC and CGWB are weighed down by their highly specialized but narrow-based skill-structure. These are massive organizations using up huge resources and energies in managing themselves. Their functioning is also mired by a highly dysfunctional organization culture. There is literally a quagmire of hundreds of different designations, which has nightmarish consequences for framing recruitment rules, career progression ladder, promotions, seniority, pay scales etc. [28] All these limitations constrain the capacity of these agencies to rise to meet major new challenges facing India's water economy. The larger water governance challenge requires a new-age, modern, agile and compact apex organization that is untrammelled by the burden of the irksome internal management complexities of these unwieldy bureaucracies.

What is more, the organisation needs to view both groundwater and surface water in an integrated, holistic manner. CWC and CGWB cannot continue to work in their current independent, isolated fashion. The one issue that brings out the need to unify the two bodies more than any other is the drying up of India's rivers. The single most important factor explaining the drying up of post-monsoon flows in India's peninsular rivers is the over-extraction of groundwater. The drying up of base-flows of groundwater has converted so many of our "gaining" rivers into "losing" rivers. If river rejuvenation is, indeed, the key national mandate assigned to the Ministry of Water Resources, then this cannot be done without hydrologists and hydrogeologists working

[28] For example, CGWB has as many as 125 different designations (Scientific-71, Engineering-20, Ministerial / Administrative-34). Rampant increase in court cases and representations related to seniority, promotions, FCS etc. bear testimony to the fact that there is a link between number of designations and court cases / representations.

together, along with social scientists, agronomists and other stakeholders.

Both the CWC and CGWB are lacking in the capacities essential for them to respond to the needs of the water sector in 21st century India. In such a situation it is unfair for us to expect these bodies to fulfill the mandate devolved upon them by the new realities of the water sector. Civil engineers (the main discipline overwhelmingly present in the CWC) and hydrogeologists (the main discipline in the CGWB) are crucial for effective water management. But alone they cannot be expected to shoulder the entire burden of the new mandate. There is an acute lack of professionals from a large number of disciplines, without which these bodies will continue to under-perform. These disciplines include, most importantly, the social sciences and management, without which we cannot expect programmes such as Participatory Irrigation Management and Participatory Groundwater Management to succeed; Agronomy, without which crop water budgeting cannot happen and water use efficiency will not improve; Ecological Economics, without which we will not gain an accurate understanding of the value of ecosystem services, which need to be protected in river systems and River Ecology, which is essential to the central mandate of river rejuvenation.

Our goal, therefore, has to be to make a manifold increase in the capacities of the apex bodies managing water in India. This can be done through both in-house enhancement of capacities (through capacity building of existing personnel as and by inducting fresh personnel) and through building robust partnerships with institutions of excellence across the country.

It is, therefore, imperative that:

a) a brand new National Water Commission (NWC) be established as the nation's apex facilitation organisation dealing with water policy, data and governance;

b) NWC should be an adjunct office of the Ministry of Water Resources, River Development and Ganga Rejuvenation, functioning with both full autonomy and requisite accountability;

c) NWC should be headed by a Chief National Water Commissioner, a senior administrator with a stable tenure and with strong background in public and development administration, and should have full time Commissioners representing Hydrology (present Chair, CWC), Hydrogeology (present Chair, CGWB), Hydrometeorology, River Ecology, Ecological Economics, Agronomy (with focus on soil and water) and Participatory Resource Planning & Management.

d) NWC should have strong regional presence in all the major river basins of India;

e) NWC should build, institutionalise and appropriately manage an architecture of partnerships with knowledge institutions and practitioners in the water space, in areas where in-house expertise may be lacking

The key mandate and functions that the National Water Commission needs to pursue has the following building blocks:

i. enable and incentivize state governments to implement all irrigation projects in reform mode, with an overarching goal of *har khet ko paani* and improved water resource management and water use efficiency, not just construction of large scale reservoirs, as the main objective;

ii. lead the national aquifer mapping and groundwater management programme;

iii. insulate the agrarian economy and livelihood system from pernicious impacts of drought, flood and climate change and move towards sustainable water security;

iv. develop a nation-wide, location-specific programme for rejuvenation of India's rivers to effectively implement the triple mandate of *nirmal dhara, aviral dhara, swachh kinara;*

v. create an effective promotional and regulatory mechanism that finds the right balance between the needs of development and environment, protecting ecological integrity of nation's rivers, lakes, wetlands and aquifers, as well as coastal systems;
vi. promote cost effective programmes for appropriate treatment, recycling and reuse of urban and industrial waste water;
vii. develop and implement practical programmes for controlling point and non-point pollution of water bodies, the wetlands and aquifer systems;
viii. create a transparent, accessible and user-friendly system of data management on water that citizens can fruitfully use while devising solutions to their water problems;
ix. operate as a world-class knowledge institution available, on demand, for advice to the state governments and other stakeholders, including appraisal of projects, dam safety, inter-state and international issues relating to water;
x. create world-class institutions for broad-based capacity building of water professionals and knowledge management in water

New Paradigm of Water Governance in India: Features, Principles, Dimensions

From the above discussion, we get a clear idea of the fundamental change we need to effect in the paradigm of water governance in India, if we are to meet the challenge of sustainable and equitable access to water and livelihood security for the Indian people. The new paradigm would need to have the following features, principles and dimensions:

1. **Weaving our Interventions into the Contours of Nature**: Rather than command-and-control, our attempt needs to be to fully appreciate and apprehend the enormous diversity that characterises this nation and plan our interventions in full

cognizance and understanding of this diversity, making them as location-specific as possible, to avoid the pitfalls of indiscriminate centralised planning. Watersheds, aquifers and river systems would be the cornerstones of such planning

2. **Governance based on Partnerships**: Rather than making governance the sole responsibility of governments, we need to craft a carefully designed architecture of partnerships, where all primary stakeholders get deeply involved in the collective endeavour of participatory water governance
3. **Multi-disciplinarity**: We must acknowledge that we cannot understand water other than in a deeply multi-disciplinary perspective. This involves not just engineering and hydro-geology but also river ecology, agronomy, soil science, the various social sciences and management, among others
4. **Multi-dimensionality**: We must adopt the perspective proposed in the current draft of the National Water Framework Law, which states that: "water is the common heritage of the people of India; is essential for the sustenance of life in all its forms; an integral part of the ecological system, sustaining and being sustained by it; a basic requirement for livelihoods; a cleaning agent; a necessary input for economic activity such as agriculture, industry, and commerce; a means of transportation; a means of recreation; an inseparable part of a people's landscape, society, history and culture; and in many cultures, a sacred substance, being venerated in some as a divinity".
5. **Breaking the Silos**: The proposed NWC will hopefully help in our being able to take an integrated view of water, so that the current hydro-schizophrenia can be overcome, ensuring protection of watersheds, river systems and endangered aquifers
6. **Demand-management and Sustainability as a central Focus**: Rather than seeking to endlessly augment supplies of water, the

focus must shift to effectively managing demand so that we recognise the finite nature of the resource and that sustainable use will be impossible without this shift. The supply-side thrust is a vicious infinite regress with no end in sight other than depletion of quantities and quality

7. **Emphasis on Equity in Access to Water**: We need to centrally emphasise the imperative to end discrimination in access to water on grounds of caste, class, gender, location and community, as emphasised in the National Water Framework Law
8. **Transparency and Easy Access to Water Information:** The issue here is not just access to information which should have transparency but also availability of information in a manner and form that is useful to and useable by primary stakeholders. The aim must be to pro-actively proffer water solutions to problems people face
9. **National Water Framework Law**: The draft NWFL provides an essential corrective to British Common law by building upon the Public Trust Doctrine enunciated by the Supreme Court, whereby the state at all levels holds natural resources in trust for the community. This would ensure that no one's use of water would be able to deprive anyone of their right to water for life as defined under the NWFL

It is my considered view that only through this comprehensive shift in the paradigm of water governance in India can we come to grips with and find sustainable and equitable solutions to the grave crisis of water facing the country. This is the kind of reform, reflecting the specificities of the water sector, that we require, rather than a blind adherence to the agenda embodied in the Washington Consensus. Only through this kind of detailed and comprehensive exercise in each sectoral context, can we begin to get a grip on the real reforms India needs to solve the emerging challenges of the 21st century. It is, therefore, not simply a matter of privatisation, liberalisation and globalisation. That is a lazy dogma, which we must decisively reject, while carefully considering the requirements of change in each sector of the economy.

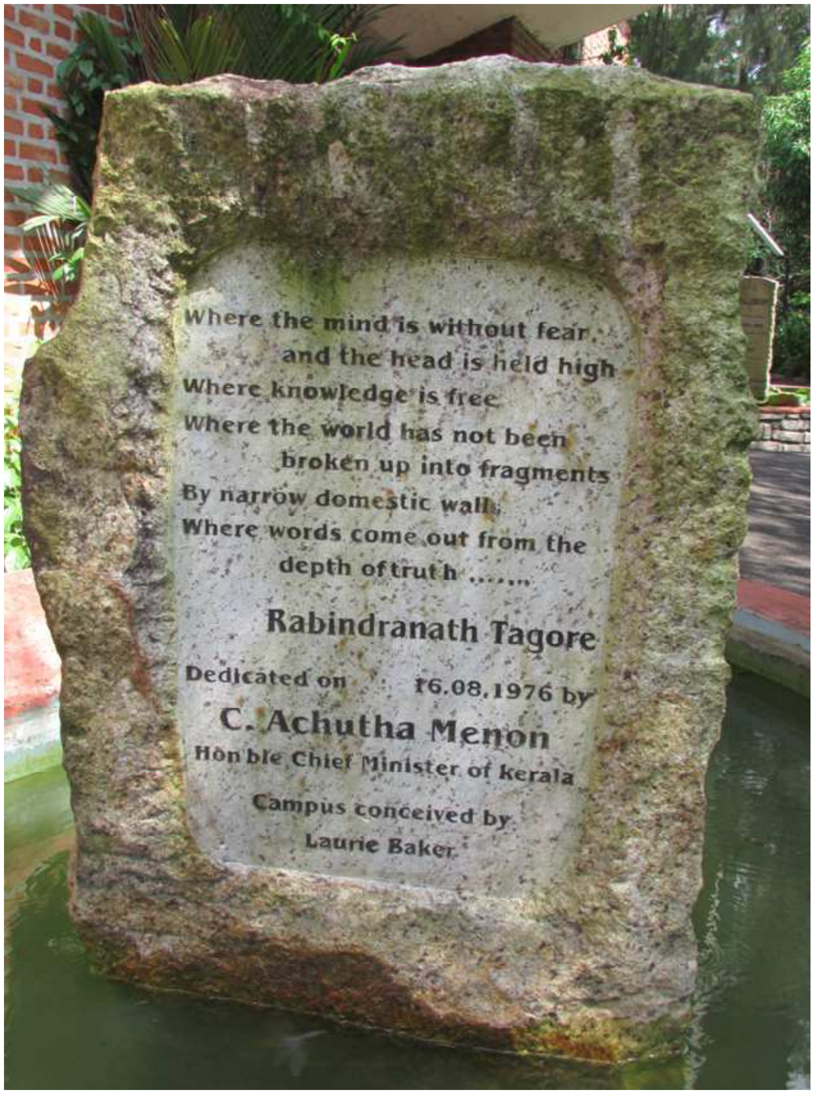
From 2009 to 2014, Dr. Mihir Shah was Member, Planning Commission, Government of India, where he was chiefly responsible for drafting the paradigm shift in the management of water resources enunciated in the 12th Five Year Plan. He also initiated a makeover of MGNREGA, the largest employment programme in human history, with a renewed emphasis on rural livelihoods based on construction of productive assets.

Dr. Shah graduated in Economics from St. Stephen's College, Delhi University (where he won the prestigious KC Nag Economics Prize) and did his post-graduation from the Delhi School of Economics (where he was Merit Scholar) in the 1970s, before going on to complete his doctoral dissertation at the Centre for Development Studies, Kerala.

After teaching briefly at the Centre, he resigned to explore fresh terrain beyond the ivory towers of conventional academia, which culminated in 1990 in the formation of Samaj Pragati Sahayog, which is today one of the largest grass-roots initiatives for water and livelihood security, working with its partners on a million acres of land across 72 of India's most backward districts. Dr. Shah has spent nearly three decades living and working in central tribal India, forging a new paradigm of inclusive and sustainable development.

Dr. Shah is a Founding Signatory of the Geneva Actions on Human Water Security, 2017. He is Distinguished Visiting Professor, Shiv Nadar University, where he has designed a globally first-of-its-kind Masters Program on Water Science and Policy. He is also Visiting Professor at Ashoka University, where he teaches a course on the *Political Economy of India's Development*. He is a Member of the International Steering Committee of the CGIAR Research Program on Water, Land and Ecosystems (WLE). He is the first President of the Bharat Rural Livelihoods Foundation, set up by the Government of India to support innovative civil society action in close partnership with state governments.

Dr. Shah was the Keynote Speaker at the Global Water Summit at Rome in 2012 and the International EcoSummit Congress at Montpellier in 2016.



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