POLICY BRIEF

BEYOND 2019: WHY SANITATION POLICY NEEDS TO LOOK PAST TOILETS

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SUMMARY

In the three years since the Swacch Bharat Mission was launched over 30 lakh urban toilets have been built and a further 30 lakh are planned to be built by the program's deadline in 2019. The efforts in toilet construction have not been matched by equivalent efforts to create infrastructure and institutional mechanisms to collect, treat and safely dispose of the waste, creating a new public health crisis. Using data from various sources, the brief lays out the inadequacy of wastewater and fecal sludge management in India and argues for a focus on the entire sanitation value chain. Local and state officials need to consider a diversity of local factors when choosing treatment options rather than solely opt for centralized, uniform solutions like sewerage.

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INTRODUCTION

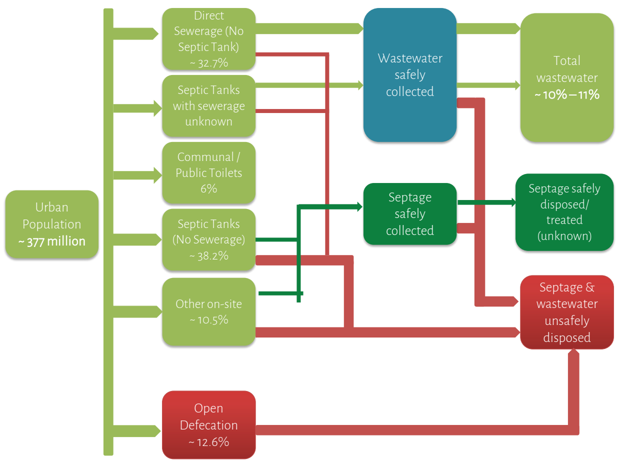
Sanitation policy has been a part of India's development planning since the early 1980s, but the launch of the Swacch Bharat Mission(SBM) in 2014 brought a new urgency to these efforts. The urban scheme has, at last count, subsidized the construction of over 31 lakh Individual Household Latrines and 1 lakh Public Toilets (SBM Urban Dashboard). India is now just under 30 months away from the October 2019 deadline of declaring India Open Defecation Free (ODF) and it is imperative to critically examine the government's efforts vis a vis the creation of a "Swacch Bharat".

Like other developing countries, Indian cities grapple with the challenge of extending basic sanitation services to a rapidly growing population, while concurrently building a sustainable service delivery model. A decade ago, the National Urban Sanitation Policy (2008) laid out the following vision:

"All Indian cities and towns become totally sanitized, healthy and liveable and ensure and sustain good public health and environmental outcomes for all their citizens…"

On the first part of this challenge, current policy seems well designed- the SBM (U) fueled wave of toilet construction aims to build 66.4 lakh urban toilets by 2019. However, similar investments in mechanisms to safely, collect, transport, treat and dispose of the waste produced have "not kept pace" (Dasgupta et al, 2016). In particular, households with septic tanks account for nearly half of all latrine-owning households in India and yet most cities lack effective septage management facilities (Census 2011). As a result, the vast majority of faecal sludge and wastewater is released into the environment untreated, with significant effects for urban public health (see Figure 1).

Figure 1: Wastewater Generation and Treatment in India



Source: Census 2011, CPHEEO 2011 and CPR Analysis

As India's urban population continues to increase-UNDESA projects a doubling of the urban population between 2014 and 2050- the safe treatment and disposal of waste water and faecal sludge will become critical to the success of any sanitation program. The road to a truly Swacch Bharat should address bottlenecks at all points in the sanitation value chain, from capture until disposal (see Figure 2). This is a not inconsiderable task since Indian sanitation policy also serves as an arena for debate on overlapping issues like public health, affordable housing, urban infrastructure and municipal governance. Crafting sustainable waste management solutions will require negotiating these multiple, sometimes competing, priorities.

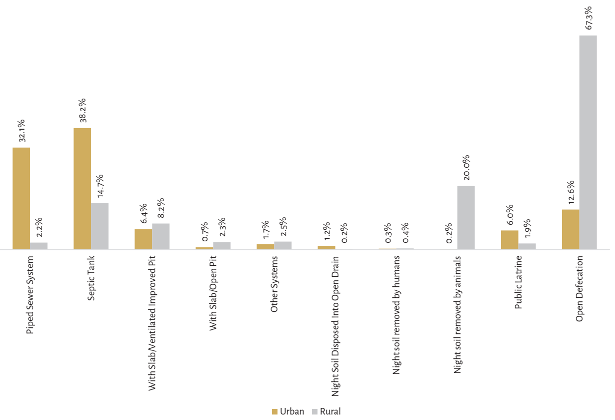
INDIA: IS INSTITUTIONAL OPEN DEFECATION THE NEW NORM?

In the densely populated urban settlements now prevalent in India, inadequate sanitation poses health risks to not just the individual and immediate community, but also the broader city. In 2011, 19% of urban households reported not owning a toilet and having to resort to public facilities (often poorly maintained) or open defecation. Another 4 percent of urban households were classified as using 'unimproved sanitation facilities', referring to toilet and containment systems which take inadequate measures to hygienically separate the waste from the user.

These proportions do not capture the full scale of the crisis. Nearly 40 million urban dwellers make do without a toilet, using roadsides, railway tracks or open fields to defecate. A 2016 WaterAid publication estimates that the number of urban Indians lacking improved sanitation could be as high as 157 million. The waste produced finds its way into open sewers or public areas and waterbodies, making the spread of diseases like diarrhea and cholera or conditions like tropical enteropathy more likely. Studies by Hathi et al. (2014) have shown that open defecation in dense areas is far more dangerous than in relatively open spaces, such as those of rural India.

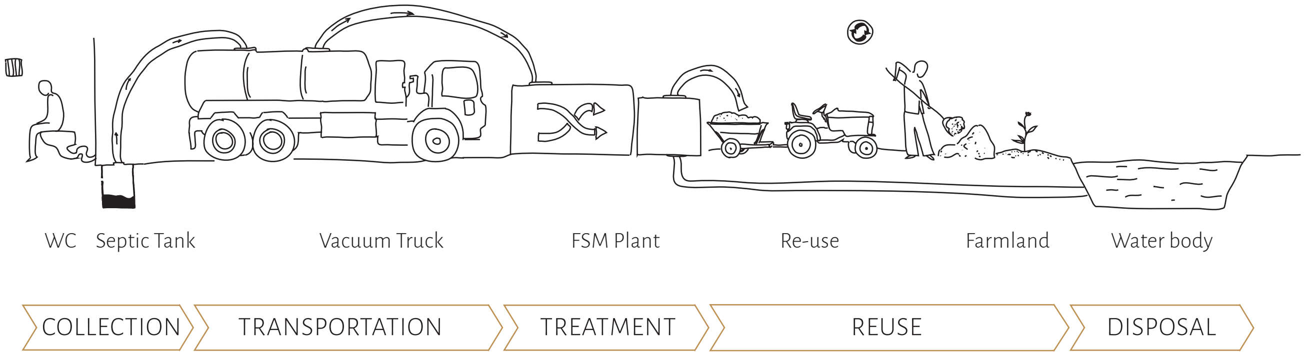
The 2011 Census captured the strong urban bias towards on-site sanitation (OSS) technologies. These are systems where the waste is contained on-site and later manually transferred to a treatment facility rather than being immediately transported into a networked sewer system. In 2011, 30 million households reported a septic tank, compared to 25 million with a sewerage connection, while another 2 million reported using pit latrines or toilets where the waste is removed by humans and animals (See Figure 3). Across the country, nearly 70% percent of toilet-owning urban households report reliance on an on-site sanitation system.

Figure 3: Toilet Technology in India



Source: Census 2011 and CPR Analysis

Figure 2: The Sanitation Value Chain



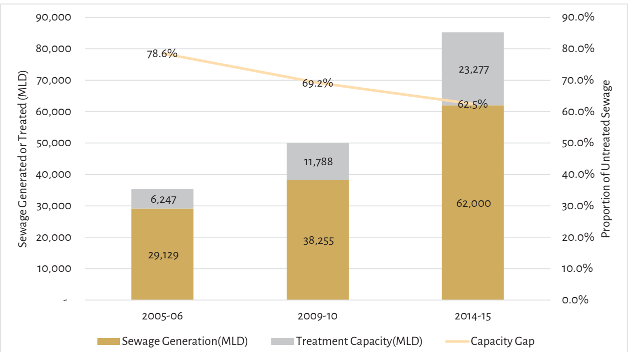
Despite this trend, there is little standardization of the sector. The last set of septic tank construction standards were codified in 1986 by the Bureau of Indian Standards. Scant financial and technical resources at the Urban Local Body (ULB) level have limited the development of maintenance, cleaning (de-sludging) and transport services for pits and septic tanks. In the absence of formal de-sludging and waste collection services, unregulated and informal private operators fill the gap. Without widespread mechanization, this practice is sometimes left to manual scavengers, in contravention of The Prohibition Of Employment As Manual Scavengers And Their Rehabilitation Act, 2013. The informality of the transporting modalities "greatly influences the disposal practice" (Dasgupta et al, 2016). These desludging enterprises typically do not maintain a safe distance between dumping grounds and settlements, using drains, waterbodies, open land and agricultural fields as uncontrolled dumping sites. Barren areas or wastelands near low-income slum settlements are also frequently used by these operators, threatening the health prospects of an already vulnerable population.

As the most visible symbol of the indignities caused by inadequate sanitation, questions of open defecation and toilet access have historically commanded a greater share of policy attention and investment. Increasingly, however, the need for waste management and treatment is being recognized in policy documents- the 2017 National Urban Faecal Sludge and Septage Management Policy, issued by the MoUD, declares untreated faecal sludge and septage as "the single biggest source of water resource pollution in India." Studies by the Central Pollution Control Board (CPCB) have found that partially treated or untreated wastewater accounts for 70% of the "pollution load to streams or water bodies in India" (CPCB, 2015). The Board estimates that Class I cities and Class II towns generated approximately 62,000 MLD (Millions of Litres Per Day) of wastewater in 2015. Installed treatment capacity was approximately 23,000 MLD, leading to a treatment shortfall of nearly 39,000 MLD or more than 60% of the amount generated. This is a slight improvement from previous years where the shortfall was close to 80% but still represents a significant source of environmental contamination (see Figure 4).

In 2014-15, CPCB recorded 816 Sewage Treatment Plants (STPs) across India. However, only 522 of these are functional (as of March 2015) accounting for 81% of the treatment capacity available. Figure 5 summarizes the current (2015) state of STPs in India.

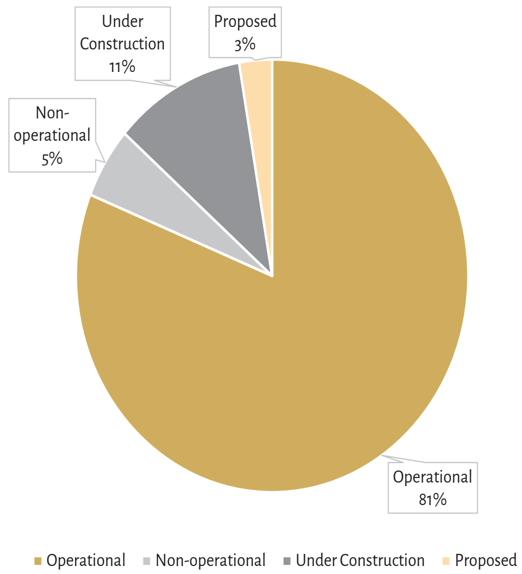
There is ample evidence that technical standards and regulatory oversight in the wastewater management sector need improvement. A 2013 CPCB investigation of STPs funded under the National River Conservation Plan (NRCP) found that 49 out of 152 STPs, or more than one-third, were discharging treated effluent in violation of the Biochemical Oxygen Demand (BOD) standard(BOD is a key water quality parameter that controls wastewater's impact on the receiving environment (especially water bodies) by setting a limit on the amount of oxygen-consuming substances). In states like Haryana (14 out of 16), Punjab (6 out of 11) and Uttar Pradesh (12 out of 24), most STPs under NRCP violate BOD limits. For example, Uttar Pradesh accounts for 16.4% (562 MLD) of

Figure 4: Wastewater generation and treatment in Class I and II cities



Source: CPCB Reports (2004-05,2009-10 and 2014-15) and CPR Analysis

Figure 5: Sewage Treatment Plants in India by Status, Number and Capacity (%)



Source: CPCB, "Inventorization of Sewage Treatment Plants" (2015) and CPR Analysis.

treatment capacity in the sample, second only to Tamil Nadu. Uttar Pradesh STPs that do not comply with the BOD standard account for 60% of this capacity, translating to nearly 340 MLD of hazardous wastewater being discharged into the River Yamuna and agricultural fields every day (CPCB, 2013). The regularity of such practices, combined with unregulated dumping, have contaminated 75% of all surface water across India (NUSP, 2008). A 2015 CPCB report on river pollution finds that 275 of 445 monitored rivers are polluted. Together, these polluted stretches make up over 12,000 km of riverine length.

What is the impact of untreated faecal sludge and wastewater being released into the environment? The hazard of untreated faecal sludge can be examined from three separate angles- direct impact on human health, impact on soil and impact on water bodies. Firstly, direct exposure to untreated faecal sludge risks pathogen transmission through the faecal-oral route. Direct contact with the faecal material and subsequent ingestion via contaminated skin or cooking implements is a common transmission vector (WHO, 2006). Enteric (intestinal) infections can be transmitted by pathogenic species of bacteria, viruses, parasitic protozoa and helminths, depending on their prevalence in the population (WHO, 2006). In populations with high enteric infection rates and inadequate sanitation, such as slum populations and low-income groups, a cycle of disease can easily become entrenched. Contamination through food may occur not just through use but also through unhygienic kitchen practices. If crops fertilized with untreated sewage are eaten without being properly cooked, transmission of similar pathogens is possible (WHO, 2006).

The effect of untreated or partially treated faecal sludge on soil conditions depends upon the content of salts, heavy metals and persistent organic compounds (WHO, 2006). Since greywater (wastewater from baths, sinks, kitchens) and blackwater (wastewater containing faecal matter) are rarely separated in India, the wastewater may contain not just harmful faecal matter but also pharmaceutical and other waste that is highly toxic and can degrade soil. Moreover, in arid or semi-arid regions, like parts of Punjab and Gujarat or rain-shadow regions in the Western Ghats, the sparse rainfall is insufficient to flush salts from the soil. Thus, increased dumping of untreated wastewater combined with low rainfall can lead to salinization of the land with adverse effects for agricultural productivity.

Untreated faecal sludge can contaminate water resources in several ways. Improperly designed, located or constructed septic tanks in areas with high groundwater tables lets sludge leach into surrounding groundwater, while dumping faecal sludge in areas with high groundwater can have the same effect. India is the world's largest user of groundwater and contamination poses a critical health risk (World Bank, 2014). 50% of urban water usage and 85% of drinking water supplies draw on groundwater supplies-as these levels are further depleted from overuse, protecting their quality becomes an environmental and public health priority.
Direct dumping of untreated sludge into drains and waterbodies or through treatment plants that empty into lakes and rivers pollutes surface water which constitutes about 60% of India's available water resources (Suhag, 2016). High BOD levels in the sludge lead to consumption of dissolved oxygen, affecting aquatic organisms and causing algal blooms that drastically disturb the river's bio-diversity and potential to be used for human consumption (WHO, 2006).

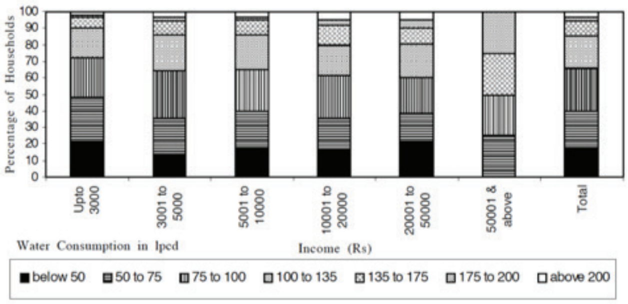
Clearly, urban India is moving to a sanitation paradigm qualitatively different from that of the recent past. As toilet coverage continues to increase, policy makers and urban planners will deal with questions not of "who has a toilet", but "what does that toilet connect to", not with how to punish open defecators but how to develop regulatory frameworks for septic tank builders and treatment plant operators. The challenge of combating open discharge thus becomes more relevant than issues of individual open defecation. Policy makers seeking to simultaneously develop wastewater management plans and build sustainable water-supply and sanitation delivery models should examine issues of wastewater supply, treatment demand and governance.

PLANNING FOR AN OPEN DISCHARGE FREE FUTURE IN INDIA

Increasing the supply of wastewater collection, transport, treatment and disposal technologies is a significant challenge facing urban sanitation planners. As policymakers and practitioners develop urban planning strategies, their chief hurdle is reckoning with the large variation in conditions across, as well as within, Indian cities. Rarely does a single element define a sanitation choice; rather, it is a combination of several considerations that should drive the decision.

Estimating current and future trends in a city's wastewater generation is key to a sustainable wastewater management scheme. CPHEEO estimates that upto 80% of a household's water consumption is released as wastewater, so a household or city's wastewater generation moves in sync with its water consumption patterns. In a 2007 paper, Shaban and Sharma examine these patterns across seven major Indian cities- Delhi, Kolkata, Kanpur, Ahmedabad, Hyderabad, Mumbai and Madurai- separating water consumption across activity type and socio-economic group. Their findings highlight the difficulty in evolving solutions that tackle all types

Figure 6: Monthly Income-wise Distribution of Households in Various Water Consumption Categories



Source: Shaban and Sharma, 2007

Figure 7: Area-wise consumption of water per household and Per Capita Per Day

Area	Per Household		Per Capita		N
	Mean	Std Deviation	Mean	Std Deviation	
High income group (HIG) areas with well planned building	402.5	230.3	99.9	59.8	551
Middle income group (MIG) areas with well planned building	396.4	248.6	94.2	57.6	571
Low income group (LIG) areas with well planned building	393.5	176.4	90.2	40.6	552
Slum areas	398.7	216.8	81.9	41.1	530
Others (mixed areas)	400.5	222.0	91.3	53.1	530
Total	398.3	220.2	91.6	51.5	2734

Source: Shaban and Sharma, 2007

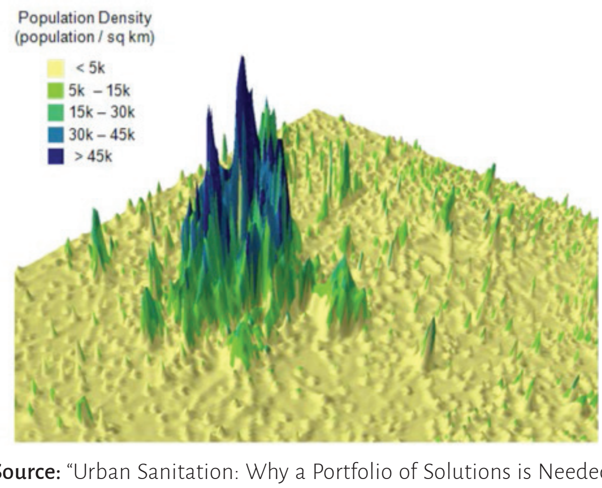
of behaviors in a modern Indian city. For example, when separating water consumption patterns by income group, they find that increases in income correlates with increased water consumption- but also that every level of water consumption exists in every income group (See Figure 6).

The heterogeneity of water consumption behaviors complicates, for example, efforts to impose income-based water tariffs. Similarly, area-wise consumption patterns are equally important. Sidhwani (2015) finds evidence of high spatial segregation in service delivery for metropolitan cities. Shaban and Sharma (2007) show that there are significant differences in water consumption patterns between planned areas and those with less formal methods of development (see Figure 7).

In other words, technologies that capture, store, transport, treat and dispose of blackwater and greywater will need to consider not just the variance in volume generated across areas but also qualitative differences in wastewater. This could imply overlapping treatment mechanisms or even new technologies and investments in 'at-source treatment' to reduce the load on downstream systems.

There are various factors that affect the appropriateness of a sanitation solution. Here, they are discussed under the headings of economic geography, physical geography and economic/planning considerations. Economic geography factors that influence sanitation choice include population density, a city's spatial layout and water consumption. While sewerage is still the preferred solution at densities above 30,000 for its ability to quickly and efficiently transport large amounts of waste, at lower population densities, decentralized solutions like condominial sewers (small-bore, shallow sewer systems) and OSS become both more feasible and cost-effective (Boston Consulting Group, 2014). While higher densities allow immediate distribution of high sewerage capital costs, lower densities mean that the costs and capacity of sewerage will only be realized over time. In metropolitan cities like New Delhi, densities typically vary greatly, a phenomenon that makes the development of city wide, centralized networks difficult.

Figure 8: Varying population densities in New Delhi



Source: "Urban Sanitation: Why a Portfolio of Solutions is Needed", BCG, 2014

Equally important are questions of spatial layout and water consumption. As India's urban population grows, this is expected to manifest as low-density, unplanned urban sprawl rather than high-density planned urbanization (UNDESA, 2014). Decentralized and OSS solutions may be more amenable to the needs of such scenarios rather than the rigidity of centralized solutions. On the other hand, areas with high water use will be easier to serve with sewerage which requires high volumes of water. Since OSS technologies do not use water as a conveyance, septic tanks in high water use areas tend to fill up faster, accelerating the frequency and cost of cleaning. As an example of how these issues might interact, take the case of a medium density area that has high per capita water consumption. The capital costs of sewerage vary less with density than with the area to be covered, so upfront costs of sewerage are still higher than decentralized technologies. However, high water usage may increase the operating costs for OSS and render small-bore sewers unfeasible. In such cases, considering the physical geography of the area may help.

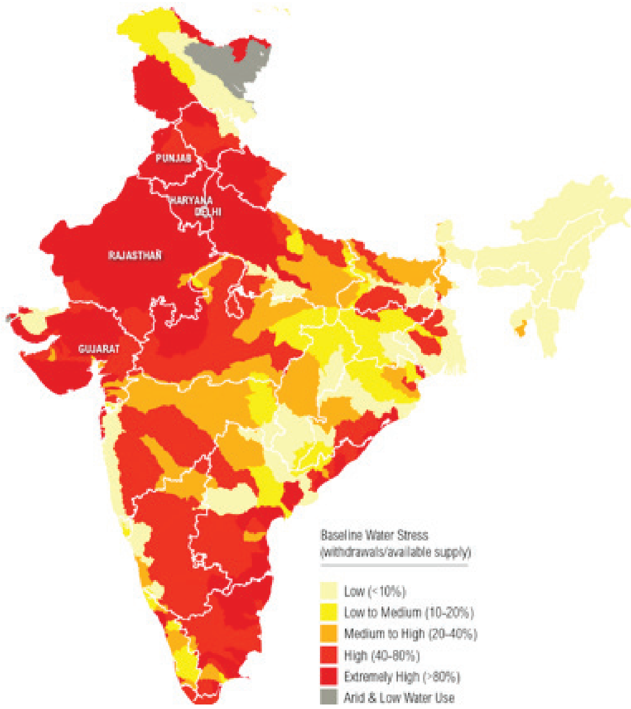
The questions of physical geography that determine a sanitation solution choice involve either cost considerations or environmental degradation. The former includes factors like a city's topography or the availability of water, while indicators like soil permeability and height of the groundwater table fall under the latter.

Cities that install sewerage in areas with flatter topographies must factor in the additional costs of pumping stations needed to drive the waste till treatment points, while hilly areas might reduce the need for pumping stations but increase construction costs. OSS technologies are less affected by this factor since their modular infrastructure can be adapted to different kinds of topography. Even in favorable topography, planners should consider how water is sourced for the chosen sanitation solution. Sewer systems require large amounts of water to transport the waste, an important consideration in India where widespread water scarcity is already a fact of life. As climate change further depletes water resources, the reallocation of water towards essential uses could threaten the sustainability of water-intensive sanitation infrastructure (See Figure 9).

A successful deployment of on-site solutions requires high soil permeability to increase water exfiltration. As soil permeability reduces, the waterlogging of surrounding soil becomes common and septic tanks fill faster due to water remaining in the tank and surrounding soil. Waterlogged soil reduces the effectiveness of existing septic tanks and constrains the number of septic tanks. As septic tanks fill faster, operating costs increase due to the increased frequency of emptying. Soil permeability has minimal effect on sewer based solutions (whether centralized or otherwise) though increased monitoring for sewer leaks is necessary (Boston Consulting Group, 2014).

High groundwater tables complicate both OSS and large centralized sewer systems. Construction of these systems

Figure 9: Water Scarcity in India (2017)



Source: Water Resources India, www.indiawatertool.in, 2017

becomes more expensive in such areas. In the case of OSS, a high groundwater table drives up both capital and operating costs because of the watertight tanks required. Moreover, the higher the groundwater level the stronger the possibility and extent of contamination from leaking septic tanks or sewer systems.

Finally, there are economic and planning considerations inherent in deciding on a sanitation solution. Most important is the cost of capital for the project. Centralized sewer-based projects are extremely capital intensive and fall on the local utility or state while also saddling local government with on-going O&M. OSS solutions are not just cheaper to build and operate but their modular nature is responsive to private investment or Public-Private Partnerships. Whether it is the construction of individual septic tanks or septic-tank emptying services, on-site sanitation offers market opportunities in a way that sewer-based systems simply cannot. OSS solutions are also easier to scale with the fluctuations of urban populations while sewer systems typically reach their capacity towards the end of their lives (Boston Consulting Group, 2014).

CONCLUSION

As India urbanizes, its cities and towns are likely to serve as the driving force behind economic growth and wealth creation. Key to the development of any city is its comparative ability to attract and develop valuable human capital. Thus, for Indian cities to grow and attract investment in both physical infrastructure and human capital, they will have to provide an environment conducive to this new labor force. In the sanitation context, this means taking an integrated view of sanitation-from toilet till disposal. National policy statements, like the draft NFSSM policy from MoUD, and international agendas like Goal 6 of the Sustainable Development Goals are already shifting the conversation towards a broader view of sanitation. Local governments should view SBM investments as merely the first step in a line of coordinated schemes like AMRUT and NRCP that will enable them to create the synchronized infrastructure required to tackle the waste generated in a city. While the SBM is to be lauded for its efforts in bringing sanitation to the forefront of the national agenda, national, state and city governments should not allow this effort to go to waste by losing sight of the real goal.

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SCALING CITY INSTITUTIONS FOR INDIA: SANITATION (SCI-FI: SANITATION)

This policy brief has been produced by the Scaling City Institutions For India: Sanitation (SCI-FI: Sanitation) research programme at the Centre for Policy Research (CPR) which focuses on inclusive and sustainable urban sanitation. The programme seeks to understand the reasons for poor sanitation, and to examine how these might be related to technology and service delivery models, institutions, governance and financial issues, and socio-economic dimensions. It also seeks to support national, state and city authorities develop policies and programmes for intervention with the goal of increasing access to safe and sustainable sanitation in urban areas.

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