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Practical experience testing aspects of market development for city-wide inclusive sanitation

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Achieving effective, city-wide inclusive sanitation service delivery requires coordination of diverse actors in the sanitation value chain as many factors constrain the efficiency and quality of faecal sludge management (FSM). In partnership with government, consumer, and private sector stakeholders in Bihar's capital city, Patna, PSI India facilitated extensive market analysis, identified the market challenges, and co-developed a market-based urban FSM services 'ecosystem' which resulted in the safe collection, treatment, and disposal of over 7 million litres of faecal sludge from more than an estimated 1,500 households over two years, as part of bundled portable toilet cabins and FSM services. The FSM programme Praashadan, funded by the Bill & Melinda Gates Foundation, built trust, improved coordination, and brokered official agreements between tanker operators and government, tested a portable toilet cabin business model to subsidize operation of a faecal sludge treatment plant, and established a call centre and promotional activities to drive customers to the services of a newly formed tanker operators association. Moving forward there is a need to place the work with these market actors into a wider context of a financed, coordinated, city-wide sanitation planning to address technology, R&D, and other constraints that support better business models and allow regular quality FSM services.

Keywords: sanitation, markets, faecal sludge management, India, septage, private sector

ACHIEVING EFFECTIVE, CITY-WIDE INCLUSIVE SANITATION service delivery requires coordination of diverse actors throughout the sanitation value chain as many factors constrain the efficiency and quality of faecal sludge and septage management (FSSM). In partnership with government, consumer, and private sector stakeholders in Bihar's capital city, Patna, PSI (Population Services International) India facilitated extensive market analysis, identified the market challenges, and co-developed a market-based urban FSSM services 'ecosystem'. The result was the safe collection, treatment, and disposal of over 7 million litres of faecal sludge from more than an estimated 1,500 households over two years.

The FSSM programme, Praashadan, funded by the Bill & Melinda Gates Foundation (BMGF), built trust and rapport, improved coordination, and brokered official

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agreements between tanker operators (TO) and government agency Bihar Rajya Jal Parishad (BRJP). It tested a portable toilet cabin business model as a way to cross-subsidize operation of a faecal sludge treatment plant. It also established a call centre and launched promotional activities to drive customers to the services of a newly formed tanker operators association. A key outcome of this work was to show the potential of market development activities to open up existing government FSSM treatment infrastructure to faecal sludge collected from onsite sanitation systems by TOs. As underutilized capacity of existing treatment infrastructure in India is around 5000 MLD (million litres per day), there is opportunity to scale this approach to increase safely managed FSSM services and start cities on the pathway towards city-wide inclusive sanitation. While increasing underutilized capacity is only one piece of the larger FSSM problem, PSI's theory of change is that addressing the underutilized capacity is a critical first step towards increasing government buy in and organizing the market actors.

Global context on city-wide sanitation

Cities across the world are waking up to the reality that much of their faecal waste is going untreated into neighbourhoods, drainage, and receiving waters (Odey et al., 2019). Tools such as Shit Flow Diagrams (SFD Promotion Initiative, n.d.) have emerged to map current realities and assess if both onsite and offsite human waste ends up being treated, reused or disposed of safely (USAID Bureau for Economic Growth, Education and Environment, 2018). Shit flow diagrams from multiple cities show that only a small percentage of the population are served by sewerage, if at all, and existing infrastructure may not be fully utilized, or not properly functioning (Kappauf et al., 2018). Other tools such as the FSM Toolbox (n.d.) have been developed to help city planners, consultants, and donors through the complex process of delivering and managing sustainable, inclusive sanitation services to all citizens (International Water Association, 2019).

The multi-step process involves multiple stakeholders and is designed to address consumer, service provider, and government engagement, technology assessment and selection, equity, establishing and administering service contracts and public private partnerships, budgeting and finance, land allocation, regulation, enforcement, safety planning, M&E, promotion and communication, and R&D (Blackett et al., 2014).

Putting this puzzle together requires both soft and hard skills, a well-run partnership process built around achieving common goals and working on mutually reinforcing activities, and the ability to look at different solutions for different customer segments. The solutions must work in high density and high-water table areas, and informal settlements as well as planned areas (Mondal et al., 2018).

Traditional sanitation planning only focused on sewage treatment networks, which served a small portion of the population; but this model is no longer sufficient. Data points to the high cost of conventional sewers compared with other options (Daudey, 2018: 176–95). In the city-wide inclusive sanitation model, onsite as well as offsite solutions are needed, effective management and scale of public toilets must be considered, and new kinds of service providers, such as container-based sanitation providers, should be offered service contracts.

Evidence from a growing list of FSSM programmes shows there are weaknesses throughout the sanitation service chain, including onsite household sanitation systems. While examples of successful scheduled desludging exist, the transportation and emptying of tanks is poorly organized and managed (Jenkins et al., 2015). Options for treatment, reuse, and disposal, while potentially promising, have not been proven at scale. Additionally, there is limited data on costs and effectiveness and the safety of workers is often ignored (Diener et al., 2014).

Given the weaknesses, research and development (R&D) and trialling of innovations must be accelerated to improve onsite household sanitation solutions (Sy et al., 2014). The solutions must meet the needs and desires of consumers (landlords and households) and the business model viability of service providers (Opel and Bashar, 2013).

Background: sanitation system reality in India

FSSM, the process for safe collection, conveyance, treatment, and disposal/reuse of faecal sludge and septage from onsite sanitation systems, is increasingly acknowledged as a challenge in India (India Sanitation Coalition et al., 2017). This includes management of pit latrines and septic tanks, where the mixture of human waste (solid and liquid) is not conveyed by a centralized sewerage system. A typical FSSM system involves mechanized desludging of a septic tank/pit latrine using a suction emptier machine, which then stores the collected waste in a sealed container and transports it to a treatment facility (Government of Rajasthan, 2018).

With a population of 1.2 billion (Office of the Registrar General & Census Commissioner, India, 2011), India produces 1.7 million tonnes of human excreta daily (Down to Earth, 2016). Additionally, most of the country's toilets – 38 per cent (Office of the Registrar General & Census Commissioner, India, 2011) for urban households – use onsite systems like pit latrines and septic tanks that are unconnected to the sewer network. The faecal matter collects in these pit latrines and septic tanks until they fill up, whereupon the household must remove and dispose of the faecal sludge before the toilet can be used again. In reality, most of the faecal sludge collected is discharged into open streams, rivers, drains or open lands and ultimately pollutes the water bodies and ground water. Given how important proper removal, handling, and disposal of faecal sludge is for averting risk to human health and the environment, the need to explore FSSM options for households that are off the sewer grid is critical.

In 2014, Population Services International (PSI) began implementing project Prasaadhan in Patna, the capital city of Bihar state, to test solutions for onsite faecal sludge transport and treatment. Supported by the BMGF, Prasaadhan carried out a range of market development activities related to FSSM in Patna, where only about 21 per cent of household toilets are connected to the sewer network and as many as 65 per cent of the toilets are attached to septic tanks and require faecal sludge removal services on a periodic basis (Office of the Registrar General & Census Commissioner, India, 2011). Prasaadhan began with a landscape study of the FSSM space and its challenges, issues, and practices. The study indicated multiple market failures that were inhibiting a proper FSSM

market from taking off in Bihar, the key among them being lack of awareness on and demand for FSSM among consumers, lack of policy support for the FSSM market, and 'illegal' status of private service providers.

Based on PSI's activities, it was learned that in Patna, as in most of Bihar, the task of faecal sludge removal, transportation, and disposal is largely carried out by unorganized private TOs who are not recognized by the government and perform the function illegally and often irresponsibly. In the absence of legal and regulatory provisions and guidelines, the 'illegitimate' operation exposes the private TOs as well as their clients to risk of abuse and poor service quality.

As shown in the Shit flow diagram (SFD) (Figure 1) the informal operation also results in around 100,000 litres of the extracted faecal sludge being disposed of in open land and natural water bodies, causing faecal contamination of the environment. In fact, as much as about 90 per cent of the city's faecal matter is

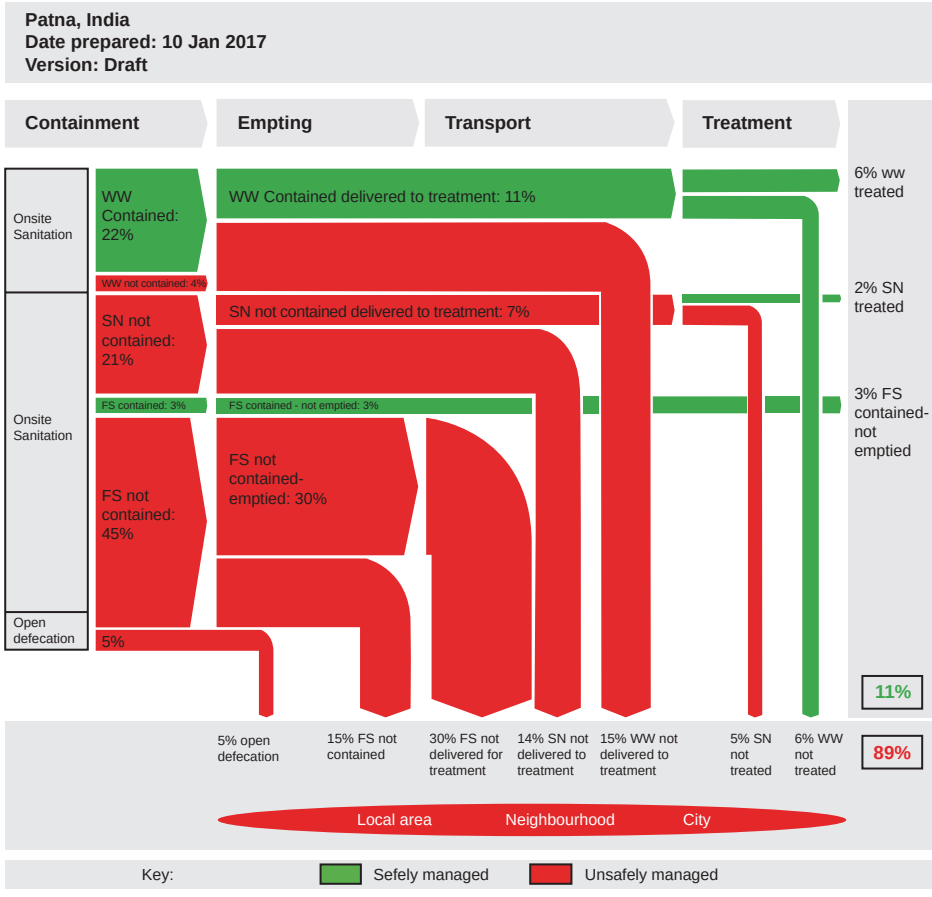

Figure 1 Shit flow diagram
Note: SN: supernatant
Source: Thakur and Singh, 2017

disposed in an unsafe manner. The SFD was used at the beginning of the project as an advocacy tool to demonstrate the grave situation of unsafe disposal to government officials at various levels.

Furthermore, government sewage treatment plants (STPs) are being underutilized in Patna. STPs and sewage pumping stations are traditionally designed for the underground sewerage system which was envisaged to one day provide for the whole city through sewer lines. The responsible government department never considered their responsibility to provide safe services to the households with onsite sanitation systems. Thus, the underutilized capacity of STPs was never leveraged as a means to expand the city's FSSM system.

FSSM market context India

PSI takes a market development approach to understand who the market is failing, how it is failing, and how to address these issues by working in the market. This process steers us to address the root causes of systemic market failures so that better products and services can reach consumers and improve their health.

PSI engaged WASH Institute to support a landscape study of the FSSM space and its challenges, issues, and practices. The study had three components: a desk review of literature; a study of existing FSSM solutions and best practices; and a sample survey in three districts of Bihar and one district of West Bengal. The study was conducted among households that were already using single pit toilets or septic tank toilets. It captured community behaviour and practices relating to demand and supply of FSSM services through personal interviews, focus group discussions, and key informant interviews. At the household level, the study included primary providers of healthcare needs in the family (head of the household or the primary caregiver of children). Key informant interviews were done with pit emptying service providers, corporation/municipal officials, labourers involved in the service, and the government officials, and government or private sludge treatment plant operators. The findings and the post-study groundwork pointed to the following major market barriers:

Enabling environment:

1. Lack of a robust FSSM regulatory system at the urban local body level and awareness and demand generation for FSSM services at the user level.
2. No enforcement of safe treatment and disposal regulations to protect public health. Instead, dumping of untreated sludge in fields, rivers, and other open areas occurred regularly, polluting surface and groundwater and harming human health.
3. Private vacuum TOs regularly face challenges in performing their activities, as the business is treated as illegitimate and they are barred from access to STPs to treat and dispose of faecal sludge, despite spare, unused STP capacity. Patna city has 102 MLD treatment capacity, yet discussions with STP operators imply that only around 67 per cent of the treatment capacity is utilized.
4. No mechanism exists for municipalities to officially collect fees from TOs who use their facilities to cover the costs of maintaining a system for safe treatment and disposal.

5. Unclear roles and responsibilities and lack of coordination across state and municipal agencies for water, sanitation, and public health increased the complexity of targeting advocacy to overcome these barriers.

Supply:

1. Public service is insufficient and inefficient. The number of available public vacuum tanker trucks operated by urban local bodies (ULBs) is insufficient to meet the FSSM service needs of consumers and they are not providing the services they are supposed to provide. While they should provide emptying services within two to seven days upon receipt of an advance fee, most ULBs do not have a vacuum tanker service and when they do, the tankers are often not functional or lack a driver or helper.
2. Private sector TOs struggle to have a viable business model for FSSM service provision. While there are many private TOs providing services, they lack communication channels with customers; thus they do not have consistent and predictable revenue streams.
3. Customers contacting private or public service providers do not receive timely or high-quality services. Customers face discriminatory pricing and questionable service quality from private sector TOs, depending on the urgency of pit cleaning needs.

Demand:

1. Significant lack of awareness about FSSM and consequently, a lack of demand for quality services, concern, and commitment to managing faecal sludge safely.
2. Lack of understanding of the immediate threats poor FSSM practices have on public health and environmental damage.
3. Lack of consumer awareness of the importance of quality FSSM and limited knowledge of the availability of FSSM services.
4. Absence of an efficient system and mechanism to contact and hire private pit emptying services at reasonable prices.

These findings informed Prasaadhan's response and the thinking and design of its interventions. The interventions, discussed briefly in the next section, were tested in Patna city for viability in both urban and rural areas.

PSI India's market development interventions

Testing a private faecal sludge treatment business model

Recognizing the lack of alternatives for and difficulties in accessing government STPs, Prasaadhan explored decentralized solutions for privately run safe faecal sludge disposal. The programme engaged the private company, Saraplast Pvt. Ltd, to test the viability of setting up and operating a small faecal sludge treatment plant (FSTP) of 15,000 litres/day capacity.

The initiative, leveraging the private tanker operators in Patna's interest in expanding its business of renting portable toilets (portaloos) in Patna, also tested the feasibility

Box 1 Project prasaadhan overview

Aims
- Develop business models for pit emptying and a combined service provision for emptying, tipping, and treatment.
- Increase access to and use of quality FSSM services for consumers.
- Create an enabling environment for private operators through public-private partnerships.

Approach
Test and explore:
- Can a local sludge treatment plant be managed and run by a private entity, and how much cost recovery can be achieved through supplementary business models?
- Can existing unregulated private operators be professionalized?
- Can the government be engaged to support a better operational environment for TOs and for FSSM services in general?

of combining the services of providing a toilet as well as its emptying, tipping, and treatment. The model was built around the revenue generation from renting portaloos, which would enable Saraplast to operate and maintain the complete mechanism for extraction of waste from the rented toilets and its transportation, disposal, and treatment in the FSTP. Saraplast collected sludge from the rented toilets while other private operators collected sludge from household toilets and were able to dispose of it in the Saraplast FSTP free of charge to encourage emptying at the site.

During its operation, which concluded in November 2017, the FSTP received a total of 8,308,480 litres of faecal sludge, providing the proof of concept for an innovative mechanism for safe disposal. Prasaadhan supported the business model in its early demonstration phase and from its launch in December 2014 to November 2017, the portaloo renting + cleaning service business was able to generate revenue to meet 60 per cent of its operational cost. The broad distribution of monthly operational cost is given in Table 1.

The implementation of the model demonstrated that the return on investment was too slow to attract an enterprise to invest in the capital expenditure, which mainly includes the installation/construction of the treatment plant and the cost of land. In the FSSM value chain of collection, transportation, disposal, and treatment, the major source of revenue was limited to the rent collected for the portaloos that included the portable toilet cabins and periodic removal and transportation of the faecal sludge up to the treatment plant.

Three private tanker operators were linked with the treatment plant for disposal of the faecal sludge collected from the household toilets but no revenue could be

Table 1

Serial Number.	*Cost area*	*Cost (US$)*
1	Human resources	418
2	Fixed expenditure (land, lease, rent)	507
3	Variable expenditure (fuel, electricity, etc.)	302
	Total	1227

generated through them. The reason was the absence of governmental regulation and monitoring mechanisms for safe collection, transportation, and disposal, which gives liberty to the operators to dispose of the sludge anywhere at their convenience.

The sludge cleaning cycle is 5 to 10 years between services; the number of operators has significantly grown and increased competition has had an impact on the cleaning prices, compelling operators to reduce costs by reducing the time for transportation of the sludge and finding the closest place to dispose of it. If they must travel to far away disposal locations it increases expenditure. It requires a level playing field for all the operators, with strict monitoring by the government to ensure that no faecal sludge collected from the tanks is disposed of in the environment. The cost of providing cleaning services may increase for the customers, but that cannot be avoided, if safe disposal is the aim.

The plan was that revenue would be generated by renting out the portable toilet cabins (PTCs) and maintaining them (faecal sludge removal and toilet cleaning), charging a disposal fee from the vacuum TOs, and selling portable toilet outer walls as advertising space. However, the Patna market responded bleakly. A smaller number of PTCs than anticipated were rented, which did not yield a significant enough advertising revenue and TOs would not accept paying to discharge the faecal sludge.

Furthermore, the absence of government regulation prohibiting disposal in the open also disincentivized operators from travelling to the STP for the disposal of sludge. The model therefore could only generate revenue by renting out the PTCs and their low number could only collect a maximum of 65 per cent of the operation cost in a month. Therefore, it is prudent to note that different markets may behave differently. In situations similar to Patna, governments should provide a support of 50 to 75 per cent of the operation cost until the market matures, which could take from two to five years.

To be viable, the government must invest the capital cost and provide a subsidy or financial support to the enterprises to encourage private sector interest in FSTP operation and maintenance. Moreover, there should be a regulatory and monitoring mechanism to ensure the quality of services. Based on the learnings from this model, Prasaadhan decided to pivot to work directly with governments to maximize the efficiency and use of its existing infrastructure and organize the service providers, in this case TOs.

Testing the legitimization of tanker operators and optimizing government FSSM infrastructure

Seeking to alter the dynamics of the FSSM market in Patna, PSI deployed a multi-pronged approach to not only enable safer disposal of faecal sludge but also to increase consumers' access to and use of quality FSSM services, and safeguard private operators from risk of abuse. Prior to the project, no database about private service providers was available in the city. To efficiently link the untapped resources of STP capacity to private TOs, Prasaadhan conducted a complete mapping of the providers and STP locations in the city to identify feasible locations for safe disposal.

Operators usually charge around Rs.1,000 (about US$13) per trip, removing around 3,000 litres of faecal sudge from the pit and transporting it to the nearest

disposal location. The usual distance that they travel for pit cleaning is around 7–8 km and for disposal, no more than 2 km. In exceptional cases they can travel up to 20 km, depending on feasibility, which directly corresponds to the cleaning fee. The truck operation requires two people, one driver/supervisor and one other who does all the connections, pumps, and holds the pipes for suction. The driver is paid on a monthly basis while the helper is employed and paid on a daily basis.

The first major priority for Prasaadhan was to build trust and rapport between the private operators and the government to create an improved environment for the operators. Securing access to government STPs for the TOs was identified by the project as critical for safe faecal sludge disposal. Prolonged discussions and negotiations with Patna municipal corporation and government officials helped the private operators secure access to two of the four government STPs in Patna.

Initially the government agreed but imposed a minimum fee of Rs300 ($3) per day and the same fee for the subsequent trips. This condition was too costly, and no operators turned out. After long negotiation, the government opened the STPs without charging a fee for a period of three months, as a pilot to understand the TO response. The pilot demonstrated enough activity and the government agreed to remove the minimum one trip condition and reduced the tariff from Rs300 ($3) to Rs.100 ($1.30) per trip. Now the operators can dispose the faecal sludge into the STP by registering themselves with the Bihar Rajya Jal Parishad. The Bihar Rajya Jal Parishad – now merged with Bihar Urban Infrastructure Development Corporation – is a government agency and custodian of all sewage treatment infrastructure, responsible for its operation and maintenance. TOs must pay the agency a registration amount of Rs1,000 (about $13) accompanied by the requisite information such as vehicle number, ownership, and proof of identity.

Since March 2018 more than 5 million litres of faecal sludge has been diverted from unsafe disposal into the environment. This has enabled TOs to safely dispose the collected faecal waste and legitimize their business. Since the disposal locations were not open to TOs prior to the project, the baseline for collection of sludge and the amount that reached treatment was nil before the government granted TOs access to the STPs.

Effort has also gone towards strengthening the TOs' capacity and professionalism. Prasaadhan has helped private operators form an informal association which has already agreed upon a tariff structure (Rs100 per trip ($1.30)) for different areas within Patna city. The association currently has 14 members. This is a small but significant step towards organizing private operators and bringing them into a government-recognized framework. As a result of this recognition, the Patna municipality also contracted the TO Association to provide emptying services at a major city festival.

Testing demand creation. Another component of the project was enhancing demand for and easing access to quality FSSM service. PSI set up a toll-free helpline to connect interested households with private pit-emptying service providers. A toll-free number was established and disseminated through leaflets, FM radio, branding of the tankers, and temporary canopy installations. Since the cleaning of tanks happens on average every 5–10 years, the expected number

of calls is relatively low compared with other services. Nonetheless, the helpline received 760 unique customer calls in 13 months of operation, resulting in the cleaning of 205 tanks by the registered TOs. Because of these improvements to supply and demand, 99 per cent of FSSM tank cleaning requested through the helpline is completed within 24 hours. In order to increase sustainability of these efforts the management of the call centre will be handed over to the TO Association.

Insights

Insights from Prasaadhan's implementation have demonstrated the potential of decentralized, light-touch, market facilitation solutions for FSSM. Though more work is needed to take those solutions to scale, the experiments in Patna have yielded learnings about advocacy, trust, and rapport building that can be applied in the city and beyond.

Building awareness among government officials, the private sector, and consumers on the crucial need for FSSM has emerged as a necessary first step. Prasaadhan took the following steps to build awareness among the different stakeholders in Patna:

1. Prepared the SFD to demonstrate the grim situation to government officials.
2. Did an estimation of the quantity of faecal sludge in the city that is being transported and disposed by operators in the open.
3. Interviewed the Bihar Rajya Jal Parishad and understood that excess capacity in the STPs is available where the transported sludge can be accommodated.
4. Advocated with the government to utilize excess capacity of the STP by allowing TOs to dispose faecal sludge into the STPs and other sewage locations in the city's STP network.
5. Supported private operators in forming an association and linked association members to the government by registering them as official TOs with access to STPs.
6. Persuading operators to register by demonstrating the future advantages of doing so.
7. Helping the government to develop standard operating procedures for septage collection, transportation, and disposal.

Shit flow diagrams, like the one prepared for Patna, are important tools in building awareness. Improved appreciation for and commitment to FSSM at all levels must also be met with regulatory support from the government. They should provide a good operational environment and technical support to the private sector. Customers should be supported to know their options for having regular access to quality FSSM services.

A key insight from the FSTP pilot was that waste collection, transportation, and disposal can earn a small profit and draw in private enterprises. But the large expenditures – land and capital costs – involved in setting up and maintaining a treatment plant, and other important infrastructure, like transfer stations, can prove overwhelming. These costs may, perhaps, be best borne by the government

through municipal taxes. There is a strong case for evaluating the costs of supporting FSSM in a market system at the outset, based on which a plan must be made to unlock the required resources from all the different stakeholders in that FSSM market.

Certain elements of the project can be applied and practised in other parts of the world. For example, PTCs can be used as a source of revenue for operation and management of small treatment plants. Organizing informal service providers to address issues in the process of collecting, transporting, and disposing of faecal sludge is also applicable in hybrid cities where an underground sewerage system and onsite sanitation systems exist in tandem, as well as in cities with only the latter. PSI has already started replicating the model with the governments of Lucknow and Kanpur, cities in the adjacent province to Bihar.

Challenges and recommendations

There is a huge opportunity in India to support governments to unlock their existing infrastructure, much of which is currently underutilized, to accommodate FSSM for households that have onsite systems. Doing this however requires intensive advocacy efforts, rewriting of policy and guidelines, hands-on support to TOs, and education of the consumer on the need to clean onsite systems. Prasaadhan has tested the execution of all aspects of this work and as a result has identified several key challenges and recommendations:

Technology planning

Technology considerations are important for supporting the TOs' business models, but addressing those considerations are outside of the scope of what TOs can do themselves. For example, tipping points need to be technically appropriate for the emptying, tanker and transportation equipment. Transfer stations need to be positioned in key locations appropriate for TOs to remain profitable. City-wide inclusive sanitation planning efforts have to take into account the insights and data from TOs' business models for a sustainable market to exist.

Incentives for TOs

TOs need to be officially recognized as a key player in achieving city-wide inclusive sanitation and building a system for regular desludging. Addressing cost and administrative issues related to tipping, monitoring, and the transaction mechanisms (how government will monitor) are critical for creating the right incentives. This requires advocacy, planning, policy, and operations efforts and for TOs to receive support in the form of education, financing, marketing, and organization. Moving forward there are opportunities to increase responsibilities and public–private partnership opportunities for the TO Association to join forces with other associations as they emerge. This potentially paves the way towards a national association of TOs.

Monitoring

Effective monitoring systems need to be created to track TOs extraction, transportation, and disposal to the safe tipping point and ultimate treatment in the STP. It is also critical to monitor the tipping transaction and payment of the fee.

Finance

Finance considerations for both government and TOs need further exploration and remain challenges. Government will require finances to upgrade and expand systems to make the technology changes to accommodate TOs. TOs will require finance to upgrade their equipment and operations. Prasaadhan explored but did not find feasible financing options because the loan size required by TOs is larger than microfinance institutions can offer. Commercial banks are the only option and they have cumbersome qualifying parameters to be eligible for the loan. Furthermore, the equipment TOs require is customized so is usually not eligible for bank loans. Facilitation will be required with financial institutions to explore FSSM related financing mechanisms. Further exploration of other revenue generation, for example through recycling and selling water for industrial and agricultural use, will also be needed to create a sustainable system.

Collective action

Achieving city-wide inclusive sanitation requires a multitude of actors working together on a common goal with agreed measurements and constant communication. Too often in urban settings different development actors are working in their own silos – policy, advocacy, implementation, etc. – resulting in fragmented planning and results. These actors need to come together as part of a city-wide inclusive sanitation team to ensure plans and activities are supporting the common goals, addressing root causes of problems, and are not duplicative.

By addressing these challenges, engaging all actors in the market system, and continuing to push for city-wide inclusive sanitation, we can create the reality of safely managed sanitation for all.

Conclusion and key findings

1. The laying of sewer grids in a city requires huge investments and time which seems unrealistic at present in a majority of cities in India and many other countries. Therefore, prevention of faecal sludge contamination in the environment should be done by improving the service delivery of tanker operators by engaging the private sector entrepreneurs that can handle the problem without much investment. The work of engaging, organizing, and professionalizing private sector players to maximize usage of any existing treatment capacity within a city should be part of any city faecal sludge management effort. More work is required to further codify and cost this work so that the efficiency can be improved and government and development actors will invest in it.

2. In cities and municipalities where sewage treatment plants already exist and are working, faecal sludge should also be co-treated at the same place if there is excess capacity.
3. To effectively engage the private sector in faecal sludge management the most important factors are the development of constructive policies and rules that incentivize private sector participation and deliberately increasing the demand for increased septic tank cleaning through marketing and communications activities.

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