The Economics of India's Clean Water Transition and Its Social Dividend

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Abstract

By the 2020s, the Indian water economy was paradoxical, while 76th round estimated that 94.5% of rural households and 97.4% of urban households accessed improved water, less than a quarter of Indian households had piped water connection within the household, and less than half the rural households had sole access to their primary water source. The article argues that the water economy of India is no longer constrained by access to infrastructure, but rather by the quality, reliability and service provided at the point of delivery. Based exclusively on secondary data available until December 2020 (NSS 76th round, CGWB dynamic assessment 2020, CPCB national inventory of sewage treatment plants, Niti Aayog Composite Water Management Index and World Bank, 2016, Excreta and Economic Growth study), the article sets up an accounting framework linking water quality with health expenditure, economic productivity and human capital investment. It finds that the marginal social benefit of spending one additional rupee on wastewater treatment and service level guarantees is greater than the benefit of spending it on additional connections; and that the disproportionate impact of water quality is borne by rural women, the lower consumption quintiles and geogenic hotspots.

Keywords: drinking water; water quality; Jal Jeevan Mission; wastewater economics; groundwater depletion; health and productivity channel; India.

1. Introduction

Historically, India's water policy was judged by the fraction of the population served by an upgraded water delivery system. The country is nearly done with the job. Measured by any standard of the quality, quantity and cost of tap water to the household, this book must be seen as just the beginning. In its Composite Water Management Index 2018, NITI Aayog finds India at 120th out of 122 countries in the domain of quality of drinking water. About 70% of India's water is contaminated. Over 600 million Indians are under high to extreme water stress and nearly two lakh die each year without safe drinking water. The projection that demand for water would exceed supply by a factor of 2 by 2030 and that the impact on GDP would be around 6 percent is now a benchmark for national water reform.The question this paper tries to answer is the following. Using publicly available water, sanitation and finance data until December 2020, how should the additional public financing provided to the Indian water sector be spread between expanding piped water coverage, treating the waste generated by the connections, and providing service level improvements? The investigation is meaningful given the Jal Jeevan Mission was launched at a cost of Rs 3.60 lakh crore in August 2019 with the union government transferring 2.08 lakh crore. The scheme is the largest one-time investment by a single program in rural drinking water in India. The merit of the mission, however, is in its design, where it counts families served and functional water connections rather than houses and plans, and is the first national rural water program where its performance can potentially be measured on service delivery.

2. Data and Method

The research involves an examination of secondary data. A primary assessment was not performed. Five authoritative sources underpin the empirical segment, all released or with reference periods ending on or prior to December 2020. The first source is the NSS 76th round on Drinking Water, Sanitation, Hygiene, and Housing Condition, with fieldwork conducted from July to December 2018 and the report published in November 2019, encompassing 106,838 households; the second source is the Central Ground Water Board's National Compilation on Dynamic Ground Water Resources of India, 2020; the third source is the Central Pollution Control Board's National Inventory of Sewage Treatment Plants, with state-specific data reported as of June 30, 2020; the fourth source is NITI Aayog's Composite Water Management Index from 2018 and its subsequent edition from 2019; and the fifth source consists of program and budget information for the Jal Jeevan Mission for the fiscal years 2019/20 and 2020/21. Two studies included in peer-reviewed publications, Greenstone and Hanna (2014) and Brainerd and Menon (2014), provide the causal evidence that descriptive administrative data fails to deliver. The approach constitutes an accounting framework instead of a structural model. Physical metrics, including billion cubic meters of extraction, million litres per day of untreated sewage, and household percentages categorised by source and access, are correlated with three economic pathways: the health expenditure pathway, the labour time pathway, and the human capital pathway. Due to the foundational values being anchored in estimates from 2006, all financial figures should be interpreted as orders of magnitude rather than precise estimates.

Table 1. Key indicators of India's water economy, latest data available up to December 2020

Indicator	Value	Source (reference year)
Households with drinking water within the dwelling (rural)	About 28 per cent	NSS 76th Round (July to December 2018)
Principal source is piped water into dwelling (all India)	21.4 per cent	NSS 76th Round (July to December 2018)
Rural households with a tap connection at JJM launch	3.23 crore (16.7 per cent)	Ministry of Jal Shakti (August 2019)
Annual groundwater extraction against extractable resource	244.92 of 397.62 BCM (61.6 per cent)	CGWB Dynamic Ground Water Resources (2020)
Assessment units in the overexploited category	16 per cent of 6,965 units	CGWB Dynamic Ground Water Resources (2020)
Urban sewage generated against sewage actually treated	72,368 against 20,235 MLD (28 per cent)	CPCB Inventory of STPs (as on 30.06.2020)
Habitations affected by arsenic or fluoride	22,016 (1.79 crore persons)	Ministry of Jal Shakti (2019 baseline)
Annual economic loss from inadequate sanitation	Rs. 2.4 trillion (6.4 per cent of GDP)	WSP and World Bank (2010, base year 2006)

Note: BCM denotes billion cubic metres and MLD denotes million litres per day. Figures compiled by the author from the sources listed in the third column. Full citations appear in the reference list.

3. The Resource Base: A Groundwater Economy Under Stress

Thus, this study is based on secondary data: there was no assessment of the material carried out. Five sources of secondary data were used in the empirical part of the thesis: the data for all five sources were published or reporting ended by December 2020. The first source was the NSS 76th round on Drinking Water, Sanitation, Hygiene and Housing Condition. Its survey round was conducted from July to December 2018, and the subsequent report was released in November 2019. The first source is the survey covering 106,838 households. The second source is the report published by Central Ground Water Board as National Compilation on Dynamic Ground Water Resources of India, 2020. The third publication was from CPCB published report National Inventory of Sewage Treatment Plants (as on 30 June 2020) with state level data. The fourth publication was the Composite Water Management Index report published in 2018 by NITI Aayog and its 2019 edition. The fifth data source was the program and other budgetary data on the Jal Jeevan Mission for 2019/20 and 2020/21. Of the two peer-reviewed journal articles, Greenstone and Hanna (2014) and Brainerd and Menon (2014), the former makes the causal inference that descriptive administrative data cannot.

The approach is an accountancy framework and involves three economic pathways, the health expenditure pathway, the labour time pathway and the human capital pathway, as well as a number of physical metrics, such as billion cubic meters of extraction, million liters per day of untreated sewage, and household percentages by source and access. All monetary figures are orders of magnitude approximations given that all the underlying values were based on estimates for 2006.

4. The Quality Gap: A Closed Loop of Contamination

The most economically significant statistic in the Indian water sector as of December 2020 is not a coverage metric. The CPCB inventory indicates that urban sewage production amounts to 72,368 MLD, with an installed treatment capacity of 31,841 MLD, representing 43.9 percent; of this, 26,869 MLD was functional, and just 20,235 MLD, around 28 percent of the produced sewage, was effectively treated. Approximately 52,133 MLD of effluent is predominantly released untreated into waterways, including rivers, lakes, and aquifers. Numerous states with significant sewage burdens indicated a complete lack of operational treatment capability.

This constitutes a closed circuit. The identical surface and groundwater bodies that accept untreated sewage are the sources from which city and rural systems extract potable water. Each dollar of unprocessed effluent thus escalates the future treatment expenses for every rupee of potable water provided downstream. Investment in domestic connections without corresponding investment in wastewater treatment partially negates itself in financial terms, since it amplifies the volume supplied while diminishing the quality of the source from which the supply originates. Geogenic pollution must be included in this anthropogenic burden. At the inception of the Jal Jeevan Mission, 22,016 settlements were recognised as impacted by arsenic, totalling 14,020, or by fluoride, totalling 7,996, with an at-risk population of around 1.79 crore.

5. The Economic Accounting: Three Channels

The avenue of health spending is the largest and the best quantified. The World Bank's Water and Sanitation Program has estimated the cost of lack of sanitation at Rs. In India, the cost of access to sanitation was 2.4 trillion in 2006. That is 6.4 percent of India's GDP. Of these costs, premature death and other health costs accounted for 71.6 percent (or USD 38.5 billion), lost production due to lack of sanitation access accounted for 20 percent (USD 10.7 billion) and that due to drinking water for 7.8 percent (USD 4.2 billion). Most of the loss of life and associated morbidity (over three-quarters of the mortality loss) was in the under-5 age group. Across the urban area, this distributional result roughly mirrors the absolute effects of the flood, with the bottom quintile having losses per capita comparable to 75% more than the overall average.

Women are also mainly used as conduits for work time. As per the NSS 76th round, less than 28 percent of rural households had the main source of drinking water within the household, and 42.9 percent of households had the main source of drinking water as a hand pump. Thus, water collection forms unpaid time burdens, mostly on women. The time of these women could otherwise be spent on wage labour, childcare, household duties, or at school. Alternatively, that time could otherwise be devoted to other rural household activities such as farming; or it could add to the effective supply of labour available to rural households.

For India, the human capital channel is the only one with direct evidence. Brainerd and Menon (2014) provide evidence that exposure to fertilizer agrichemicals in drinking water in the first trimester of pregnancy harms infant health (IMR, NMR and height-for-age). They merge data on mother's exposure and the health of their children with data on pollution levels of the CPCB monitoring network. They have compiled three waves of the Demographic and Health Surveys data on poor, less-educated rural women. Water quality thus factors into growth accounting not so much as a consumption of health spending, but rather as a contributor to the human capital reservoir a generation possesses at maturity.

A fourth study, however, complicates the first three. Greenstone and Hanna (2014) analyze the effects of India's environmental regulations. They find that the air pollution regulations led to large reductions in pollution and small reduction in infant mortality. In contrast, the water pollution regulations had no impact on water quality or infant mortality. In short, the tough lesson for the water sector is that capital investment, and regulation, will do no more to ensure the health impact without the complement of supervision, enforcement and accountable local authorities.

6. The Social Dimension: Who Bears the Residual?

Aggregate coverage numbers will obviously not depend on who remains in the residual after filtration. In the NSS 76th round, only 48.6 percent of rural families and 57.5 percent of urban families were the only ones to access their primary source of drinking water. The balance was distributed, arranged, or discussed for it. Shared access is not only a nuisance. This makes it a social exchange in which caste, tenure and gender roles in Indian villages determine that the effective cost per liter of safe drinking water (monetary cost (in time spent collecting, defensive expenditures on filters or packaged drinking water, and health)) is greatest for the landless, tenants, socially excluded (Dalits and Adivasis), and/or those in areas where arsenic or fluoride levels are high.

When the water source is outside the house, fetching the water is the responsibility of women in the household, which increases the costs to the household. Because fetching water is unpaid work, national accounts do not include it. In terms of these three goals, it has the advantage of moving the source of water supply from the village standpost to the resident household; thereby reducing the incidence of illness, freeing up women's time, and removing one daily occasion for public display of caste hierarchy at the public water standpost. The third is the hardest to quantify and arguably the most meaningful.

7. Policy Implications

Firstly, we want to take the focus off the number of connections, and onto a measure of service. The supply of 55 liters per person per day, for a given period of time, as prescribed in the BIS 10500, is a valuable resource. A link that provides none of these is a financial burden with a touch on it. Tranche disbursement should be based on independent audits of functionality, made public, not based on coverage provided by the implementing agency.

Second, drinking water investment should be naturally linked to capital investment in sewage treatment in the same river basin or metropolitan area. The CPCB's own data shows that 72% of urban sewage is treated in no way, shape, or form. No drinking water program can be sustainable in the face of such statistics.

Third, there must also be explicit funding provided for operation and maintenance, as demonstrated by the 2020/21 devolution framework. Beside the allocation of Rs. 23,500 crore in the budget for Jal Jeevan Mission, 50 percent of the allocation made by the Fifteenth Finance Commission (approximately Rs. This meant 30,375 crore was going to be used for water supply and sanitation, and should have been financed through conditional grants, which could deal with recurrent costs, provided local water and sanitation committees were able to set tariffs, and received technical assistance to implement the results.

Fourth, if the exploited source is to be sustainable, some demand management is needed (for groundwater, usually agricultural demand, since most groundwater is used for agriculture). Fifth, addressing Greenstone and Hanna's concern with regulatory capacity is more than a matter of administration; it is what makes the investment translate into health. The least expensive components of the program are water quality testing labs, publicly available compliance statistics, and community screenings, which are the benefits' foundation.

8. Conclusion

As of December 2020, the water crisis in India is caused more by quality, reliability and institutional capacity than by physical water scarcity or access. The burden of its costs is disproportionately borne by rural women, the poor and communities living over polluted aquifers. The World Bank estimates that inadequate sanitation costs the country about 6.4 percent of India's GDP. The NITI Aayog estimates that water scarcity could cost the Indian economy 6 per cent of its GDP by 2030. Correlatively, such a shift to clean water is not merely a welfare cost, competing with anything else, but also an economic growth

ISSN PRINT 2319 1775 Online 2320 7876
, Journal UGC CARE Listed (Group-I) Volume 10,Sp Issue 01, 2021

investment. The objective for the next decade is to transform a once in a lifetime capital program into a certainty of service through the responsible management of outcomes and inputs.

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