Water and public engagement in science

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Balaram's editorial, 'Indian science: The need for public engagement'[1] is timely. It focuses on biotechnology and space technology, both at the forefront of commercial growth and economic prosperity. But, there is another area of science, which, in comparison with biotechnology and space technology may now be less spectacular, but may soon assume an importance matching those of other materials, biological and engineering technologies. This area concerns earth resources, especially water. What follows is a reflection on how public engagement of science may look like with regard to water. As a prelude, important developments in water policy since 2007 are first recounted, followed by a discussion of the relative significance and implications of these developments. These findings then form the basis for comprehending public engagement in science, both by experts and by the lay citizen.

Current status, 2007–2011

Over the past few decades, many concerned writers, including Sunita Narain, have written extensively about India's critical water situation with regard to its availability, wise management and equitable distribution of water. Until 2009, the National Water Policy of the Ministry of Water Resources, Government of India guided water policy, concentrating attention on large-scale integrated water projects. The overall position of the National Water Policy was that, '…Clearly, the overall demand will outstrip availability in another 35 to 40 years,…'[2]. The perception was that water was available in plenty and that the engineering challenge was but one of equitable and efficient distribution.

This perception was questioned by Narasimhan[3] on the basis of global water balance and evapotranspiration, who concluded, '…India's water budget, as provided by the Ministry of Water Resources (1999)[4], is widely used as the basis for making projections about India's water future, and related policy matters. There is sufficient evidence to suggest that the budget estimates may be seriously overestimating available water resources and utilizable water resources. It is hoped that this technical note would motivate researchers in surface water hydrology, meteorology, and climatology to revisit India's water budget and provide credible revised estimates, which would be of broad interest to earth scientists, water managers, policy makers and the concerned citizens.'

Other developments having relevance to the National Water Policy followed in 2009 and 2010. In 2009, alarmed at India's water crisis, the Supreme Court instructed the Department of Science and Technology (DST) in March 2009 to set up a high-powered Committee of Experts, including NRIs, to find solutions to India's acute problems. As an outcome, DST initiated a water mission in April, 'Winning, Augmentation, Renovation (WAR)'[5]. The focus of this venture is to draw upon best available technology to find more water to meet the country's growing water needs, make increased water availability through cleaning contaminated water, and further enhance water availability through recycling and renovating wastewater.

In May 2010, the Prime Minister's Climate Council[6,7] made water a component of an eight-mission challenge posed by impending climate change. The objective of the mission highlights water conservation, minimizing wastage and ensuring equitable distribution both across and within states through integrated resource development and management. Notable among the principles of the mission are: a comprehensive database in public domain, public participation through promotion of citizen–state interaction, integrated basin-wide management, enactment of state-wide legislation through persuasion, and review and adoption of a National Water Policy by March 2013. Notable among the specific goals are: expanding monitoring network, expeditious formulation of river-interlinking project, and implementing rainwater harvesting and augmentation of artificial recharge in all Blocks by 2017.

Following this, the Planning Commission[8] concluded in its Mid-Term Appraisal (MTA) Report, '…On reviewing these issues in the course of the Mid Term Appraisal, problems in this area appear even more serious than originally assessed and solutions are almost certainly more difficult… . The central message emerging from the MTA is that we cannot expect to find a solution unless we can come out of the silos into which we have divided water and take a holistic view of the hydrologic cycle.'

Meanwhile, other concerned citizens have expressed serious thoughts about the approach of the Water Mission and the WAR mission, both of which focus on finding more water to satisfy demand, mobilizing all available technologies. Notable among these is Ramaswamy R. Iyer, a former Secretary of the Ministry of Water Resources. Iyer[9] forcefully argues for addressing India's highly mismanaged water resources, regardless of the uncertainties associated with climate change. He advocates the abandonment of the National Water Policy of 2002 to set in place a radically new start. 'Business as usual' that has led to the present crisis, cannot any more be a viable option[10].

Central to Iyer's thesis is a reasoning that has scientific relevance, namely, '…we must start from the fact that the availability of freshwater in nature is finite, and learn to manage our water needs within that availability. This will mean a stringent restraint on the growth of "demand" for water (other than basic needs), which will be difficult and will involve painful adjustments; but the effort is inescapable.' The sustainability of India's economic expectations in relation to water availability has also been questioned by Narasimhan[11]. Recently, the Vice-Chairman of the Planning Commission, Montek Singh Ahluwalia has asserted that higher GDP cannot be achieved without water management[12].

Where do we stand?

It is clear that India is in a state of water crisis. What are the scientific underpinnings of this crisis that merit public engagement and clarification? These include:

All water required for biological sustenance comes from rain. Because of the nature of evapo-transpirative and other losses, annual water availability for human use is finite, limited and vulnerable to seasonal climatic variability. Therefore, the questions of primary scientific signi-

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ficance are whether (i) water is available in plenty in India, and that the challenge is one of effective management, or (ii) water availability is finite, and that regardless of the most effective management, water use and continued economic growth have to be moderated.

Throughout the world, the second half of the 20th century has revealed devastating effects of over-exploitation of surface water and groundwater due to aggressive technologies, not only degrading the quantity and quality of the resource, but also causing extreme hardship to poor people displaced by large projects. Some would argue that the present water crisis in India is partly due to high-technology large engineering projects. In this context, the Planning Commission's observation[8], '…*The central message emerging from the MTA is that we cannot expect to find a solution unless we can come out of the silos into which we have divided water and take a holistic view of the hydrologic cycle*' is significant. It departs significantly from the erstwhile mind-set of supply–demand to one of adapting to the finiteness of the hydrological cycle. Such a concept of adaptation is compatible with the reasoning espoused by Iyer[9], Narasimhan[8] and Ahluwalia[12].

Both the Water Mission of the Climate Council and WAR of DST envisage public-sharing of data, basin-wide water management, and public participation of water management at all levels. These goals have implications to whether one chooses to follow a supply–demand perspective or a holistic hydrological cycle perspective.

Discussion

The foregoing provides a basis for initiating discussion on the nature of science engagement with regard to water. Essentially, we as laymen and experts in narrow areas, would like to have a credible body of information about India's water situation of availability and use so that we can make informed decisions about the country's water future. It is in providing this general body of information in a fashion that the common citizen can comprehend, devoid of jargon and cliche, recalling Mayor Velucci's memorable injunction, 'Refrain from using the alphabet…'[1]. It is in fact a challenge to India's learned academies to guide this engagement in such a way that it is educational and instructive, rather than confrontational and destructive.

To keep the discussion within focus, we may restrict attention to two issues: water availability and basin-wide management.

Water availability

The traditional engineering view of the 2002 National Water Policy is that water is available in plenty, and the challenge is one of distribution. This view is also implicit in the WAR mission of DST. On the contrary, Iyer[9], Narasimhan[10], and Ahluwalia[12] are of the view that water use at current rates is unsustainable due limitations of the hydrological cycle and gross mismanagement. How may one assess the relative scientific merits of these opposing views?

Basinal management and public participation

The Water Mission envisages basinal management and public participation. Both these have science implications.

Basinal management implies that water will be managed over watersheds, not administrative units such as Panchayats or Blocks. In nature, watersheds are interlinked, nested, hierarchical structures. Choice of a viable watershed for management is a site-specific task, governed by local physiography and geology, and may vary from several hundred to several thousand square kilometres, comprising tens or hundreds of smaller water sheds, shared by many Panchayats, Blocks and towns, which would collectively own the water, and make strategic decisions about its sharing.

In order for this to happen, the first task is to identify viable units of watersheds for management, and to equip them with gathering of basic data and permanent monitoring networks, staffed by trained hydrologists and biologists. On an on-going basis, the information provided by the scientific staff will form the basis for water use by the publicly elected officials. An example of this approach can be found in the Silicon Valley of California[13].

Thus, basinal management with public participation will require an unprecedented effort, never perhaps experienced anywhere in the world, of dividing a large, diverse country into watersheds, with adequately trained scientific personnel, aided by well-designed monitoring networks. Conversely, without carefully considered, substantial scientific investment, basinal management and public participation will likely have little chance of success. Has the emerging direction in India's Water Mission paid adequate attention to scientific infrastructure and manpower requirements and training needed for basinal management with public participation?

Concluding remarks

Water is too important for India's future to fall victim to apathy and shying away from social responsibility. At present, the whole world is going through self-education in water. In this atmosphere, India's learned academies have an enormous opportunity to provide leadership in educating the public about the essential elements of the hydrological cycle, water resources, and water use to guide the citizen think independently. After all, success of democracy rests on a well-informed citizen. Will the academies rise up to the challenge?

1. Balaram, P., *Curr. Sci.*, 2011, **100**(6), 799–800.
2. Planning Commission, Report of the Expert Group on 'Ground Water Management and Ownership', Yojana Bhavan, New Delhi, September 2007, p. 70.
3. Narasimhan, T. N., *J. Earth Syst. Sci.*, 2008, **117**, 237–240.
4. Ministry of Water Resources, Report of the National Commission for Integrated Water Resources Development, 1999, vol. 1.
5. Department of Science and Technology, Government of India, Plan Document, April 2009, p. 51.
6. Prime Minister's Council on Climate Change, Report, May 2010, p. 49.
7. Narasimhan, T. N., *The Hindu*, 8 June 2010.
8. Planning Commission, Mid Term Assessment Report of Eleventh Plan, September 2010.
9. Iyer, R. R., *The Hindu*, 29 October 2010.
10. Narasimhan, T. N., *The Hindu*, 4 November 2010.
11. Narasimhan, T. N., *Curr. Sci.*, 2008, **95**, 1525–1526.
12. Ahluwalia, M. S., *The Hindu*, 4 April 2011.
13. Narasimhan, T. N., *Econ. Polit. Wkly*, 2010, **45**, 40–45.

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