

Provision for Household Water Supply in India

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ABSTRACT

Sustainable development goal six (especially target 6.1) describes about safe and affordable drinking water for all. In line with goals, the government of India was also keep on advancing its reforms and at the earliest comes with adopting service delivery approach and community management to achieve the target water for all. The objective of this study is to understand the status of drinking water supply in urban and rural India. It is found that a significant issue with India's urban and rural water supply is the inadequate cost recovery and coverage; apart from these issue unreliable water supply and high non-revenue water are the other issues. As per the NSSO's household access to improved water source shows a improved picture both in urban and rural area. Still access to safe water within their premises is a serious problem in rural areas as compared to urban areas.

Key Words: Drinking water supply, Coverage, Sustainability, Household access, Cost recovery

1. Introduction

The Bhor committee of 1946 and Environment Hygiene Committee in 1949 has put light on the poor drinking water both in quantity and quality of rural and Urban India and recommend the provision of safe drinking water for the health need of the country (Government of India, 1950; Duggal, 1991). The constitution of India in 1950 specifies water as a state subject.

According to the National Portal of India (2021), the 73rd Amendment Act to the Indian Constitution placed the duty of providing potable water to the Panchayat Raj institution in 1992, and the 74th Amendment Act gave that duty to the Urban Local Bodies (ULBs). Especially since the 73rd Amendment to the Constitution, decentralisation of essential service delivery to rural families has been a hot topic. Local governments, known as Panchayats or Panchayati Raj Institutions (PRIS), have been given more authority and responsibility to carry out programmes to improve infrastructure such water and sewage systems, sanitation, and lighting (De, 2009).

Sustainable development goal six (especially target 6.1) describes about safe and affordable drinking water for all. The recognition of water as an economic and social good in the Dublin conference 1992 and the human right to water in 2010 gives an argument for equitable distribution of water (Dublin, 1992; Hall, Koppen & Houweling, E, 2014).

Broadly, government, private, community, NGO and a mixed type are the different institutional arrangement

available for providing water services to household. Household, itself, work as an institution for providing water service to its member by creating sources within its premises. Most of the country has adopted community-based management as an institutional arrangement to provide water supply to the rural household. But in case of urban area the arrangement quite differs on the basis of region. There can be multiple arrangements found within a country, but a particular arrangement is meant for a specific region, because the provision of water supply is capital intensive in nature. It is cost effective to place one type of arrangement to serve the household within a specific region.

The institutional structure of water distribution differs from state to state and even within a single state. There are a variety of organisations around the country that work to ensure that everyone has access to clean water, but the majority of them are "state departments, state level boards and corporations, statutory and non-statutory authorities at the city level, and urban local bodies" (Tiwari & Gulati, 2011). Water distribution is a local government responsibility that varies from state to state.

In 1987, the Government of India's Ministry of Water Resource created a national water strategy with the goal of protecting India's water supply and getting the most out of it. Priorities shifted, therefore the policy was updated in 2002 and again in 2012. In every iteration of the NWP, the drinking water requirements of humans and other animals have been prioritised above all others. Both NWP1987 and NWP2002 stress the importance of recovering O&M costs and a portion of capital costs through user charges

to ensure the long-term financial and physical viability of the service. To improve the utilities' financial stability, the Indian government mandated a change from partial cost recovery to full cost recovery in its Water Policy 2012 (GOI, 1987; 2002; 2012).

1.1 Characterisation of water supply industries

Water supply industries are characterized by natural monopoly. Existence of economies of scale, potable water service as merit good and with information issues i.e., "many people are unaware of the need for consuming safe water supply and a source of X-inefficiency are the other characteristic of found with water supply industries (Dalhuisen, Groot, Rodenburg, & Nijkamp, 2002; Santhakumar, 2010; Gracia & Thomas 2001).

Individual and community contributions, government spending, ODA, loans, grants, international private sector investments, domestic small-scale provider investments, and international private sector investments are just some of the sources of money that go into the water industry. Annamraju, Calaguas, and Gutierrez (2001) found that in most countries, the central government provides the bulk of funding (i.e. 70-75%) for water infrastructure.

"There is no universal model which can be applied in all situations. It varies from region to region and according to cultural practices. Hence our task is to design such institutions through social experiments. This is the challenge facing the sector" (Pushpangadan, & Murugan, 1997).

Every institutional arrangement has its own merit and demerits. The success or failure lies with the circumstances in which they are operating (Jeffery, 1994). Public owned utilities suffer with x-inefficiency, high financial cost and revenue generation. Although introduction of privatization in water supply has benefited in terms of improving the health benefit to its consumer but has created inequality for its high price. The next alternative mechanism i.e. community water supply has evidence of creating health benefit to its consumer. It has also evidence of rising socio-economic inequality, because of the monetary contribution in access to the resource. There is evidence which has success story as well as failure to supply water and maintain the financial sustainability.

Despite of the development different institutional framework to achieve the target safe water for all, it is estimated that globally by 2017, "785 million people still lack a basic water service among them 144 million people are still collecting drinking water directly from rivers, lakes and other surface water sources. The poor and the rural household are least likely to use basic water service. 5.3 billion people used safely managed services, i.e.

accessible on premises, available when needed and from contamination. 1.4 billion used a basic water services i.e. improved sources within 30 minutes per round trip to collect water. Over a quarter of a billion (206 million) used 'limited service where water collection from an improved source exceeded 30 minutes. In most countries the burden of water collection continues to fall mainly to women and girls. Seven out of 10 people used a safely managed drinking water service" (UNICEF & WHO, 2019).

This study tries to understand the status of drinking water supply in urban and rural India.

2. Urban water supply in India

According to the findings of Anand (2010), Raj (2013), Sastry (2006), Tiwari & Gulati (2011), and Water Aid India (2005), as well as the findings of a number of other studies, the urban water supply in India has a number of problems that need to be remedied. Inadequate resource allocation, ineffective operations and maintenance practises, tariff systems that are economically prohibitive, and inefficient collection are only a few of the difficulties that lead to inadequate water quality and quantity. Inadequate resource allocation, inefficient operations and maintenance practises, and inefficient collection are all problems. An examination into the urban water situation in India was carried out by a variety of international and bilateral financial institutions (IFIs). They came to the conclusion that the state-dominated paradigm, in addition to a failure to recover capital and management costs, is to blame for the poor water supply in India's urban areas. The International Financial Institutions (IFIs) conducted research and made recommendations based on their findings about institutional, governance, economic, and financial changes. On the other hand, the research came to the conclusion that the attempts that the government of India undertook to restructure the economy and the institutions that control it had been fruitless. This was the result that was reached by the study. Protests against the Municipal Corporations of significant cities were organised in Latur and Mysore as a response to the modifications in prices that were made by the ULBs. These cities can be found in the country of India. In addition to the one in Tripura, public-private partnership (PPP) efforts that were carried out in Chandanpur, Nagpur, and Latur were also unsuccessful. The failure of economic and institutional reform in ULBs may be traced back to the fact that investment in infrastructure was given higher priority than the provision of services by the respective local governments. This is the key reason why the attempt was unsuccessful. The reforms that were made by the Chennai Metropolitan Water Supply and Sewerage Board were successful in providing customers with the promised

services and in allowing investors to recoup their initial investments. This is in contrast to the reforms that were implemented by the Tamil Nadu Urban Development Fund, the Greater Bengaluru Water Supply and Sewerage Board, and the Chennai Metro Water Supply and Sewerage Board. In 2009, the Ministry of Urban Construction (MoUD) of the Indian government shifted its focus on urban water supply from the construction of

infrastructure to the provision of services. This shift was made in response to an ongoing crisis. This change was made with reference to the provision of water in metropolitan areas. The government has developed service-level targets in an effort to improve the overall quality of the services supplied to individual families (GOI, 2009). This will help improve the overall quality of the services offered. The SLB measurements are presented for your consideration in Table 1.

Table 1: Service Label Benchmarking Indicators

S. No	Indicators	National Benchmark
1	Coverage of water supply connection	100%
2	Per capita supply of water	135 litter per capita per day (LPCD)
3	Extent of metering of water connections	100%
4	Extent of non-revenue water	20%
5	Continuity of supply	24 hours
6	Efficiency in redressal of customer complaints	80%
7	Quality of water	100%
8	Cost recovery in water supply services	100%
9	Efficiency in collection of water-related Charges	90%

Source: Ministry of Housing & Urban development Department, government of India, 2009

Accelerated Water Delivery Programme (AUWSP), Jawaharlal Nehru National Urban Renewal Mission (JNNURM) in 2005, and the Urban Infrastructure Development Scheme (UIDSSMT), to name a few of the state-level programmes that have prioritised the distribution of water in urban areas as their primary objective, are just a few examples of the state-level initiatives that have been put into place. These are just some of the examples of the state-level initiatives that have been put into place. The fundamental reason that contributes to poor service delivery is a lack of available capital money, which in turn results in insufficient management and care of physical infrastructure. This cycle continues until the problem is resolved. According to Bakshi (2017), in order for a system to be self-sustaining, bulk metres need to be installed, water audits has to be undertaken in high NRW ULBs, and the system needs to be run and maintained on a consistent basis. Additionally, Bakshi (2017) states that a system must have regular operations and maintenance performed on it. Support from the PPP model of the Nagpur Orange City water supply project and the scientific methodology of leakage mapping by the Surat Municipal Corporation have allowed the ULBs to decrease their NRW and improve service performance. Public-private partnerships (PPPs) enhance governance since regulation and monitoring are separated from service provision. When there is maximum

culpability, full accountability, and complete planning, more water is available, losses are decreased, and consumers are delighted. "Service delivery issues are being addressed by enhancing infrastructure and expanding elevated service reservoir capacity," says NMC. "Water revenue is increased, and commercial losses are decreased as a result of replacing connections and identifying unauthorised connections." The citizens of Nagpur may now enjoy a greater standard of living because to the city's improved access to water. The ULB appreciates OCWPL's 24-hour call centre and zone-level kiosks for managing bill payments and customer service inquiries. To determine the degree of non-revenue water and to maintain NRW at no more than 20% of total water use, the Surat Municipal Corporation set up an NRW cell. The NRW cell has prioritised leakage mapping, which involves gathering recent citizen complaints and evaluating the situation on the ground. Leakage mapping and corrective action, such as repairing the necessary piping and faulty valves, reduced the number of leaks per km of pipeline, decreased customer complaints, and conserved water (Niti Aayog, 2017).

2.1 Urban household access to water

According to Pushpangadan (2003), the qualities of a reliable water delivery system are proximity, adequacy, sufficient, and water quality.

According to the census report from 1991, 81% of homes had access to improved drinking water; by 2001, that number had risen to 97.8%, but by 2011, it had fallen back down to 89%. The drop can be attributed to the distinction between piped-in treated water and untreated, unprotected water. The percentage of homes with access to running water has increased from 68.7% in 2001 to 70.6% in 2011. Seventy-one percent of these homes have

access to running water within their own residence, while twenty-seven percent have such access within walking distance. Slum residents can reach the community's piped water supply via a stand post (Water Aid, 2018). In metropolitan areas of India, piped water is the primary supply of potable water. Table 2 provides information from the 76th Round NSSO survey on the availability of potable water in metropolitan areas (GOI, 2019).

Table 2: Urban Household access to drinking water

S.No	Urban household access to drinking water	Percentage
1	Piped water into dwelling as principal source of drinking water	40.9
2	Exclusive access to principal source of drinking water	57.5
3	Sufficient water source from principal water source throughout the year	90.9
4	Drinking water facilities within the household premises	80.7
5	Improved source of drinking water	97.4
6	Use of Improved source of drinking water located at the household and available through out the year	72

Source: NSS 76th Round, NSS Report No. 584(76/1.2/1) available at http://www.mospi.gov.in/sites/default/files/publication_reports/Report_584_final_0.pdf

Table-3 presents data on the availability of drinking water sources to urban households from the National Family Health Survey and the National Survey of Science and Obesity, 1998-2018. In metropolitan areas of India,

piped water has always been the primary supply for human consumption. There was a steady transition from piped water to bottled water as the primary source of drinking water in homes.

Table 3: Urban household use of drinking water source(In percentage)

	1998-99	2002	2005-06	2008-09	2012	2015-16	2018
Major Source of Drinking Water	NFHS2	NSS58 th	NFHS3	NSS65 th	NSS 69 th	NFHS 4	NSS 76 th
Bottled Water			0.9	2.7	5.2	5.1	12.2
Piped Water/Tap/Public Tap/ Standpipe	74.5	73.6	71.0	74.3	69.1	69.0	65.0
Tube Well/ Hand Pump	18.1	19.6	21.3	17.5	19.9	17.4	17.1
Well	6.0	5.1					
Protected			1.8	2.1	1.1	3.7	1.7
Unprotected			2.9	1.2	2.2	1.0	2.4
Rainwater (Harvested or Improved)			0.0	0.0	0.0	0.1	0.0
Surface Water (River/Canal/Lake/Tank/Pond)	0.4	0.3	0.8	0.3	0.1	0.4	0.2
Spring		0.1	0.2	0.1	0.0	0.3	0.1
Other Source	1.0	1.3	1.1	1.9	2.4	3.0	1.3

Source: NSO, Envistats-India 2020: Vol.I, Government of India New Delhi, 2020
<http://mospi.gov.in/download-reports>

NFHS: National Family Health Survey, NSS: National Sample Survey, NSO: National Statistics Office

However, there are still regional and municipal disparities in India, despite the fact that 93% of the population has access to water. Because of a lack of available supplies, more and more city residents are relying on ground water that has been privately taken, which is depleting aquifers. People living in poverty in urban areas continue to be the most heavily impacted by a lack of water access (Niti Aayog, 2019). The demand for piped water supply in urban households is expected to rise in tandem with the rapidity with which cities are expanding. Water aid (2018) warns that urbanisation, city planning that ignores water resources and the water rights of inhabitants, and a lack of

1991 the NRDWM was renamed as Rajib Gandhi National Drinking Water Mission (RGNDWM). In 1999-2000 the reform in the sector initiated to involve community participation in the rural water supply. The Scheme Swajaladhara was started in the year 2002 with the aim to provide water supply to rural habitation in a sustainable manner through community participation. The scheme revised as per the government guideline and renamed as National Rural Drinking Water Programme (NRDWP). The programme shifted the coverage criteria from habitation to household and emphasises on water quality, sustainability and O&M of the scheme as support

Table 4: Rural Household access to drinking water

S.No	Rural household access to drinking water	Percentage
1	Hand pump into dwelling as principal source of drinking water	42.9
2	Exclusive access to principal source of drinking water	48.6
3	Sufficient water source from principal water source throughout the year	87.6
4	Drinking water facilities within the household premises	58.2
5	Improved source of drinking water	94.5
6	Use of Improved source of drinking water located at the household and available trough out the year	51.4

Source: NSS 76th Round, NSS Report No. 584(76/1.2/1) available at
http://www.mospi.gov.in/sites/default/files/publication_reports/Report_584_final_0.pdf

regulation all pose a threat to water supplies in the same metropolitan region.

3. Rural water supply in India

Ministry of Jal Shakti (previously known as Ministry of Drinking water & Sanitation) is the mainly responsible for planning, financing, policy formulation for the rural water supply in India. Provision of universal access to safe and adequate water for drinking cooking and other domestic uses within the premises is the vision to achieve through community participation (Government of India, 2019).

National rural drinking water programme with the technical support from UNICEF in 1969 is the first attempt of the government to provide drinking water service to rural areas through bore well and pipe water supply scheme. Accelerated rural water supply programme (ARWSP) is the major intervention of the government that emphasises upon water quality, accelerate coverage, and adoption of appropriate technology The scheme was renamed as National Rural Drinking Water Mission (NRDWM) in 1986 with the aim to accelerate the coverage of water supply in the rural areas. In the year

activity. This is one of the flagship programmes of Bharat Nirman (Government of India, 2015). One of the objectives of NRDWP is to facilitate rural household access to sufficient and safe water within the household premises by 2030. It was found that 18.33% of the rural household have piped water connection by 31 March 2019.

In order to achieve the NRDWP target by 2024 the NRDWP is restructured and named as Jal Jeevan Mission (JJM). The aim of the scheme is to provide functional tap connection to every rural household with reliable, adequate and potable water supply (through technological intervention) and improve service delivery approach of water supply. In order to encourage sense of ownership among community and long-term sustainability of the scheme, the mission has emphasised the implementation of the scheme by GP or VWSC or Pani Samiti with a 10 percent capital cost contribution either in form of cash or kind. NGO, Voluntary organisations, women SHG under NRLM or SRLM will act as partner to facilitate and implement the scheme in mobilisation of rural community and protecting the rural water resource (JJM, No date).

3.1 Rural household access to drinking water

According to the National Sample Survey's 76th round estimates (July 2018-December 2018), the vast majority of rural households rely on a hand pump for their drinking water needs. Next to hand pump pipe water is the second major principal source. 11.3 percent of the household have access to pipe water into the dwelling 10.3 percent use pipe water into yard, one percent use pipe water from neighbour and 10.3 percent use public stand post as their principal source of water (GOI, 2019). The table 5 represents the rural household access to drinking water.

From the data in the table, we can conclude that 87.6% of homes have year-round water availability and that 94.56% use an improved water source for consumption. These results indicate that the vast majority of homes have ready access to a safe and reliable supply of drinking water. However, there is still an absence of year-round access to safe drinking water, of drinking water facilities in private homes, and of sole ownership of the main source of drinking water. Table 5 displays the results of the NFHS and NSS surveys for the drinking water sources of rural households during 1998-2018. Insight into the year-to-year availability of clean water for rural dwellings will be provided.

Table 5: Rural household use of drinking water source(In percentage)

Year	1998-99	2002	2005-06	2008-09	2012	2015-16	2018
Major Source of Drinking Water	NFHS 2	NSS 58 TH	NFHS 3	NSS 65TH	NSS 69 TH	NFHS 4	NSS76 th
Bottled Water			0.1	0.5	1.6	2.1	4.0
Piped Water/Tap/Public Tap/Standpipe	25.0	27.5	27.9	30.1	31.2	33.7	32.9
Tube Well/ Hand Pump	47.3	51.3	53.2	54.7	52.4	50.9	53.8
Well	23.5	17.9	2.8	5.5	2.7	3.6	2.9
Protected			12.4	6.3	9.0	6.0	4.4
Unprotected			0.2	0.1	0.2	0.2	0.2
Rainwater (Harvested or Improved)			0.2	0.1	0.2	0.2	0.2
Surface Water (River/Canal/Lake/Tank/Pond)	3.5	2.3	2.1	1.8	1.1	0.8	0.9
Spring		0.8	1.1	0.7	0.7	1.0	0.6
Other Source	0.7	0.3	0.1	0.3	1.1	2.7	0.3

Source: NSO, Envistats-India 2020: Vol.I, Government of India New Delhi, 2020

<http://mospi.gov.in/download-reports>

NFHS: National Family Health Survey

NSS: National Sample Survey

NSO: National Statistics Office

From the table 5, it is evident that there is a decline in percentage of household use of well (both protected and un protected), surface water, and spring as major source of water for drinking and rise in household use percentage in tube well or hand pump, pipe water supply, and bottle water. There are households using harvested rain water for drinking and the percentages remain same for all survey. Tube well/ hand pump is the first major source of drinking water in all the survey round.

A sustainable rural water supply includes sustainability in a. finance, b. sources, c. technology, d. quality, e. institution and f. human behaviour under the scheme (Eliamringi & Kazumba, 2017). Each scheme is an improvement over the previous one to achieve the target of safe and adequate water to the household in a sustainable manner. Although there is little achievement in terms of coverage and adequacy the failure lies with implementing sustainable water supply. Here we mean financial sustainability, i.e. retain O&M cost through user charges. NRDWP emphasises upon the community management of rural water supply. Why there is a failure in community management. Why users are not paying the

tariff are the questions? Therefore, it is essential to find out reason for failure of institutionalisation of community in provision of water supply to household.

India is diverse in religion and culture; therefore, the community and their behaviour in managing resource do differ. Therefore, the case of each supply scheme is an addition to the knowledge.

4. Conclusion

Water distribution is a state subject and the solution to its problem must adhere locally. From the discussion it is clear that a significant issue with India's urban and rural water supply is the inadequate cost recovery and coverage. Although there is different initiative taken by the government through various plan and programme to make water for all. But the consequence of all these economic and institutional reform comes out as protest, as because these reforms are not as par with the consumers interest. Researchers have shown that low tariff is one cause of inadequate cost recoupment. Similarly, raising prices without making any changes to how services are delivered does not ensure that those prices are being recouped. Finally, the service led approach and community management was adopted to enhance the performance of water distribution network.

As per the NSSO's still there are households do not have access to safe water and do not have access within their premises. The figure relates to it, is quite better for urban household as compared to rural household.

References

- Anand, M. (2010). Budgetary Implications of Costs of and Recovery from Select Public Services in Rajasthan, *Economic & Political Weekly*, 45(33), 68-77.
- Annamraju, S., Calaguas, B., & Gutierrez, E. (2001). *Financing Water and Sanitation Key Issues in Increasing Resources to The Sector*. London: WaterAid. <http://www.oecd.org/unitedkingdom/2552051.pdf>
- Bakshi, V. (2017). Examining Non-Revenue Water: A Case Study of Ahmedabad. *International Journal of Research in Engineering and Technology*. 6(7), 14-20.
- Dalhuisen, M.J., Groot, D.L.H., Rodenburg, A.C., & Nijkamp, P. (2002). The Economics of Urban Drinking Water Use, *Built Environment* 28(2), 111-123.
- De, I. (2009). Can decentralization improve rural water supply services? *Economic and political weekly*, 44(1), 68-71.
- Dublin. (1992). *The Dublin Statement on Water and Sustainable Development*. Available at <http://www.wmo.int/pages/prog/hwrrp/documents/english/icwedece.html>
- Duggal, R. (1991). Bhore Committee (1946) and its Relevance Today, *Indian Journal of Preiatr*, 58, 395-406.
- Eliamringi, L., & Kazumba, S. (2017). Assessment of sustainability of rural water supply services in Tanzania: the case study of Dodoma region. *Water Science and Technology: Water Supply*, 17(2), 372-380.
- Garcia, S., & Thomas, A. (2001). The Structure of Municipal Water Supply Costs: Application to a Panel of French Local Communities. *Journal of Productivity Analysis*, 16(1), 5-29.
- Government of India (1950). *Report of the Environmental Hygiene Committee, October 1949*, Ministry of Health, New Delhi, Manager, Government of India Press, Simla
- Government of India (GOI), (2019) *Drinking Water, Sanitation, Hygiene and Housing Condition in India, NSS 76th Round*, Government of India, Ministry of Statistics & Programme Implementation, National statistical Office, NSS Report No. 584(76/1.2/1) available at http://www.mospi.gov.in/sites/default/files/publication_reports/Report_584_final_0.pdf
- Government of India (GOI). (2009). *Handbook of Service Level Benchmarking*. New Delhi: Ministry of Urban Development, Government of India.
- Government of India (GOI). (2009). *Handbook of Service Level Benchmarking*. New Delhi: Ministry of Urban Development, Government of India.
- Government of India. (1987). *National Water Policy 1987*. Government of India. [online] Ministry of Water Resources. http://jalshakti-dowr.gov.in/sites/default/files/nwp20025617515534_1.pdf
- Government of India. (2002). *National Water Policy 2002*. Government of India, Ministry of Water Resources. [online] http://jalshakti-dowr.gov.in/sites/default/files/nwp20025617515534_1.pdf
- Government of India. (2012). *National Water Policy 2012*. Government of India. Ministry of Water Resources. [online] http://mowr.gov.in/sites/default/files/NWP2012Eng6495132651_1.pdf
- Government of India. (2015). *Annual Report 2014-15*, Ministry of Drinking Water and Sanitation, 1-155. www.mdws.gov.in

18. Government of India. (2015). Annual Report 2014-15, Ministry of Drinking Water and Sanitation, 1-155. www.mdws.gov.in
19. Hall, R. P., Van Koppen, B., & Van Houweling, E. (2014). The Human Right to Water: The Importance of Domestic and Productive Water Rights. *Science and Engineering Ethics*, 20(4), 849-868.
20. Jal Jeevan Mission (JJM) (No date) Jal Jeevan Mission available at https://jalshakti-ddws.gov.in/sites/default/files/JJM_note.pdf
21. Jeffery, J. (1994). Privatization in England and Wales. *American Water Work Association*, 86(3), 64-68.
22. National portal of India (2021). The constitution (Seventy-third Amendment) Act, 1992 available at <https://www.india.gov.in/my-government/constitution-india/amendments/constitution-india-seventy-third-amendment-act-1992>
23. Niti Ayog. (2017). Selected Best Practice in Water Management, Supported by Teri university, New Delhi. https://niti.gov.in/writereaddata/files/document_publication/BestPractices-in-Water-Management.pdf
24. Pushpangadan, K., & Murugan, G. (1997). User Financing and Collective Action Relevance for Sustainable Rural Water Supply in India, Working Paper No. 274 Thiruvananthapuram: Center for Development Studies
25. Pushpangadan. (2003) Drinking Water and Well-Being in India: Data Envelopment Analysis. [online] Working Paper No. 352, Thiruvananthapuram: Center for Development Studies, <https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/3058/wp352.pdf?sequence=1&isAllowed=y>
26. Sastry, S. G. (2006). Issues of Unaccounted for Water in the Urban Water Sector. [Online] Working Paper No. 176. Institute for Social and Economic Change. Bangalore, India: 1-29. <http://www.isec.ac.in/WP%20-%20176.pdf>
27. Tiwari, P., & Gulati, M. (2011). Efficiency of Urban Water Supply Utilities in India. *International Journal of Water Resources Development*, 27(2), 361-374.
28. UNICEF & WHO. (2019). Progress on Household Drinking Water, Sanitation and Hygiene 2000-2017. Special Focus on Inequalities. Available at <https://data.unicef.org/topic/water-and-sanitation/drinking-water/>
29. Water Aid India. (2005) Drinking Water and Sanitation Status in India Coverage, Financing and Emerging Concerns. Water Aid India, New Delhi. <https://washmatters.wateraid.org/publications/drinking-water-and-sanitation-status-in-india-coverage-financing-and-emerging-concerns>
30. Water Aid. (2018). State of Urban water supply in India, Water Aid, 1-34 [online] <https://www.wateraidindia.in/sites/g/files/jkxoof336/files/state-of-urban-water-supply.pdf>