DISCUSSION PAPER

DECEMBER 2016

Faecal Sludge Management in Urban India: Policies, Practices, and Possibilities

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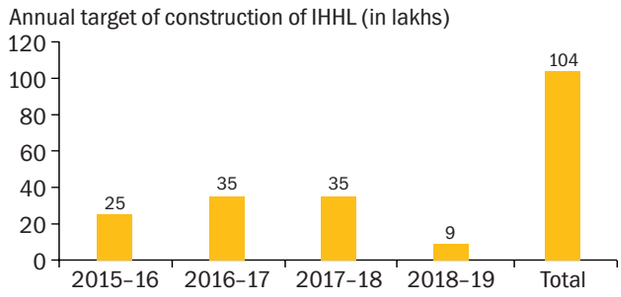
Introduction

Urban Sanitation and Need for Faecal Sludge Management (FSM) in India

The Government of India has undertaken an ambitious social change endeavour of clean and open defecation free (ODF) India. Sustained efforts in this direction has improved the sanitation scenario in India, which in turn would help in achieving the United Nations' Sustainable Development Goal 6 of universal and equitable access to safe and affordable drinking water and adequate and equitable sanitation and hygiene for all.[1]

Swachh Bharat Mission (SBM) is one of the biggest ever drives to accelerate efforts towards eliminating open defecation from India by achieving universal sanitation coverage and improving cleanliness by October 2, 2019, the 150th birth anniversary of Mahatma Gandhi. The two Sub-Missions, the SBM (Gramin) and SBM (Urban),[2] with huge financial outlays are being implemented

Figure 1: Target of individual household latrine construction



Source: SBM Website

[1] United Nations. Sustainable Development Goals, 2015. From http://www.un.org/sustainabledevelopment/water-and-sanitation/, Accessed on July 18, 2016.
[2] Ministry of Urban Development (MoUD), 2014. Guidelines for Swachh Bharat Mission (Urban). New Delhi: Government of India.

in a target-oriented approach in rural and urban India, respectively. There is an increased recognition among the policy makers that open defecation constitutes serious health and human capital crisis, and hence, achieving sustainable ODF communities should be the foremost priority of the Government.

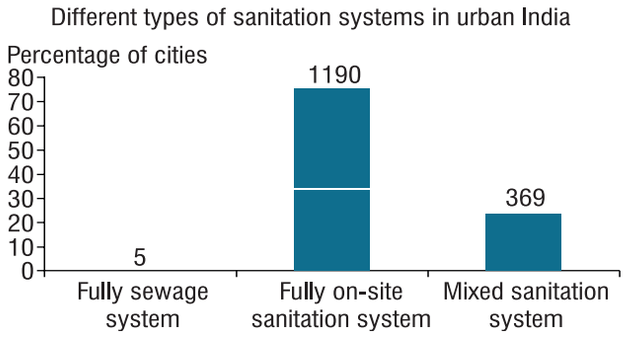
In urban India, a total of 26.64 lakh constructions have been achieved against a target of 66.42 lakhs individual household toilets[3] which is equivalent to 3500 urban toilets being constructed on a daily basis. The rate of growth of coverage of household toilets is unprecedented, and as per the annual target plan of SBM (Urban), this momentum is going to continue further,[4] as depicted in Figure 1, because of the high political will towards achieving ODF communities.

The Census of India reveals that about 41% of the urban households use on-site sanitation systems (OSSs) such as septic tanks, pit latrines. The Twelfth Five Year (2012–17) Planning Commission Report on Urban Development also highlights that 4861 cities and towns in India lack even a partial sewerage network and almost 50% of households in cities such as Bangalore and Hyderabad do not have sewerage connections.[5]

The Performance Assessment System (PAS)[6] project conducted by the CEPT University presents interesting ground-level realities. Under this project, the service level benchmark data submitted to Government of India by 16 states covering 1564 cities reveal that 1190 cities are completely dependent on OSS (more than 70%), 369 cities use a mixed system with both sewer network and on-site systems, and there are only 5 cities with full sewer systems, as shown in Figure 2.

The urban sanitation scenario of states in India representing 99.3% of the population (Swachhta Status Report, MOSPI 2016), as depicted in Table 1, shows that at all India level, 56.4% wards are reported to have sewer network for disposal of liquid. This indicates that there is an incremental improvement from around 50% sewer connection as per Census 2011 data. However, most of the faecal sludge ends up in the environment, and only 19% of faecal matter is safely disposed due to lack of proper FSM (Figure 3).

Figure 2: Different types of sanitation systems in Urban India (2013)



Source: CETP University, PAS Project

Table 1: Sewer network coverage in Indian states

Percentage of Sewer Network	Number of States	Percentage of population
<20%	5	3.44
20–50%	8	32.64
50–70%	6	37.55
70–90%	5	19.29
>90 %	2	6.38
All India	56.4% coverage	99.29 % (total population considered)

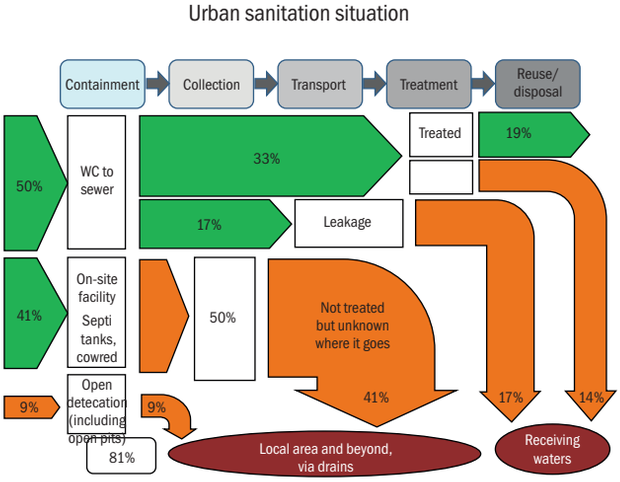
Note: Results of some states/union territories (with less than 20 urban frame survey) have not been presented separately. However, the same are included in the all India results, which represent 99.29% of the population.

Source: Swachhta Status Report, MOSPI 2016[7]

Considering the high coverage of OSS in urban India and a socio-economic bias towards it, we need to address the larger question: "Do we have the requisite policy framework, sanitation

[3] Ministry of Urban Development (MoUD), Government of India, From http://www.swachhbharaturban.in/sbm/home/, Accessed on November 19, 2016.
[4] Ministry of Urban Development (MoUD), Government of India, RFD for the Swachh Bharat Mission, From http://www.swachhbharaturban.in/sbm/home/#/SBM, Accessed on June 17, 2016.
[5] Planning Commission, 2012. 12th Five year Plan, Urban Development Report. New Delhi: Government of India; p. 321.
[6] Performance Assessment System (PAS). PAS Project Findings of CEPT University, Ahmedabad, 2012. From www.pas.org.in, Accessed on July 18, 2016.
[7] Ministry of Statistics and Programme Implementation (MOSPI), 2016. Swachhta Status Report. New Delhi: Government of India.

Figure 3: FSM in Urban India



Source: Census of India 2011

infrastructure, and institutional capacity to safely contain, transport, treat, and dispose the faecal sludge accumulated at the household level and its rapid increase because of the zero-open defecation drive?"

This discussion paper discusses and shares insights on the current policies and practices and explores the possibilities of effective and integrated FSM in Indian cities.

Policy and Regulatory Framework of FSM In India

Historically, the Government of India has focussed its Sanitation investments on centralized sewerage and treatment. A number of centrally sponsored schemes such as Jawaharlal Nehru National Urban Renewal Mission (JNNURM), Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT), Basic Services for Urban Poor (BSUP), Rajiv Awas Yojna (RAY), etc., provided funds for asset creation in urban sanitation sector, such as individual toilets, community toilet blocks, wastewater disposal, and treatment facilities, at the city level. However, the National Urban Sanitation Policy (NUSP) of 2008[8] brought about a paradigm shift in India's approach from 'conventional centralized sewerage network' approach of urban sanitation to a more 'holistic framework'. With regard to FSM, NUSP has very clearly outlined:

i. Promoting proper disposal and treatment of sludge from on-site installations (septic tanks, pit latrines, etc.);
ii. Ensuring that all human wastes are collected safely, confined, and disposed of after treatment so as not to cause any hazard to public health or the environment;
iii. Promoting proper functioning of network-based sewerage systems and ensuring connections of households to them;
iv. Encourage recycle and reuse of treated waste water for non-potable applications, wherever possible.

NUSP initiated a framework for cities to prepare City Sanitation Plans (CSPs) under the scheme of State Sanitation Strategy and introduced Urban Sanitation Awards based on the benchmarking of sanitation services in cities. However, the message of NUSP received slow response from the states in terms of framing of septage-management policies as NUSP guidelines remained very broad and failed to provide specific suggestions for FSM, leaving further policy development and role delegation to be done by the respective states. As of now, very few states such as Tamil Nadu and Gujarat (2014), Delhi (2015), and Odisha (2016) and Maharashtra (2016) have developed their septage-management guidelines. Box 1 highlights the key aspects of Septage Policy developed by Odisha. Apart from that, Ministry of Urban Development (MoUD) has recently released a primer on faecal sludge and septage management (FSSM) as well as Rapid Assessment Tool to estimate the budget for FSSM. The Ministry aims to support 131 designated cities[9] in India to implement citywide FSM. This tool gives an estimate of the financial requirement of the city to put in place the necessary infrastructure for FSM. MoUD has also directed the states to assign responsibility of FSSM to the respective 'Water and Sanitation Board' and rename these boards as 'Water, Sanitation, and Septage Board'.[10]

[8] Ministry of Urban Development (MoUD), Government of India, 2008. National Urban Sanitation Policy 2008. From http://www.moud.gov.in/policies/NUSPpolicy, Accessed on July 3, 2016.

[9] Ministry of Urban Development, Govt. of India, Rapid Assessment Tool of MoUD on FSSM, 2016.

[10] Ministry of Urban Development (MoUD), 2016. Circular to states - DO No. MD-SBM/AA/63/2016. New Delhi: Government of India.

BOX 1: KEY ASPECTS OF ODISHA URBAN SEPTAGE MANAGEMENT GUIDELINES, 2016

The Housing & Urban Development Department, Government of Odisha, intends to put in place a set of operative guidelines for ULBs that will formalize and provide a framework for safe handling of septage in the entire sanitation delivery chain (containment, emptying, transport, treatment, and disposal/reuse) and aims to achieve the goals of Odisha Urban Sanitation Strategy, 2011.

These guidelines conform to the advisory note on septage management developed by Ministry of Urban Development (MoUD), Government of India, and the guidelines on design and construction of septic tanks issued by the Bureau of Indian Standards (BIS) and the Central Public Health and Environmental Engineering Organization (CPHEEO). Further, these guidelines are intended to strengthen the existing framework focussed on implementing the provisions of the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013, in the state of Odisha.

The operational procedures outlined in these guidelines are applicable to all urban local bodies (ULBs) of Odisha and covers the following areas:

- Framework on septic tanks, including standard design and construction;
- Adoption of desludging procedure for the septage generated;
- Safe transportation of septage from collection point to receiving facility;
- Technological intervention for proper treatment of septage, disposal, and re-use;
- Public awareness

The guidelines framed by the Housing and Urban Development Department of Odisha have now made it compulsory for all households to construct septic tanks and stop the sludge from letting out into municipal drains. The rules direct house owners to contact only civic body officials or other registered sanitary agencies to clear out the septic tanks and strictly keep away from engaging manual scavengers.

The SBM (Urban) Guidelines 2014 also specifically mention that wherever toilets cannot be connected to sewer systems, *"in addition to the construction of the toilet superstructure, an on-site treatment system (such as twin pits, septic tanks, bio-digesters, or bio-tanks) should also be constructed for the collection, treatment, and/or disposal of sewage at or near the point of generation."*[11]

Though the guidelines specifically mentioned that ULB officials or private contractors should "ensure safe disposal of septage at a treatment plant," it fell short of suggesting any monitoring framework or suggestive action steps by states if the quality standards of construction of septic tanks or emptying and safe disposal by private contractors are met or not.

The construction standard for septic tank is prescribed by National Building Code (NBC)[12] 2005, and Central Public Health and Environmental Engineering Organization (CPHEEO) 2013 referenced from Indian Standard Codes (IS code 2470, 1985, Part-1 and IS 9872, 1981). These standards have been incorporated in city-level development regulations and the ULBs are responsible for enforcing these regulations. Also, as per the Prohibition of Employment as Manual Scavengers (and their rehabilitation) Act, 2013, manual cleaning/emptying of pit toilets and septic tanks is prohibited. All ULBs are required to adopt mechanical processes for cleaning of pits/ septic tank. However, there has been poor on-ground implementation because of several factors such as weak institutional capacity to oversee designs and construction, weak public interest in following regulations,[13] inability of bigger trucks

[11] Ministry of Urban Development (MoUD), Government of India, 2014. Guidelines for Swachh Bharat Mission. New Delhi: Government of India; p. 7.

[12] National Building Code, 2005. From http://www.bis.org.in/sf/nbc.htm, Accessed on July 18, 2016.

[13] Murty J V R, 2013. Faecal Sludge and Sullage Management in Urban Maharashtra, Performance Assessment System Project.

to enter highly congested slum areas due to narrow lanes, longer response time taken by the mechanical desludging truck to attend to urgent requests,[14] poor understanding of septage by the operators on ground, lack of proper technical guidance, lack of finance,[15] and lack of any state or central legislature on septage management. As a result, the construction standard is based entirely on the skill of the mason as well as the owner's ability to pay.

The NBC of India has gone a step further and has suggested frequency of cleaning and precautionary measures that should be taken for safe containment and disposal. According to NBC, "Septic tanks should be cleaned when a large quantity of septage has collected in the bottom of the tank. The interval of cleaning should not normally exceed 12 months. After cleaning, three or four shovelful of surface earth containing grass roots and decaying vegetable matter should provide a good start. No disinfectants should be used in latrines attached to septic tanks as they kill the organisms, which digest sewage." However, this code does not assign implementation responsibility to any particular agency and not surprisingly, only few cities have developed policies to meet this desludging requirement.[16]

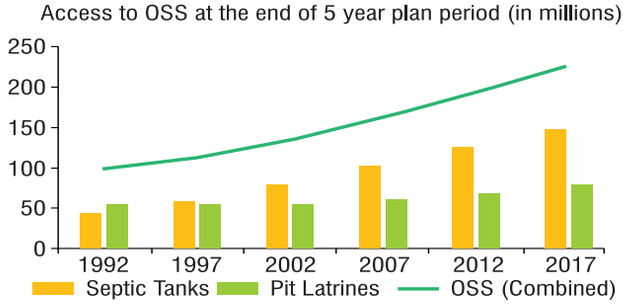
There also has not been any centrally sponsored scheme since independence for septage management or treatment so far, except the AMRUT guidelines that could enhance state's priority towards FSM. According to the AMRUT guidelines 2015, need of septage management has been highlighted, especially, 'mechanical and biological cleaning of septic tanks' and central funding support in partnership of state government has been suggested. However, the AMRUT guidelines fell short of mentioning dedicated septage treatment facilities and emphasizing upon disposal/reuse of the sludge. Enhanced convergence between AMRUT and SBM (Urban) would streamline activities of making ODF communities.

There is an urgent need for an exclusive national policy on regulation for septage management—handling, transport, and disposal of septage—in India. Although the municipal legislations of various states have provisions to regulate these practices, they are neither given due importance nor implemented in true spirit. Hence, FSM practices in the country are far from satisfactory due to lack of awareness, concern, recognition of risks, and lack of technical expertise.

Current Practice of FSM in India

The number of septic tanks has significantly increased over the last few decades, as households have invested in private sanitation backed by programmes such as SBM and its predecessors (Figure 4). There are more than 160 million urban

Figure 4: Access to on-site sanitation (OSS) at the end of 5-yr plan period



Source: USAID Rapid Assessment of Septage Management in Asia, 2010

people (close to 50% of total urban population) using OSS, and in states such as Odisha and Rajasthan, the prevalence of on-site sanitation (OSS) is close to 80%.[17] However, except for few states (as mentioned in the previous section), there are no septage management programmes or treatment facilities in the country.[18]

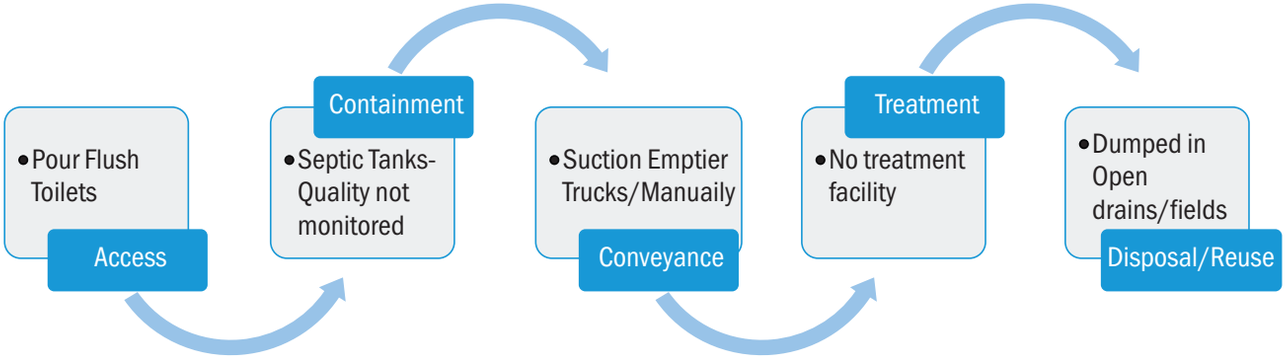
In the absence of a national regulation on septage management and poor enforcement capabilities by the ULBs, there has been a gross mismanagement in handling of faecal sludge matter in the country at all levels of the value chain[19] (access, containment, conveyance,

[14] WaterAid, 2014. Report: Faecal Sludge Management, Water Aid.
[15] Urban Development Department, 2016. Guidelines for Septage Management in Maharashtra. Government of Maharashtra, UDD-Govt. of Maharashtra.
[16] USAID, 2010. Rapid Assessment of Septage Management in Asia, USAID.
[17] USAID, 2010. Rapid Assessment of Septage Management in Asia.
[18] Population Service International Report, 2015. Faecal sludge management: A landscape study of practices, challenges, and opportunities.
[19] WaterAid, 2014. Report: Faecal Sludge Management, WaterAid.

and disposal/reuse), as depicted in Figure 5. This poses a significant health and environmental hazard for the population as well as the environment.

At the access level, despite the guidelines of CPEEHO 1993 and 2013, the construction of septic tanks or pit latrines is not monitored by the ULBs and is left at the jurisdiction of the households. As a result, generally the septic tanks are either simple self-built having one or two compartments or are prefabricated ones, connected to a simple soak away pit. Pour-flush toilets are basically offset pit latrines, with the faecal waste being flushed into the pit through a short sloping PVC soil pipe. Improved pit latrines are characterized by a concrete slab, while traditional pit latrines are typically covered by soil or a precarious arrangement of assorted waste

Figure 5: Current FSM practices in India



building materials, with the pit sometimes lined or sometimes not lined.

In addition to this, the regular cleaning and maintenance of septic tanks, which should ideally be done in 12 months as per the NBC 2005 guidelines, are mostly neglected. The households do not bother about it till the tanks get full and usage gets restricted. Many a times, the traditional pit latrines are too weak to be emptied by mechanically powered equipment. The water flushed types produce a more watery sludge, which is easy to pump but needs to be removed in relatively larger volumes (typically 2–3 m^3), while pit latrines have thicker sludge that require the use of scoops and buckets as they are too heavy to pump.

Some ULBs provide septic tank cleaning as a municipal service but generally as a complaint redressal activity when the septic tank/pit overflows and a complaint is registered with the ULB. Many of the ULBs do not have adequate number of emptying trucks and are unable to provide prompt service.[20] As a result, many private operators have come up to fill the gap. However, their fees are quite high and their services are not regulated. Mostly faecal sludge is dumped into open urban areas or into surface drains or nearby areas to save cost and time as most of the treatment plants are located in the outskirts of the city and suitable dumping or treatment sites are not located in areas near collection sites.[21]

In densely populated urban areas, truck mounted desludging systems can have limited access. Moreover, the typical amount of sludge generated per household will vary between 3 m^3 and 6 m^3, which may not necessarily be a viable operation for a mechanized desludging system with a capacity between 2000 and 8000 litres. This creates an unintended market for manual scavenging despite being banned as per Manual Scavenging Act 2013. The manual scavengers also dump faecal sludge into nearby surface drains or lakes.

Evidences suggest that uncontrolled improper construction and usage of toilets with septic tanks/pit latrines is a potential threat to

[20] Urban Development Department, 2016. Guidelines for Septage Management in Maharashtra. Government of Maharashtra.

[21] Kumar S, et al., 2016, Urban Shit: Where Does it all Go? From http://www.downtoearth.org.in/coverage/urban-shit-53422, Accessed on July 25, 2016.

contamination of groundwater due to faecal coliform bacteria, which causes tropical enteropathy[22] and stunting in children.[23] Extent of contamination of groundwater is a contextual phenomenon since it is essentially dependent on environmental context of the area, namely the soil and hydrological conditions. In areas closer to river basins and where the water table is higher, the threats of water pollution, both surface water and groundwater, is significant. In densely populated areas such as urban slums and low income communities where hand pumps are used for drinking water, if the latrine is not properly lined or if there is a breakage in the lining, liquid leaches from the pit mixes with soil and the pathogenic materials get absorbed in the soil, thereby increasing the susceptibility of water-borne diseases.

In a study conducted in the Kozikhode District of Kerala, in the Calicut Corporation area, samples were collected from 24 different dug wells seasonally (pre-monsoon, monsoon, and post monsoon), in different parts of the city. Majority of the groundwater samples were found to be contaminated with bacteria, which indicates faecal contamination and were declared unfit for drinking due to this reason. Most of the contaminated wells were found to be near latrines, which exposed them to higher risks of contamination.[24]

In order to maintain safe ground water quality, there needs to be a vertical distance of at least 3–4.5 metres between the bottom of the toilet pit and the water table.[25]

The World Health Organization (WHO) has defined risk criteria in terms of the time required for groundwater to travel from the toilets to drinking water facilities. In situations where the travel time is less than 5 days, there is significant risk of contamination; if the time is between 25 and 30 days, the risk is low.[26]

This sector also carries with it a social stigma and a lack of suitable incentives in the sanitation structure. Consequently, there are low returns on investment and funding is difficult for managing faecal sludge. In 2013, the Indian Parliament enacted The Prohibition of Employment as Manual Scavengers and Their Rehabilitation Act (the 2013 Act) outlawed all manual cleaning of human excreta. The 2013 Act also recognized a constitutional obligation to correct the historical injustice and indignity suffered by these communities by providing alternate livelihood and other assistance. People who have left manual scavenging, even those who had the support of community-based civil society initiatives, report significant barriers to accessing housing, employment, and support from existing government programmes. Notably, under the 2013 Act, rehabilitation provisions are left to be implemented under existing central and state government schemes—the same set of programmes that have not thus far succeeded in ending manual scavenging.

Possibilities of sustainable FSM

In comparison to laying sewer network across all the cities in India, an integrated approach to FSM offers a much more economic and better governance model. An integrated cycle of FSM (as shown in Figure 6) would not only include safe containment and transport of the sludge but also adequate treatment and reuse of the treated sludge in various applications.

One of the most common uses is using faecal sludge as a soil conditioner after treating it. For example, in Bamako, Mali, there is an integrated plant for organic waste and faecal sludge. Solid waste and faecal sludge is collected and transported to treatment sites. Faecal sludge is screened before being subjected to treatment

[22] Haghighi P, Wolf PL, 1997. Tropical sprue and subclinical enteropathy: A vision for the nineties. *Critical Reviews in Clinical Laboratory Sciences* 34(4): 313–341

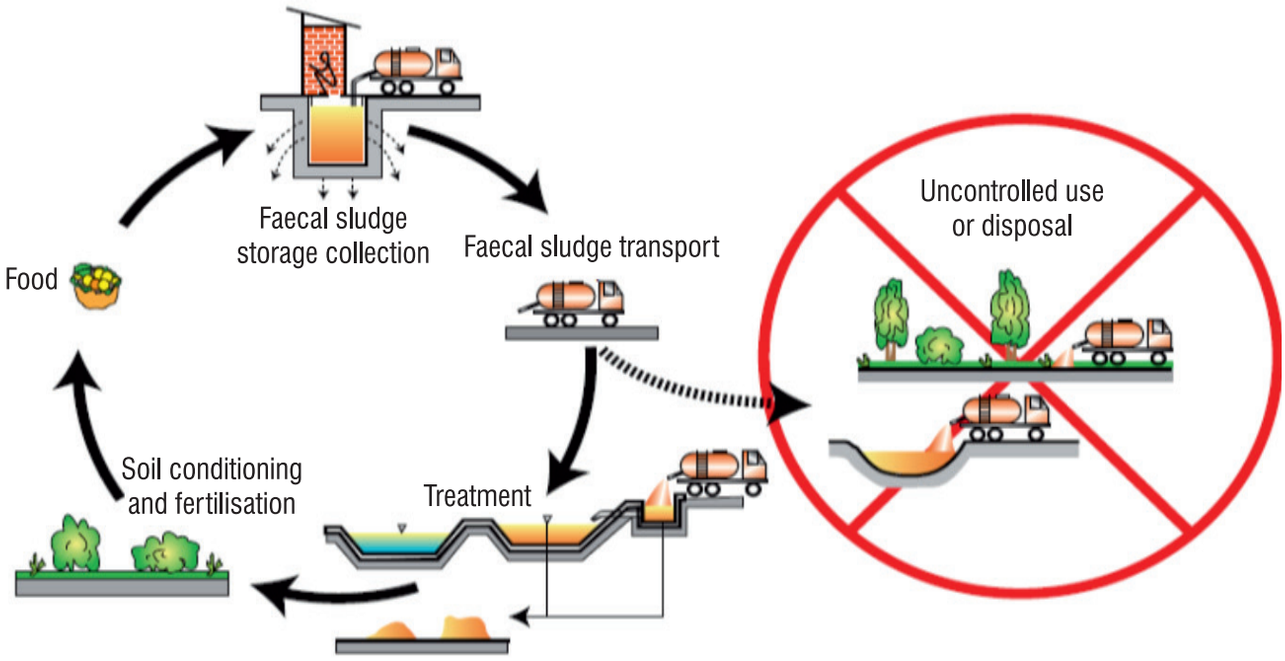
[23] Chambers R, Von Medeazza G, 2013, Sanitation and Stunting in India. Undernutrition's Blind Spot

[24] Megha, P. , Kavya, P. , Murugan, S. and Harikumar, P. (2015) Sanitation Mapping of Groundwater Contamination in a Rural Village of India. *Journal of Environmental Protection,* 6, 34-44. doi: 10.4236/jep.2015.61005.

[25] Graham J P, Polizzotto M L, 2013. Pit latrines and their impacts on groundwater quality: A systematic review. *Environmental Health Perspectives,* 121: 521–530.

[26] Krishnan S, 2011. On-site Sanitation and Groundwater Contamination: A Policy and Technical Review. From INREM Foundation Website www.inrem.in/publication.html, Accessed on July 8, 2016.

Figure 6: Complete FSM Cycle



Source: Rapid Assessment of Septage Management in Asia, USAID 2010

in a three-pond treatment system. Hyacinths are cultivated in the ponds and bacteria attached to its roots decompose the organic matter. The treated effluent is stored in a reservoir that is used to irrigate banana plantains. Even the compost and humus is used on banana fields, if it is not marketed. The project is initiated by WASTE, CPAC, and ALPHALOG along with the municipality.[27]

Private sector participation in management of FSM is also increasing and there are interesting business models and entrepreneurship cases that have emerged over the years. For example, in the state of Tamil Nadu, private sector has a crucial role to play in managing faecal sludge, in many of the towns. They are usually engaged in the emptying from septic tanks and disposal of faecal sludge. Cost of emptying faecal sludge is constant and fixed per trip. The cost depends on the distance covered, the quality of faecal sludge, as well as the septic tank size. On an average, the fee charged by the private players is around ₹2000 per trip. Private players also use modern equipment for emptying faecal sludge though they mostly do not have any training for using the equipment. However, the private sector does not involve itself in treatment of faecal sludge before disposal. Majority of disposal is done in open spaces since there is a lack of proper dumping place, except for one town, Gudalur, where the sludge emptied from public toilets is disposed in the municipal waste yard.[28] An interesting enterprise model of an innovative FSM practice is represented by Sanergy in Africa (Box 2) and private sector septage management in Malaysia (Box 3). Devanahalli (Box 4) in Karnataka has been an exemplary practice of FSM in India. Malaysia is a global trendsetter in terms of an integrated approach to FSM. There are lessons to be learnt from its experiences.

[27] Water Research Institute (CSIR) & EAWAG/SANDEC. Workshop on Faecal Sludge Treatment, Singapore, December 3–5, 1997.

[28] WaterAid, 2014. Report: Faecal Sludge Management.

BOX 2: SANERGY BUSINESS CASE STUDY
Best Practice Case under FSM Entrepreneurship Model

ORGANIZATION PROFILE

Sanergy, a for-profit social enterprise based out of Kenya was set up in November 2011. The company manufactures and designs sanitation facilities that are low cost and high quality. Sanergy initially focused on developing an intricate network of pay-per-use toilets throughout informal settlements of Nairobi and collecting their waste to convert it into organic fertilizer and biogas. Gradually, they added additional distribution channels to cater to a large, diverse population and also looked at the scope of other by-products of processing the waste.

BUSINESS MODEL

Sanergy follows a franchise model and thereby distributes the toilets to the community, and the community members are responsible for running them. This has resulted in employment opportunities for the slum dwellers by appointing them as Fresh Life Operators and also improving the sanitation as well as hygiene status of the community. These operators run the toilets and charge a nominal fee per use. The price is set by the operators themselves based on the market. Most of the Fresh Life operators own more than one toilet and find a feasible and viable business in these toilets since they are able to accrue a profit of $1000 per toilet on an average every year. Services are provided to the Operators to maintain quality sanitation facilities. These operators are provided training by the company along with access to finance as well as operational and marketing support. It is the job of the operator to create demand for these Fresh Life Toilets in their community and also to keep them clean. Daily waste collection services are provided by the company itself.

The company generates revenue through three main channels:
Sale of sanitation units, these are designed at $500 a unit; waste collection services for non-Sanergy service providers, primarily for producers of food waste; and sale of by-products from human waste, predominantly organic fertilizer and insect-based feed.

IMPACT

Sanergy has managed to install 732 active Fresh Life Toilets in the informal settlements. Around 8504 metric tonnes of waste has been successfully removed from the community and treated by the company. The company has also been able to create 788 jobs for the community, including the Fresh Life Operators as well as the attendants who they hire as they expand.
This kind of an example provides learning for India in terms of engaging the private sector in the sanitation chain. With efforts toward incentivizing and making participation in the sanitation chain economically beneficial, private players can be attracted towards improving the situation of sanitation in the country.

(Source: http://saner.gy/our-work/the-sanergy-model, Accessed on July 25, 2016)

BOX 3: MALAYSIAN CASE STUDY ON SEPTAGE MANAGEMENT
Best Practice Case under Public–Private Partnership at Country Level

Malaysia has developed itself as a pioneer in sewerage and septage management services in the Asian continent. Around 73% of the urban households in Malaysia are well connected to sewerage while the remaining 27% (equivalent to 29% septic tank coverage in India) relies on well-managed septic tank system. The improved sanitation status of the country can be attributed to the hybrid approach of prioritizing sewerage and septage both as a solution towards integrated sanitation management, evident through the legislative and institutional reforms, and successful implementation of the reforms.

A consolidated legal framework was developed along with clearly defined institutional responsibilities to ensure provision of sewerage and septage services at the national level. For this, the government passed Sewerage Services Act (SSA) (from 1993 to 2008) and Water Services Industry Act (from 2008) to provide efficiently monitored water and sewerage services in the country. The government employed a private firm, IWK, which was later nationalized to help them with operation and maintenance (O&M) of septage management in the country. IWK works closely with government regulatory bodies to establish policy guidelines along with the operating procedures for the developers and operators of treatment plants.

The legislative reforms helped delineate proper roles and responsibilities to various institutions and organizations. Mandatory desludging helped provide scheduled and regular emptying of septic tanks. Vehicle safety inspection, driver's medical fitness, adherence to disposal guidelines, use of personal protective equipment by workers, and many such regulations were put in place. Guidelines and rules enforced compliance since there was the impending fear of fine and punishment as a consequence of non-compliance and integration of wastewater as well as water and sanitation services meant that water supply could also be stopped as a punishment.

The Malaysian authorities also made good use of private sector efficiency and engaged in a successful partnership with a private firm to improve the situation of sanitation facilities in the country, which is responsible for developing around 70%–80% of the sanitation infrastructure of the country.

IWK based their operational scheme on a three-tier approach. First by, it located and restored old treatment plants, while subsequently developing their septage handling capacity. Secondly, it used oxidation ponds for septage disposal while identifying and constructing trenching sites where trees were subsequently planted. Thirdly, it constructed centralized septage management facilities for densely populated areas. Individual septic tank users participate in desludging programmes and pay wastewater bills semi-annually.

To summarize, the key success factors for Malaysia to become a pioneer in FSM are:

- Clear and bold policy governing septage and sludge management;
- Institutional reforms with clear responsibilities of the institutions involved;
- Collaborative efforts of the government and private sector to achieve efficient septage management;
- Three-tier approach by IWK helped focus on each aspect of sanitation infrastructure gradually and develop as well as improve each aspect at a time;
- Compulsory training for staff as well as contractors and acceptance of payment for services; and
- Stringent monitoring and enforcement

BOX 4: ADOPTION OF FSM AT DEVANAHALLI

Best Practice Case of Faecal Sludge Treatment at City Level

Devanahalli is located at a distance of 39 km north-east of Bangalore and falls under the Directorate of Municipal Administration (DMA), Government of Karnataka. It has a population of roughly 35,000 and is located near the airport and state capital. The large geographical area of Devanahalli uses partially piped water system with no sewerage system, hich is unviable. Around 90% of the households (~5800) are equipped with toilets having single pit, septic tank, twin pit, and open drain. Rest 10% of the households are without toilets and mostly use open defecation, shared toilets, or public toilets. Hence, a comprehensive FSM system was conceived by the DMA under the Government of Karnataka.

The FSM service value chain of Devanahalli covers all stages of the Faecal sludge treatment, including capture, storage, transport, treatment, and finally, reuse of the faecal matter.

The plant at Devanahalli has the capacity to serve approximately 30,000 people with the plant spread over an area of 650 square metres. It's a simple and low cost O&M plant using the technology of gravity-based biological treatment. The plant was commissioned with a capital cost of Rs 90 lakhs and has an operating cost of Rs 24 lakhs per year. The lifecycle cost of the plant is Rs 1500 per capita, which is very low in itself. The treatment module comprises of six stages that include screening, sludge–liquid separation, sludge stabilization, dewatering, disinfection, and liquid treatment.

Figure 7: FSM treatment plant in Devanahalli, Bangalore

The project has been implemented in the following steps:

1. Trucks brought by DMA followed by service offering from ULB;
2. FSTP was built for safe treatment of sludge;
3. An integrated O&M contract for truck and treatment plant was signed; and
4. Finally, FSM policy, which includes licensing, penalties, and monitoring, was implemented

One of the key challenges that persist in the project is its costing with the project falling short of the break even by `371,000 a year. However, on a holistic framework, including environmental impacts, the results have been quite promising. The plant has helped prevention of pathogens equal to that produced by 4400 people defecating in the open everyday. More than 100 operators have been trained and the project has evinced interest in local farmers, who regularly buy treated water and sludge for agricultural purposes. The project has also been received well among the experts and subject-knowledge holders with more than 350 visitors, including 100 international visitors and 200 senior officials. It is expected that with increased coverage by the service geographically and increase in operational efficiency of the system, the process would be self-sustainable in the times to come.

Conclusion

The Millennium Development Goals (MDGs) water target has been met but MDG sanitation target was lagging far behind, making it one of the worst executed MDG genda items. Experts have criticized that the MDG criteria had too much focus on the presence of technical solutions and neglected the importance of their functionality. Prioritizing water and sanitation interventions for the poor and socially excluded communities would help bridge one of the most important gap of equity. This will go a long way in addressing the huge imbalances in water and sanitation aid distribution and perhaps enhance the ability to achieve the Sustainable Development Goals over the next 15 years.

The drive for ODF India is a welcome step and in accordance with the Sustainable Development Goal 6. However, it must be noted that such a drive is not the first of its kind in the world. Countries such as Vietnam, Bangladesh, and Peru have undergone similar exercise and have achieved significant success. However, there are lessons to be learnt from their experiences. For example, in Vietnam, the prevalence of open defecation has decreased dramatically from 44% (1990) to 3% (2012) but the human waste that is generated is not properly collected and treated. Vietnam is incurring an economic loss of 1.3% of GDP due to environmental impacts of inadequate sanitation.[29] Also, the percentage of households using unimproved latrines increased from 26% to 30% over the same period, and the prevalence of stunting among the population remains high in the range of 28%–31%.[30]

Also, during the 1970s, in pursuit to improve the access of drinking water coverage, the National Rural Drinking Water Supply Programme was launched. This $125 million effort resulted in rapid construction of 1.2 million bore wells anticipating that groundwater would be relatively free of contaminants. However, after four decades, the groundwater exploitation and its related challenges (geogenic-contamination–led diseases) pose significant health hazards. Therefore, care needs to be taken for holistic approach towards sanitation mission which may otherwise lead to another environmental challenge.

India's urban sanitation sector has also witnessed a landmark shift post-NUSP with increased attention to the sector by the central government signalled by national-level programmes, such as JNNURM, SBM (Urban), and AMRUT. However, these programmes have missed to emphasize the need for an integrated FSM as envisioned in NUSP. Considering the volume of OSS coverage in urban cities and the economic infeasibility of achieving 100% sewer network, it is wiser for India to jump from a colonial urban sanitation approach to a more practical and hybrid approach towards urban sanitation involving on-site sanitation as a central step than considering it as an informal temporary infrastructure.

At present, faecal sludge that gets generated through the on-site systems is not properly managed and there are missing links[31] to where does this faecal sludge go. Single desludging system may not always work in all circumstances. Smaller mechanized tricycle/ motorcycle mounted collection tanks of 20–40 litres capacity with gulper or smaller vacuum pumps at the primary level backed by a secondary transport system may work in the informal slum settlements. Other options include developing intermediate collection station or holding tanks serviced by a public transport system that reduces the burden on the private entrepreneur to carry the sludge over a long distance to empty at designated places. Cluster septic tank could be built connecting several household toilets using the comparatively cheaper small bore sewerage technology developed by CPHEEO.[32]

An end-to-end FSM solution approach is critical to ensure sustainability and providing a comprehensive sanitation solution. Few states, such as Tamil Nadu, Gujarat, Delhi, Maharashtra,

[29] World Bank, 2008. *Economic Impacts of Sanitation in Vietnam,* World Bank.
[30] World Bank, 2014. *Investing in the Next Generation.* World Bank.
[31] World Bank, 2014. Research Brief: *The Missing Link in Sanitation Service Delivery,* World Bank.
[32] World Bank & Government of India, 2008. *Technology Options for Urban Sanitation in India* World Bank.

and Odisha, have developed their state-level guidelines for septage management and more states are expected to follow. Cities need to create a database of the kind of OSS systems presently in existence in their cities. City managers generally lack database and hence don't take appropriate actions. States and ULBs could make good use of the Rapid Assessment Tool developed by MoUD[33] and the flashcards and Standard Operating Procedure prepared by Urban Management Centre, Ahmedabad.[34],[35]

India needs a national comprehensive FSM legislation, robust regulatory system, and strengthened ULBs to monitor the entire value chain of FSM. In the absence of such a framework, the rapid increase of household coverage of toilets with on-site sanitation coverage will not translate into health benefits. There are significant potential of resource recovery from faecal sludge matter, which can be used for preparing compost with multiple applications. Encouraging entrepreneurship model such as Sanergy and private sector participation on the lines of Malaysia with suitable incentives across the FSM value chain can be a game changer.

Recommendations

Near-Term Steps

1. The SBM (Urban) guidelines need to elaborate further about integrated FSM, suggest a basic framework, and should encourage all states to develop their septage management guidelines. These guidelines could include modalities of public–private partnership (PPP) as well as safety standards for effluent and treated septage discharge or reuse.
2. The MoUD has directed the states to rename the 'Water and Sanitation Board' as 'Water, Sanitation and Septage Boards'. This activity should be made operational at the earliest through dissemination of knowledge, strengthening local administrative and technical governance systems through capacity building and thereby integrating septage treatment in an environmentally safe manner.
3. New construction of toilets should be monitored to ensure septic tank designs are appropriate to the local hydro-geological conditions. Stronger implementation of building planning permission process and in accordance with NBC guidelines. Awareness sessions can be held for household owners where new toilet construction is happening. Masons can also be enrolled under Recognition to Prior Learning (RPL) of skill development programme and gaps in their skills can be filled to avoid faulty designs.
4. ULBs should be notified to be watchful of indiscriminate dumping of faecal sludge by the private service providers. Punitive measures such as delicensing of the operators would check such instances. Additionally, a database of licensed operators should be provided by the ULBs and widely publicized among residents who are primary users of their services. This shall ensure citizen-led monitoring of the private operators, and non-licensed operators market shall get discouraged.
5. Coordinated efforts between ULBs, NGOs, community-based organizations, self-help groups of the statutory towns (urban areas), as well as the Panchayati Raj institutions of the Census Towns.
6. Capacity-building programmes for officials of ULBs on FSM to be done either through online module with some practical/field visits or through workshop sessions.
7. Inclusion of FSM service provision by the ULB in the property tax system will help financial sustainability of FSM service.
8. In the next city ranking on urban cleanliness, FSM should be given a definite weightage.

Medium-Term Steps

1. FSM should be given priority in urban sanitation programmes and there should be an increased convergence between AMRUT (Septage Treatment and Management goals) and SBM goals of making India ODF. Achieving ODF should not merely be restricted to the act of going for open defecation but the faecal matter should also be properly disposed to reduce its ill effects.

[33] Ministry of Urban Development, Rapid Assessment Tool of MoUD on FSSM, 2016. *MoUD, Government of India*

[34] Urban Management Center (UMC), 2014. *Value Chain of On-Site Sanitation Systems, Performance Assessment System Project.*

[35] Urban Management Center (UMC), 2015. *Standard Operating Procedure (SOP) for Fecal Sludge Management for Municipalities in Gujarat Performance Assessment System Project.*

[36] National Building Code, 2005. From http://www.bis.org.in/sf/nbc.htm, Accessed on July 18, 2016.

2. State governments could ensure that ULBs enforce strict adherence to the NBC of India.[36]
3. Separate faecal sludge disposal station needs to be constructed such as SWM plants. Need to ensure that there is a reliable fee-based service for FSM at the ULB level by incorporating this requirement as a precondition for funding under SBM (Urban). The scheme should strongly incentivize the development of local service providers based on PPP models (with viability gap funding) and encourage resource recovery.
4. Skill development of personnel on plumbing, mechanical desludging of septic tanks/ pits, truck operation with immediate job placement.
5. Incentivizing the FSM space in such a way that it does not distort the market and affect sustainability. This would help in entrepreneurship development in FSM.
6. Reuse should be facilitated not only by monetary incentives but through ecosystem support, such as purchase of by-products such as organic compost and using in state-administered gardens/parks, etc.
7. Capacity-building programmes need to be organized for farmers to make them aware of the opportunities and challenges in using these fertilizers.

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ACKNOWLEDGEMENTS

This publication is part of a study on Urban Water and Sanitation in India, which was coordinated by Coca-Cola Department of Regional Water Studies at TERI University, New Delhi, and funded and supported by the USAID.

The authors are thankful to Mr Anand Rudra, USAID; Mr A Kalimuthu, WASH Institute; Ms Meghna Malhotra and Ms Pooja Shetty, UMC; Mr A Das Gupta, CURE; Mr S Vijay Kumar, Distinguished Fellow, TERI; Prof. Arun Kansal, TERI University and Dr Suneel Pandey, TERI.

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