

Securing Safe Drinking Water for Future

Challenges and Scientific Imperatives

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India's Jal Jeevan Mission represents a transformative endeavor to provide functional household tap connections to every rural home. While its public health implications are significant, its potential to liberate millions of women and girls from water-collection burdens cannot be overstated. However, as we approach the midpoint of this initiative, fundamental challenges to its sustainability have emerged, including institutional capacity for infrastructure maintenance, water supply reliability, and drinking water safety.

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Nearly two-thirds of Jal Jeevan schemes rely on groundwater sources, many of which face depletion during summer months. This decline stems primarily from anthropogenic pressures, with agricultural irrigation representing the dominant factor. While the Mission functions as a supply-side intervention, its success necessitates complementary demand-side approaches and additional supply augmentation strategies.

Demand reduction requires improved agricultural water efficiency, adoption of less water-intensive crops, or alternative freshwater replacement mechanisms. Supply augmentation demands comprehensive watershed management: rainwater harvesting, aquifer recharge, and revival of traditional water bodies.

Scientific Gap in Aquifer Management

Presently, aquifer recharge efforts are constrained due to insufficient hydrogeological knowledge. The assumption that surface water

conservation automatically recharges shallow aquifers often proves unfounded. Without understanding localized hydrogeology and identifying specific recharge zones, interventions may prove both inefficient and costly.

The potential for shallow aquifer recharge through dug-wells remains less utilized due to contamination concerns. Implementing water quality testing and filtration systems prior to recharge is essential to prevent aquifer contamination — an approach that requires scientific expertise currently lacking at scale.

Water Quality Crisis

Water quality represents perhaps the most significant challenge. The growing trend of households purchasing bottled water or installing purification systems — 15% of urban and 6% of rural households according to the 79th National Sample Survey—reveals declining public confidence in government-supplied water safety.

The World Bank's 2019 report "Quality Unknown: The Invisible Water Crisis" highlights global challenges from nitrogen compounds, salinity, and biological oxygen demand, demonstrating substantial health impacts and economic losses. As societies grow, the range of contaminants expands beyond fecal matter to include nutrients, plastics among others.

India's water quality testing infrastructure remains inadequate, with limited data availability

and poor inter-agency coordination. Rural areas face particular challenges from microbiological contaminants, fluoride, arsenic, iron, salinity, and nitrates — requiring both scientific solutions and community engagement.

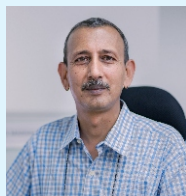
Bridging Science and Society

To address the aforesaid challenges, we must mobilize citizens, strengthen local institutions, and generate demand for improved services. The scientific community can contribute through:

1. Demystifying the “invisible” nature of groundwater depletion and water contamination through effective science communication.
2. Developing a cadre of “barefoot hydrogeologists” who can identify recharge zones and guide local planning.
3. Improving field testing methodologies, particularly for microbiological contamination.
4. Evaluating purification technologies based on scientific efficacy, capital requirements, and maintenance feasibility.
5. Creating scientific advisory mechanisms to support governments and community organizations.

The sustainability of rural water supply ultimately depends on bridging the gap between scientific expertise and community action. Without this holistic integration, the goal of safe, reliable household water connections for all rural households remains an unfinished task.

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Mr. V.K. Madhavan has spent over three decades working in the voluntary sector. Fifteen of these have been spent living and working in rural India on an integrated development approach. First, in desert districts of North-Western Rajasthan with the Urmul Rural Health Research and Development Trust till 1998, and then in the Kumaun region of Uttarakhand with the Central Himalayan Rural Action Group (CHIRAG) (2004 – 2012). In the interim, Madhavan worked on policy related issues with ActionAid, as an independent consultant and then on women's leadership and governance with the Hunger Project. For a three-year stint between 2013 and 2016, Madhavan headed a skill development company that sought to provide unemployed young people with access to jobs in the organized sector. Since May 2016, Madhavan has been the Chief Executive of WaterAid India. Madhavan has a Master's in Politics (International Studies) from the Jawaharlal Nehru University.

