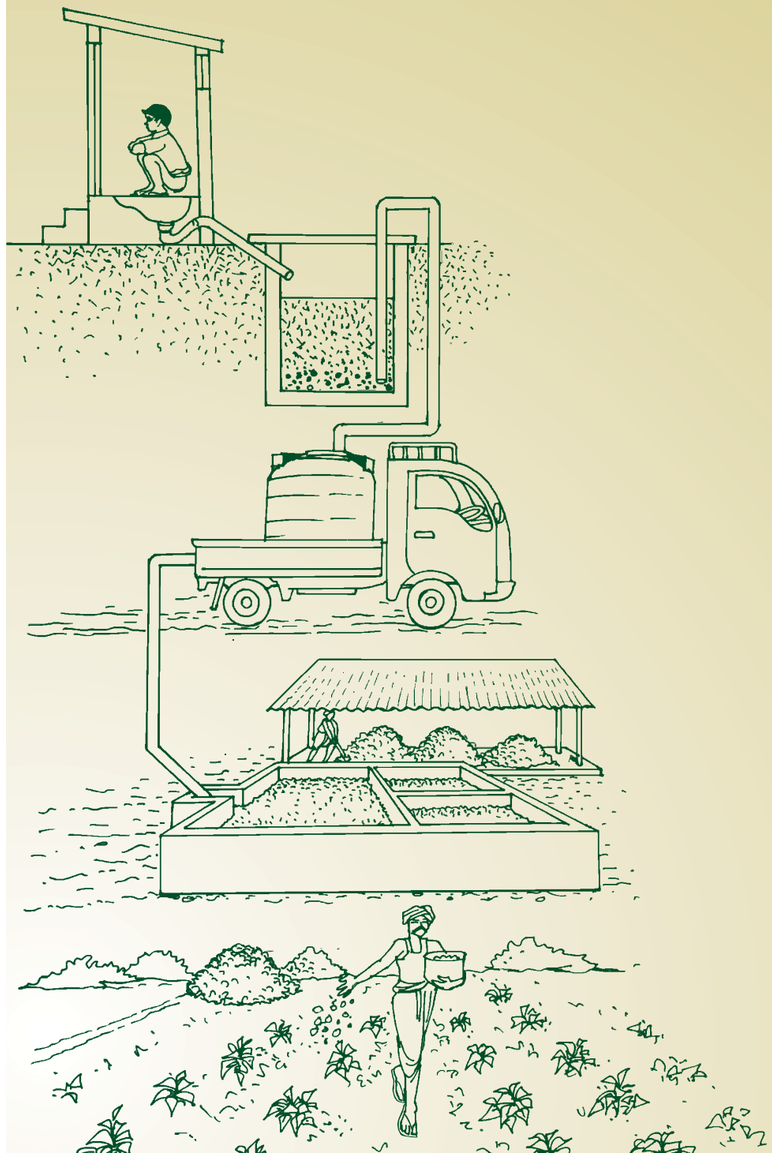
Fecal Sludge Management

A Landscape Study of Practices, Challenges, and Opportunities



A research project supported by

Population Service International

Study conducted by

Water, Sanitation and Hygiene (WASH) Institute
Kodaikanal, Tamil Nadu, India
Branch : Patna, Bihar
www.washinstitute.org

Foreword

India is slowly ensuring total sanitation coverage for all, but the path is not without hurdles. Concerted efforts over the past few decades have yielded results, but almost half (48%) of all Indian households still do not have access to proper toilets. As we move towards 100% coverage, we need to look ahead at managing the large volume of fecal sludge from the growing number of septic tanks and single pit latrines. Proper fecal sludge management (FSM)that maximizes safety and sustainability is essential and we need to develop a model that will cater to the country's future needs.

Fecal sludge comprises partially stabilized excreta and slurry from improved single pit latrines, septic tanks, as well as latrines based on other improved and unimproved technologies. Unless managed appropriately, this fecal sludge poses a huge risk to public health and the environment.

At present about 64 million Indian households must be supported with safe FSM services. Safe disposal of fecal sludge means ensuring safety while handling/emptying the sludge from septic tanks/pits and the proper transport and disposal of the removed sludge. The demand and supply services for FSM need to be assessed, along with the associated safety issues. Local bodies, both rural and urban, state governments, and the central government have a stake in ensuring that the fecal sludge is disposed of properly, in a manner that does not cause any health or environmental hazards.

Population Services International (PSI) included a detailed landscaping study on FSM issues and practices in India as part of its 'Prasaadhan' project and entrusted the study's management to the WASH Institute (WASHi). With the resources support, facilitation, and technical support from PSI and Water For People, WASHi conducted robust investigations on the issues and challenges that currently face FSM and the nature of existing FSM systems across India.

This report presents the key findings and insights from the three studies conducted on FSM — a desk review, a best practices study, and a detailed quantitative and qualitative survey. We have found that there is a viable demand for FSM and that this will grow, but unless there is regulation by governing bodies and innovation and competitive pricing by private providers the rural poor will continue to depend on the cheap and illegal services provided by manual scavengers. The insights are relevant to all stakeholders in the country's FSM space, be they state and local bodies, development partners, or others implementing sanitation programs. We also believe that this effort will spur further research to address the knowledge gaps that exist on safe FSM.

Dr. S. Shankar Narayanan
Senior Program Director,
PSI, New Delhi,
March 2015

Acknowledgement

WASH Institute is extremely pleased to have the opportunity to conduct a detailed landscaping study on the increasingly important area of fecal sludge management. We are grateful to Population Service International (PSI) for entrusting this key research project to us and extend our note to thanks to Mr. Pritpal Marjara, Managing Director, PSI, India.

We owe a big thanks to Dr. P. Mariappan, Dr. Indira Khurana, and Mr. Asit Nema for supporting the desk review of literature on FSM and bringing out strong insights.

WASH Institute also greatly acknowledges the effort of the research team that took on the difficult task of studying individual FSM practices across six states in the country and documenting eight different models. Your efforts have helped put together a rich resource for others who wish to pursue further research in this area.

We also wish to thank the Social and Rural Research Institute (SRI), New Delhi, for carrying out robust research on FSM-related community behavior and practices in the selected districts of Bihar and West Bengal and for bringing out a valuable report on the study.

The institute is also grateful to the state governments of Bihar, West Bengal, Tamil Nadu, Goa, Gujarat, Maharashtra, and Karnataka for their valuable support in facilitating this research.

We extend our thanks to Water For People/India, Dr. S. Shankar Narayanan, Senior Program Director, PSI, Delhi, Mr. Arunesh Singh, Program Director and Mr. Sanjay Singh, General Manager, PSI, Patna, for their valuable technical guidance and support throughout the study. The institute also thanks Ms. Kavita Sharma for compiling and drafting this final report.

Finally, we extend our heartfelt thanks to the people and communities who have participated in the study and without whose support we could not have completed this task.

Water Sanitation and Hygiene (WASH) Institute
Kodaikanal, India

Table of Content

Abbreviations

EMI	Equated Monthly Installment
FGD	Focus Group Discussion
FSM	Fecal Sludge Management
GP	Gram Panchayat
IDI	In-Depth Interview
NBA	Nirmal Bharat Abhiyan
O&M	Operations and Maintenance
PPS	Probability Proportional to Size
PSI	Population Services International
RSM	Rural Sanitary Mart
SEC	Socio-Economic Classification
SME	Small and Medium Enterprise
SRI	Social and Rural Research Institute
STP	Sewage Treatment Plant
ULB	Urban Local Body
WASHi	Water, Sanitation and Hygiene Institute
WB	West Bengal
WHO	World Health Organization

Introduction to the Report

Toilet construction has received more attention than maintenance across the globe. This has led to a serious deficit in comprehensive approaches to fecal sludge management (FSM) that take into account the sanitation needs of households, particularly in more disadvantaged areas of developing countries. For example, the problem is acute in India's poorer states like Bihar, where toilet penetration is less than 30 percent (Census of India, 2011). Even where toilets exist in rural areas, quality and affordable options for FSM are nonexistent, due largely to insufficient customer volume and inconsistent demand. Mechanical pit emptying is unavailable in rural areas, as the few sanitation entrepreneurs who exist operate mostly in urban areas. Sludge extraction is thus mostly performed by manual pit cleaners from marginalized communities in unhygienic conditions, despite this practice being illegal. Proper disposal of sludge is an equally critical issue and one that has significant public health and environmental consequences for the whole community.

Population Service International (PSI) has been working on health-related issues in India through interventions in WASH, malaria, child survival, and reproductive health. A consumer survey conducted for its major sanitation program, the 3SI (Supporting Sustainable Sanitation Improvements) project, identified the problem of FSM as one of the challenges reducing toilet penetration. However, neither state or non-state actors have taken any major initiatives in this regard. PSI and its partners Water For People, the WASH Institute, and Saraplast Pvt. Ltd. (a sanitation solutions provider), created a FSM project (Prasaadhan[1]) aligned with the 3SI project to explore options for FSM in rural Bihar by making pit emptying an "end-to-end" solution that includes safe disposal and possible reuse into profitable and sustainable businesses. The project aims at designing, testing, and piloting a business model that can be scaled with local entrepreneurs and enterprises to provide sustainable market solutions to the FSM problem.

[1] PSI initiated the Prasaadhan project along with Water For People, WASH Institute, and Saraplast Pvt. Ltd. in 2013. The project seeks to increase access to and use of quality FSM services for users in the 3SI target districts of rural Patna (Samastipur and Begusarai) and West Bengal (South 24 Parganas). It aims to achieve these objectives by developing an innovative business model and increasing demand for FSM services in targeted areas.

As a first step for developing this business model, PSI initiated a landscaping study of the FSM space and its challenges, issues, and practices. The landscaping study had three components — a desk review of literature; a study of existing FSM solutions and best practices; and a sample survey in three districts of Bihar and one district of West Bengal. The literature review was undertaken to develop an improved understanding of FSM issues, practices, and the ecology of de-sludging and treating the sludge globally. It has helped to critically examine the existing approaches to the problem of fecal waste. In the next step, a best practices study was undertaken to dive deep into some selected FSM models being adopted in different parts of India. The aim of this exercise was to explore existing FSM models for possible replication in Bihar. The best practices study highlighted the various factors that facilitate or hinder FSM service provision, the business economics of operating in the FSM domain, and the utility of end-to-end sanitation solutions. The study also indicated the importance of understanding the ground situation and leveraging that knowledge in developing viable and sustainable FSM solutions. The next component of study, the quantitative and qualitative sample survey, sought to develop a detailed understanding of consumer behavior, current FSM practices, and demand and supply dynamics. The survey provided key insights on consumers' current FSM practices, attitudes, barriers, and drivers and the roles, challenges, and practices of FSM service providers.

Together, the three studies have helped develop a rich understanding of FSM issues, possible solutions, and the ground situation. This report carries the details and key findings of the three studies, which represent a rigorous attempt to develop a deeper understanding of FSM from the perspective of consumers, value chain actors, and other stakeholders with the aim of developing safe, sustainable, and comprehensive FSM solutions.

1

FSM

A Desk Review

Executive Summary

Sanitation and the need to comprehensively address its varied challenges is emerging as a key priority for developing countries across the world. A recent estimate put the number of people without access to safe, clean toilets at 2.5 billion people or 36 percent of the world's population (WHO/UNICEF, 2013). The situation in India in particular is quite disconcerting. UNICEF (2013)estimates that 594 million Indians or nearly 50 percent of India's population defecates in the open. This sanitation deficit is inextricably linked to poor health outcomes; of the 2.3 million under-five children who die annually in India, 334,000 deaths are related to diarrheal diseases (WHO, 2012).

In a bid to address the issue of poor sanitation, especially open defecation, and its public health outcomes, governments and development agencies in India have undertaken major initiatives in support of fixed-point defecation, primarily through construction of on-site sanitation facilities. These initiatives have improved sanitation coverage from 1 percent in 1981 to about 47 percent in 2011 (Census of India, 2011). The increased coverage has not, however, come with suitable attention to the problem of managing fecal sludge, especially at the household level. In India's urban and peri-urban areas, as well as villages, the issue of proper FSM demands urgent attention, as improper and irregular removal of fecal sludge from toilet pits and septic tanks and its unsafe handling, transport, treatment, and disposal poses a major threat to human health and environment.

Our desk review of the limited available literature on FSM clearly points to the need for incorporating FSM as an integral component of the comprehensive sanitation strategy. It emphasizes the need for introducing a robust regulatory system for FSM at the urban local body (ULB) level, generating awareness and demand for such services at the user level, and designing business models to make FSM service provision viable for private providers. The need for FSM services exists on the ground; estimates based on Census 2011 data indicate that 64 million households in India are potential users of FSM services.

The FSM landscape is, however, characterized by knowledge deficit and lack of concern and commitment from regulators, users, and providers of FSM services. There is a clear need for a robust field study to improve the stakeholders' understanding of the key issues and the dynamics of demand and supply and strengthen advocacy for adoption of appropriate policy and legal interventions.

1.1 Background

Although the global community has made impressive strides in all walks of life, including technology and management systems, the area of sanitation continues to pose major challenges to urban planners, city managers, and rural development professionals. It is estimated that about 2.5 billion people — 36 percent of the world population — do not use safe, clean toilets (WHO/UNICEF, 2013). UNICEF (2013) estimates put the number of Indians who defecate in the open at a staggering 594 million people or nearly 50 percent of India's population. In rural India, sanitation coverage is estimated to be as low as 30 percent, which means a very large number of people in villages resort to indiscriminate and unsafe defecation practices. In urban India about 13 percent households do not have access to toilets, and over two-thirds of the remaining 87 percent do not have safe arrangements for treatment and disposal of excreta/septage/sewage (Census of India, 2011). The situation in peri-urban and hitherto unrecognized urban areas (rapidly transforming large villages) is found to be critical due to, among others, lack of requisite administrative and regulatory systems, capacities, and infrastructure.

The aggregate sanitation deficit is undoubtedly having a significantly adverse impact in terms of poor health outcomes. Around the world an estimated 1.5 million children under the age of five die annually due to diarrhoea, which is attributed to poor sanitation; the figure corresponds to 1,400 child deaths every day, more than a quarter of which occur in India (UNICEF/WHO, 2009). According to WHO (2012), 2.3 million children die annually in India before the age of five; of this about 334,000 deaths are related to diarrheal diseases. Poor sanitation is also linked to malnutrition, stunting, and learning disabilities among children.

Seeking to address the challenges of poor sanitation and its public health consequences, governments and development agencies alike have undertaken major programs to tackle the endemic problem of open defecation by changing people's behavior and inculcating the habit of fixed-point defecation. To this end, central and state agencies in India have sponsored and facilitated construction of a large number of toilets across the country. Sustained efforts over the last three decades or so have improved sanitation coverage in India from 1 percent during 1981 to around 47 percent in 2011 (urban 82 percent and rural 31 percent; Census of India, 2011). Consequently, albeit still at a low level, there is an increasing trend of toilet usage among urban, peri-urban, and rural communities in India.

The emphasis on toilet construction and usage has not, however, come with corresponding attention to the issues of FSM, especially at the household level. Improper and irregular removal of fecal sludge from toilet pits and septic tanks, unsafe handling practices, and the sludge's indiscriminate dumping into the environment are issues of serious concern and pose a significant threat to human health and environment. These problems can be avoided through proper FSM, including adequate de-sludging of sanitation facilities, proper handling and transport of sludge, and its treatment and safe disposal or reuse (Klingel et al., 2002).

In India's urban and peri-urban areas, as well as villages, the challenges of safe management of fecal sludge demand urgent attention. Improved understanding of the various issues and aspects related to FSM is a critical first step in that direction. This desk review seeks to build on the current understanding of FSM challenges, practices, and technical aspects through a brief literature survey, findings of which are shared in this report.

1.2 Study Objectives and Methodology

This desk review was the first component of a wider study design aimed at developing an improved understanding of FSM and exploring practices, technologies, and appropriate business models for service provision. A study of best practices in FSM and a qualitative and quantitative survey comprised the other components of the overall study design. The study focuses on FSM with regards to on-site sanitation systems, where handling and disposal of partially stabilized/treated excreta (called septage), is a major health issue.

The first phase of the desk review was initiated in a workshop with partners, where a detailed deliberation was conducted to facilitate a deeper understanding of the FSM project. In this deliberation, a decision was taken to conduct a literature review to enable a robust understanding of the FSM space, the challenges therein, and the ecology of de-sludging and treating the septage. Centering this main aim, the following objectives were finalized for the literature review:

- To understand the ecology of de-sludging and treating the sludge
- To understand the policy prescription and legal aspects of the FSM business
- To study the available technologies and the gaps in existing technologies
- To identify best practices

Primary selection of the relevant literature was done through a random search on the Internet. The words 'fecal sludge', 'fecal sludge management', 'manual scavenging', and 'liquid waste management' were used to search and identify the relevant published articles in national and international journals and to collect the material. Further, published policy papers and other materials on the issue of prohibition of manual scavenging, the act banning the practice, and environmental sanitation and hygiene were collected. While searching for online materials, care was taken to not select papers published prior to the year 2000 to keep the focus on more recent developments in the field.

After the initial search, the selected documents were segregated into three categories: 1) economic – related to demand-supply and the business of fecal sludge; 2) technology – related to collection, transportation, and treatment of waste and the environmental risk related to fecal sludge; and 3) policy and advocacy – related to law and legislations around liquid waste management and environment. Following the collection and classification of the selected literature, content analysis was undertaken to develop an improved understanding of FSM.

[2]Refers to the demand and supply of FSM services; the key stakeholders; and the process and business of collection, transportation, treatment, and disposal of fecal sludge, including technology options and human resources employed in the role of private players and state actors.

Overall, the available information on FSM and sludge removal and transportation services was found to be limited. Nonetheless, omission of any research or document from this desk review does not in any way comment on its existence, importance, or utility. Further, the desk review does not claim to be thematically comprehensive.

1.3 Key Findings

1.3.1. Sanitation and The Technology Options

The provision of physical structures is not the end, but only the first step in responding to the challenge of sanitation. 'Sanitation' per se refers to safe management of human excreta (including sewage and septage), including its safe confinement, collection, conveyance, treatment and disposal, and the associated hygiene-related practices. Therefore, the technology of toilets and the subsequent infrastructure is only one aspect, and the expected ultimate outcomes are defined in terms of user experience and health benefits. Successful achievement of these outcomes requires effective service delivery and operation and maintenance on the part of urban local bodies/suppliers and users, respectively. To derive lasting benefits and outcomes, sanitation requires sustained and reliable support and several upstream and downstream services. Ensuring effective intervention for safe sanitation in any community must, thus, come with appropriate measures that are incorporated in the overall scheme.

Sanitation facilities are broadly classified as on-site and off-site systems (WHO, 2002). In on-site systems, the excreta is retained, confined, and treated at the site of defecation, whereas in off-site systems it is taken away (typically through a water-based underground sewerage network) for treatment and disposal in distant sewage treatment plants. However, as this study focuses on on-site sanitation systems, let us look more closely at on-site handling and disposal of partially stabilized/treated excreta (septage), as it poses major health problems.

In on-site sanitation, the technology options are categorized (WHO/UNICEF, 2006) as 'improved' and 'unimproved', with the former offering significantly higher safety, aesthetics, and user comfort (and thus undoubtedly involving slightly higher costs). Technology options under 'improved' on-site sanitation comprise: (1) water-sealed flush toilet (connected to decentralized shallow sewer, septic tank, or single or twin leach pits); (2) ventilated, improved pit latrine with a drop hole; and (3) urine-diverting composting toilet, again with a drop hole. The options for 'unimproved' on-site sanitation arrangements comprise: (1) flush toilet discharging into the open (for example, open drain, yard, plot, ditch, etc.); (2) pit latrine with or without slab; (3) bucket latrine; (4) hanging latrine on water courses; and (5) no facilities, bush, or field — dry latrine involving handling of excreta by scavengers or animals, etc. Among the on-site sanitation technology options, only the well-constructed and operated options of 'flush toilets with twin leach pits' and 'double chamber composting toilets' do not involve handling of fecal sludge because the material that comes out after the specified idling of at least one year is deemed to have stabilized and is considered almost safe from the point of view of fecal contamination. All other options involve handling of or exposure to fecal sludge at some stage.

In the Indian context, there appears to be an overwhelming preference for better aesthetics and, consequently, on-site sanitation technology choices comprise water-sealed (pour) flush latrines connected to either the simple and low-cost single/twin leach pits or the relatively higher-cost septic

tanks (Ideas For India, 2014); the latter is the preferred option among better off households in both urban and rural areas. From the point of view of overall sustain ability, although the government-sponsored rural sanitation programs adopt the option of twin pit pour flush latrines, in most cases a single pit is provided/opted for by households due to cost considerations. Further, due to the perceived lower aesthetics and user discomfort, it has been observed that the acceptance of ventilated improved pit latrines (and for that matter the composting toilets) is almost negligible in the Indian context. Therefore, any reference to this technology option in the literature or Census 2011 data is construed as single (or twin) pit pour flush latrine.

1.3.2 Need for Fecal Sludge Removal

For reasons of economy, the substructures of household/institutional/community/public toilets are not made very large. Their capacity is designed considering, among others, a certain rate of contribution of organic solids by individual users, the expected number of users, and the rate of degradation of the organic matter; the latter depends on local geo-climatic factors. For example, areas characterized by high water table (including alluvial riverine belts, delta areas, and coastal regions) and low permeability soil warrant higher maintenance.

Looking at the needs of different technology options, in the case of pour flush leach pit toilets, the size of the perforated substructure (with 1–1.5 m depth and 1.25 m diameter) for a typical family of five to seven persons is determined considering sludge accumulation rate of 40–60 ltr/person/year for shallow and deep ground water table conditions, respectively, and pit emptying rate of once every year (Franceys et al., 1992). Notably, depending on the intensity of use and geo-climatic factors, households have reported uninterrupted usage over extended periods, ranging from two to five years.

In the case of septic tank toilets, household installations are sized from 1–4 cum considering still lower sludge accumulation rate of 25 ltr/persons/year (which is attributed to intensive biological degradation under optimal conditions) and de-sludging frequency of once in one to three years. However, depending on affordability, some house owners generally construct larger septic tanks to minimize or altogether avoid the emptying requirement. Further, given the lack of regulation and technical supervision, often the walls and floor of such 'septic tanks' are made porous to leach out wastewater. Both these practices represent irrational measures at the grassroots, which ultimately undermine the potential benefits from improved sanitation.

As regards the frequency of de-sludging of septic tanks in the Indian context, according to one study (Chowdhry and Kone, 2012) about 16 percent households reported emptying on-site toilets twice a year, 23 percent did it once a year, another 23 percent once every two years, and 17 percent once every three to five years. The remaining 20 percent reported emptying out the fecal sludge once in six to tenyears or more. As per another study (HPCIDBC, 2011) in the Kathmandu valley, Nepal, a typical household emptied its septic tank once in three to three-and-a-half years on average. In the case of larger installations, such as public and community toilets, the emptying frequency can be much higher, ranging from once a quarter to twice a year.

Timely removal of sludge is imperative if the system's efficiency in retaining solids and attenuating effluent quality is to be maintained. It is also necessary to avoid system malfunction and ensure uninterrupted service. Here, it is also important to note that for septic tanks there is another essential

maintenance requirement — the replacement/regeneration of the filter media in the soak away/drainage field; this must typically be done once every few years to avoid choking and malfunction.

1.3.3 Threat from Improper Fecal Sludge Handling and Disposal

In the context of this study, fecal sludge refers to partially stabilized excreta and slurry from improved single pit latrines, septic tanks, as well as latrines based on other improved and unimproved technologies; this fecal sludge is recognized as a risk to public health and the environment.

Besides the usual contaminants characterized by 'biological oxygen demand' and 'chemical oxygen demand', fecal sludge contains ammonia/nitrogen and phosphorus, which can adversely affect surface and groundwater quality (contrarily, due to the presence of nitrogen and phosphorus, one school of thought perceives fecal sludge as a resource for agriculture). Notably, the more serious and immediate concern is the health risk posed by pathogens, viruses, and parasites that fecal sludge harbors. Typically, it is characterized by total coliform count of 106–108/100 ml and fecal coliform count of 105–107/100 ml; bacteriophages count of 103–104/100 ml; and Helminths eggs around 4000/ltr. (Polprasert, 1996; U.S. Environmental Protection Agency, 1994; Ministry of Urban Development, Government of India, 2013).

Indiscriminate handling and disposal of such materials into the environment — in water bodies, open land, or farms — leads to contamination of drinking water sources, piped supplies, hand pumps, agriculture crops, vegetables, etc. It can infect humans and animals upon exposure and severely undermine public health. In this context, it is pertinent to highlight the serious threat posed to the health and safety of manual scavengers involved in removal of fecal sludge.

In most small towns where mechanized de-sludging devices are not available (but also in large and medium towns), fecal sludge is removed manually from pits/tanks, causing serious exposure to manual scavengers/sanitation workers and leading to, among others, skin and respiratory infections and reduced life span. In India, despite manual scavenging being banned through a recent legislation (Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013), the practice continues across the country.

In view of its multiple threats to human health and environment, effective and safe management of fecal sludge, including its removal, collection, handling, transport, treatment, and disposal, must be viewed as an integral component of a comprehensive sanitation agenda.

However, virtually no small or big municipality in the country has a regulatory system in place to address all of the various issues associated with the entire chain of operations involved in handling and disposal of fecal sludge. A recent study, supported by the Bill & Melinda Gates Foundation, mapped the urban sanitation situation in 30 cities across India and nine other counties in Asia and Africa (Chowdhry and Kone, 2012). In most cities, FSM as a service to households was found to be largely ignored by local and national governments. Both decision makers and entrepreneurs/investors lacked the necessary information on market size, business opportunity, and profitability of FSM services, which are the prerequisites for viable service provision.

1.3.4 FSM Service Requirement in India

In view of the need for regular sludge clearing and the potential health and safety threats arising from improper handling and disposal of fecal sludge, it is important to estimate the extent of requirement for

proper FSM services in India. According to the Census 2011 figures, of the 247 million households in India, about 123 million do not have toilets within the house. Of the 47 percent Indian households who report having a toilet, 55 million have installed septic tanks and 19 million have leach pit latrines. Table 1 below presents data on the number of septic tank and leach pit toilets across the country (both rural and urban areas) and in Bihar and West Bengal, the two states of interest for our study. Based on this data, a conservative estimate suggests that about 64 million household across the country and about 6 million and 8.5 million households in Bihar and West Bengal, respectively, require fecal sludge removal services.

Table 1: Estimate of potential users of FSM services (based on Census 2011 data)

Country / State	Total number (million)						Estimated households needing FSM (million)
	Septic tank			Pit latrines#			
	Total	Urban	Rural	Total	Urban	Rural	
India	55.0	30.3	24.7	19.0	5.2	13.8	64.0
Bihar	3.0	1.0	2.0	3.2	2.9	0.3	6.2
West Bengal	4.1	2.8	1.3	4.5	1.3	3.2	8.5

#The original text defines these as 'ventilated pit latrines'; however, that is not a technically correct term as ventilated pit latrines are rare in the Indian context.

1.3.5 Policy and legal Systems Required for FSM

Given the biological constituents of fecal sludge, it is seen as a bio hazard that poses serious threat to public health. In typical urban/peri-urban settings (for small and large areas alike), where the volume of daily sludge collection can be large, it is imperative that the concerned local bodies adopt robust regulatory system for the safe removal/collection, transport, treatment, and disposal of fecal sludge. An ideal arrangement would include, among others, authorization and monitoring of individual household installations; authorization and training of service providers involved in construction of septic tanks; systems and mechanisms for emptying/de-sludging of tanks and transportation of septage; monitoring and supervision of these operations; designation of sites for safe treatment and disposal; occupational health and safety measures for workers; and prohibition against disposal in water bodies, open lands, and agriculture farms.

However, as discussed in a Center for Science and Environment policy document (CSE, 2011), there is no exclusive policy or 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. Consequently, no urban local body (ULB) in the country has yet evolved its systems, let alone to a desirable level of sophistication. This can be attributed to, among others, lack of awareness, concern, or recognition of risks and lack of technical expertise. International research also points to the importance of policy support and political will in strengthening FSM. For example, a study of FSM in Madina, Ghana, pointed to the problem of weak political will, which manifested in poor budgetary allocation and low priority accorded to sanitation (Antwi-Agyei, 2009).

On the other hand, in the case of Japan, for instance, the advantage of clear policy and effective information and financial systems, coupled with people's participation and technology, are evident in

the functioning model of centralized sewerage and decentralized treatment (Ken Ushijima, 2012). About the latter, the whole issue of individual sewage treatment plants at the level of households and institutions, including for fecal sludge, is governed by the central legislation called Johkasou Law. Similarly, practices in the Manila Metro area are governed by the respective ULBs and only licensed service providers are authorized to operate.

Given India's rapid urbanization, rising population density, declining quality of urban environmental sanitation, and multiple challenges on public health front, it is essential that ULBs embrace best practices from other service domains within the country and/or from other parts of the world to address the FSM challenge. In this respect it is encouraging that in 2013 the Ministry of Urban Development, Government of India, issued an advisory on septage management, which offers a set of guidelines for ULBs and individual households; these guidelines are, however, not mandatory.

In this context, it is interesting to note the positive initiatives taken by some ULBs in India, such as, Tiruchirapalli, Musiri, and Madurai (all Tamil Nadu); Panaji (Goa); and Pune (Maharashtra). Although the systems introduced in these cities may not be addressing the entire range of sanitation and FSM issues, but private service providers have been brought in for collection and transport of septage and in one case even treatment and allied operations are regulated to a certain extent.

1.3.6 Demand and Supply of FSM Services

Households spend a very small percentage of their income on on-site sanitation. For households, the need for fecal sludge services represents an “unwanted demand” – sought only when an emergency arises and the toilet pit/tank is filled to the brim. Else, the users prefer to stretch the operational capacity of the holding tank to the maximum. This practice stems from, among others, poor knowledge about the performance of the substructure, lack of concern for the adverse impact on the environment/receiving water bodies and the public health, and lack of monitoring on the part of municipalities.

Nevertheless, with the increasing population and construction of a large number of septic tanks in areas not linked to sewerage, the absolute demand for FSM services in urban areas across the country is evidently quite high. For instance, Census 2011 estimates that nearly 30 million households in urban India are using septic tanks. Another study estimates that by 2017 about 148 million urban Indians would use septic tanks (USAID, 2010). In the small/census towns and peri-urban areas, which are characterized by high population density, relatively better socio-economic profile, and higher toilet coverage, the demand for sludge clearing from septic tanks is expected to be reasonable. However, as regards the present study's focus area in Bihar (and West Bengal), given the only 20 percent sanitation coverage, high level of dysfunctional toilets, and low usage, FSM demand in rural habitations will be rather low.

1.3.7 Prospects for Micro Entrepreneurs

Fecal sludge collection and transport as a service is generally not provided by municipal bodies in India. Consequently, these services are either outsourced or entirely offered by private service providers, who operate as an unorganized sector without regulations and government oversight. On the demand side, given the lack of mandatory or scheduled emptying of substructures, demand is not well defined and is rather uncertain. Under these conditions, the supply side is characterized by small service providers/micro entrepreneurs who typically own a single emptying vehicle. Due to the high risk perception on the part of commercial banks, the operations are generally entirely self-financed.

According to a global market study (Chowdhry and Kone, 2012) of the FSM sector, profitability is positively correlated with: (1) regulatory framework, that is, existence of local regulation on scheduled emptying; (2) size and type of the market, that is, population of the area, number of households dependent on on-site sanitation, and the opportunity to service non-domestic users; and (3) strength of the service provider and the scale of operations, that is, bundling of other services (broad basing), multi-truck operations, and the ability to perform multiple trips daily. Conversely, profitability is adversely affected by: (1) the ULB/utility offering a subsidized service; (2) greater number of trucks/service providers for the given number of installations in a city; and (3) long distances in collection and disposal. The study also determined that the private service providers often perceive profitability at the operating/gross level and do not factor depreciation, that is, the cost of replacement of trucks, etc. In some cities the ULBs/ utilities charge disposal fee, which is generally passed on to the house owners.

Given the abovementioned governing parameters of the unconventional business, it is imperative to take them into account while formulating a business model and determining the business's financial viability and sustainability.

1.3.8 Technological Dimensions of FSM

A technologically robust system of FSM is geared in such a way that it leads to almost zero exposure to FSM workers or others and almost no leakage into the environment. In such a system, the step of sludge clearing/collection is undertaken by tankers mounted on large chassis vehicles and equipped with vacuum pumping devices, with tank capacities between 15–20 m3. An innovation for congested slum localities offers smaller tanks of 1–4 m3, which are mounted on smaller 3/4 wheel chassis vehicles (Chowdhry and Kone, 2012). Vacutugs — small tanks mounted on non-motorized devices — have been introduced in some low income countries, but the experience has not been very encouraging (Opel and Bashar, 2013). Some agencies have also attempted mechanized pit emptying devices that are operated manually and involve minimal or no exposure to fecal matter. For instance, WASTE, Netherlands, introduced manual pit emptying technology (MAPET) in Tanzania in the 1980s, and Oxfam, along with the London School of Hygiene and Tropical Medicine, introduced manual de-sludging hand pump (Thye et al., 2009). However, information about the level of field application and acceptance of these innovative technologies is not available, and they have not found their way into the Indian market.

Treatment of the collected fecal sludge is a more complex issue. Septage contains a mix of partially digested sludge, scum, feces, and liquid. It is a highly variable organic waste in slurry form that often contains large amounts of grease, grit, hair, and debris and is characterized by offensive odor and appearance. Due to its composition and characteristics, it is difficult to treat fecal sludge in conventional sewage treatment plants; however, many municipalities resort to blending raw sewage with varying rates of success. In smaller ULBs where a sewage treatment plant may not exist, it is desirable to provide independent fecal sludge treatment facilities or resort to co-disposal with solid waste into well engineered sanitary landfill sites.

At the treatment plant, simple stabilization is recommended before land application to reduce levels of pathogenic organisms, lower the potential for putrefaction, and reduce odors. Among the available options, waste stabilization ponds (natural process) and lime stabilization are recognized to be the most effective and affordable (CSE, 2011; Tilley et al., 2008). Under the latter option, generally an exposure of about 30 minutes to hydrated lime (also known as quicklime, a strong alkali) is adequate to kill pathogenic bacteria. Another option is chemical oxidation, which uses chlorine gas for rapid and effective oxidation, inactivation of pathogens, and stabilization of septage. However, this is not a popular option because of associated higher cost and complexity. For emergency situations, given their high effectiveness and low-tech nature, urea treatment, hydrated lime treatment, and lactic acid fermentation are seen as promising sludge treatment technologies (WASTE, 2014).

Treated sludge is often perceived as 'manure', but given the low percentage of nitrogen and phosphorus and comparatively higher fraction of organic carbon, it is more appropriate to term it as soil stabilizer/amendment. Its application on farms is advised only under controlled conditions when it is deemed bacteriologically safe. Else, it is recommended to either dispose of in sanitary landfills or send to an incinerator. Technological innovations, however, are underway to use fecal sludge as a fertilizer, for example, optimizing the pelletization of fecal sludge-based fertilizers for agricultural use in Ghana (Nikiema et al., 2013).

1.4 Conclusion

Analysis of the limited literature on FSM clearly points to the strong need for introducing a robust regulatory system for FSM at the Urban Local Body (ULB) level and to create awareness and generate demand for such services at the user level. In the absence of such a system, the so called 'coverage' with increased construction of apparently improved and safe on-site sanitation facilities will not translate into public health benefits. Effective and safe management of fecal sludge, including its removal, collection, handling, transport, treatment, and disposal, must be seen and treated as essential components of a comprehensive sanitation strategy.

Estimates based on Census 2011 data indicate that 64 million households in India are potential users of FSM services. The domain is, however, characterized by a fair degree of knowledge deficit and lack of concern and commitment on the part of regulators, users, and providers of FSM services. A field study with sustained professional involvement is warranted to facilitate improved understanding of the issues and dynamics of demand and supply and eventually help in advocacy for adoption of appropriate policy and legal interventions. The study must assess, among others, perceptions of users, service providers, the local bodies, regulatory agencies, as well as public health professionals. Crucially, the study must also assess the scope for public private partnership and financial viability for FSM service providers.

1.5 References

Aftab Opel and M Khairul Bashar. 2013. Inefficient Technology or Misperceived Demand: The Failure of Vacutug-based Pit-emptying Services in Bangladesh. Waterlines 32 (3), 213-220.

Antwi-Agyei. 2009. Faecal Sludge Management in Madina, Ghana.

Census of India, 2011.

Chongrak Polprasert. 1996. Organic Waste Recycling: Technology and Management.
CSE. 2011. Policy Paper on Septage Management in India. New Delhi: Centre for Science and Environment.

Franceys et al. 1992. A Guide to the Development of On-site Sanitation. Geneva: WHO.

HPCIDBC. 2011. Status and Strategy for Faecal Sludge Management in the Kathmandu Valley. High Powered Committee for Integrated Development of the Bagmati Civilisation, Kathmandu, Nepal.

Ideas For India. 2014. Culture, Religion and Open Defecation in Rural North India.

Ken Ushijima. 2012. Value Network Design Approach for Sanitation System in Developing Countries – Lessons from Two Japanese Models.

Klingel et al. 2002.Fecal Sludge Management in Developing Countries. Swiss Federal Institute for Environmental Science and Technology.

Ministry of Urban Development, Government of India. National Urban Sanitation Policy.
Ministry of Urban Development. 2013. Advisory on Septage Management in Indian Cities: Preparation and Implementation of a Septage Management Sub-Plan (SMP) as a part of the City Sanitation Plan (CSP). New Delhi: Government of India.

Nikiema et al. 2013. Processing of Fecal Sludge to Fertilizer Pellets Using a Low-Cost Technology in Ghana. Environment and Pollution, 2(4):70-87.

Sangeeta Chowdhry and Doulaye Kone. 2012. Business Analysis of Fecal Sludge Management: Emptying and Transportation Services in Africa and Asia. Bill & Melinda Gates Foundation.
Thye et al. 2009. Pit Latrine Emptying: Technologies, Challenges and Solutions. EWB-UK Research Conference.

Tilley et al. 2008. Compendium of Sanitation Systems and Technologies. Swiss Federal Institute of Aquatic Science and Technology. EAWAG.

U.S. Environmental Protection Agency. 1994. Guide to Septage Treatment and Disposal.

UNICEF India. Water, Environment and Sanitation. Available at: http://www.unicef.org/india/wes.html

UNICEF/WHO Joint Report. 2009. Diarrhoea: Why Children are Still Dying and What Can be Done.
USAID. 2010. A Rapid Assessment of Septage Management in Asia: Policies and Practices in India, Indonesia, Malaysia, the Philippines, Sri Lanka, Thailand, and Vietnam.

WASTE. 2014. Emergency Sanitation: Faecal Sludge Treatment Field Trials.

WHO. 2002. Sanitation: Controlling Problems at Source.

WHO. 2012. Rotavirus Mortality in India: Estimates Based on a Nationally Representative Survey of Diarrhoeal Deaths. Bulletin of the World Health Organization.

WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP). 2013.

WHO/UNICEF Joint Monitoring Programme. 2006. Meeting the MDG Drinking Water and Sanitation Target: The Urban and Rural Challenge of the Decade.

2

FSM

A Pursuit of Best Practices in India

Executive Summary

The problem of inadequate sanitation is among the key issues India faces. Although increasing emphasis has been placed on the construction of toilets, the issue of fecal sludge management (FSM) has not received adequate attention. The problem of how the fecal sludge from the many and growing on-site facilities is to be handled requires urgent attention and action. For a comprehensive solution to the sanitation problem, FSM service provision must be built into the overall sanitation strategy. The sanitation solution promoted and adopted must be comprehensive, technologically sound, and affordable. To this end, we mapped and studied the various FSM initiatives/practices that are being employed at the local level in different parts of the country.

Our study of the select best practices in FSM service provision has pointed to the various factors that facilitate or hinder FSM business prospects and operations on the ground. The enabling factors ranged from the legislation of the act prohibiting manual scavenging to the existence of a vast market for sanitation entrepreneurs due to the poor sewerage coverage; support from authorities and the availability of sewage treatment plants (STPs); ingenuity and leadership on the part of sanitation micro entrepreneurs and service providers; and increasing environmental consciousness among users; among others. The factors that hindered FSM service provision included absence of a regulatory framework; lack of access to funds from banks or government subsidies; low toilet usage in rural areas; poor returns on investment due to the user charges being dependent on demand and not operations and maintenance (O&M) costs; inadequate focus on health and safety issues; poor capacity of staff; and the social stigma attached with the business.

Taking this improved understanding into account, an effective approach could be to develop a detailed business plan to provide an end-to-end solution based on local conditions. Overall, the study indicated that perhaps other than the end-to-end Shramik model for urban areas, as operating in Pune, no other model we studied can be called completely sustainable, in terms of meeting all the criteria for a safe sanitation solution. On that basis, we propose a comprehensive FSM model (the A to Z model), which provides an end-to-end solution — right from installation of toilets to clearing of septage, and its disposal in STPs.

2.1 Background

Sanitation is generally considered as one of the major challenges India faces. In the last three decades or so, governments and development agencies have made considerable efforts to address this issue, albeit, largely through the creation of physical structures (sanitation facilities/toilets). The urgent issue of how the fecal sludge from these on-site facilities is to be handled is in need of due consideration. Unless the issue of sanitation is addressed in entirety — from the construction of sanitation facilities to the proper removal, treatment, and disposal of the fecal sludge from the pits and tanks of these facilities — India cannot hope to have definitively put systems in place to improve sanitation and the health of its people.

For it to be sustainable, the model for FSM service provision must be viable, comprehensive, technologically sound, and affordable. In this respect, promising FSM initiatives/practices have been adopted at the local level in different parts of the country. A key component of the PSI-WASHi study has been the mapping and examination of these best practices in managing fecal sludge (collection, transportation, treatment, and disposal) being followed in India.

Findings from the study of FSM best practices are shared in this report. As the ultimate goal of the exercise was to identify the available technological options and business models for FSM and the possibility of their replication in rural areas of Bihar and West Bengal, a business model is also proposed, with detailed costing, for the consideration of rural entrepreneurs wishing to enter the FSM service domain.

2.2 Study Objectives and Methodology

The main objective of the best practices study was to collect information on the available and viable technology options and business models in FSM and the possibility of replicating them in rural areas of Bihar and West Bengal.

Exploration of the initiatives/practices in this domain helped identify 19 practices in different locations across India. The parameters for selecting best practices included economic viability, ease of operation, focus on ensuring health and safety of the operator, user friendliness, environmental soundness of the technology, and reliability, among others.

Based on the available literature, interaction with various stakeholders, and field visits, a comparative analysis was done for the 19 practices using criteria of location/coverage (urban or rural), the technology used, whether it was an end-to-end solution, management or proprietorship (state/private owned business), and uniqueness of the model. Following the comparative analysis, eight sites, spanning six states and including villages, town Panchayat, small cities, a tourist city, and a Metropolitan city, were selected for detailed study. This selection was made on the basis of end-to-end provision of service, that is, those models that provided fecal sludge collection, transportation, and treatment services. Considering the objective of the project, two models serving rural areas were also selected even though they were not providing an end-to-end solution. The eight selected models (sites) are listed in the table below.

Table 2: Selected sites for the best practices study

State	City / Village
Bihar	Muzaffarpur (villages around the city)
Goa	Panaji
Gujarat	Dhrangadhra
Karnataka	Bengaluru and Mysore
Maharashtra	Pune urban and rural models
Tamil Nadu	Musiri (town panchayat) and Trichy (municipal corporation)

The following aspects were covered during the study of FSM best practices at the selected sites: the state of sanitation; the existing services for FSM, if any; role of state/private service providers/others; legal framework, if any; technological practices; health and safety issues; business model, its viability, and access to finances; success factors and challenges; and lessons for the 'Prasaadhan' project, if any.

In this discussion, it is important to also state the limitations of the study. Firstly, business models were not available for all cases. Secondly, in most cases the business was largely not viable and the income needed to be augmented through other sources/diversification. Further, the capital cost was not taken into account for most business models. Lastly, only two rural models (Muzaffarpur and Musiri) were available; the Pune rural model has been developed but is yet to be tested on the ground.

2.3 Key Findings

The study of best practices at the selected eight sites lent our research team a clear understanding of the various dimensions of FSM service provision. Detailed case studies of the eight sites are separately available on request. To provide actionable learning, the key findings are discussed below under two main heads — (1) the success factors facilitating FSM service provision and (2) the challenges encountered in FSM service provision.

2.3.1 Success Factors Facilitating FSM Service Provision

The prohibition of manual scavenging through the Prohibition of Employment as Manual Scavengers and Their Rehabilitation Act 2013 has emerged as a major driver for the FSM sector. The act bans use of manual scavengers and makes rural and urban government bodies responsible for ensuring sanitation services. The impact of such legislation is evident in Bengaluru. The Government of Karnataka had taken an early initiative in the 1970s toward prohibition of manual scavenging and banning the carrying of human waste as head load. This initiative player a major role in generating awareness and helped in the introduction of mechanized services.

Lack of comprehensive sewerage coverage and local sewage treatment facilities create a market for FSM providers, as seen in Bengaluru, Panaji, and Pune. In all three locations, the size of market is big enough to spur growth of the sanitation business. In Pune, for example, around 10 percent of the households are without sewer connections. In the thriving metropolis of Bengaluru, the city's water and sanitation infrastructure and services have not kept pace with the explosive population growth, rapid pace of construction, and expansion of city's limits, creating a demand for informal sanitation services. In the same context, proximity to urban areas that do not have a sewerage network also drives the demand for FSM services.

The end-to-end FSM solutions approach, as offered by the Pune service provider (3S Shramik), is critical to ensure sustainability, in terms of meeting all the criteria for safety and providing a comprehensive sanitation solution. The provider generates demand for toilets, supplies the toilets, and offers services for cleaning septage from the toilets. It manufactures portable restrooms/toilets made from recyclable materials and provides total sanitation and waste management services. The service is comprehensive: right from installing restrooms in places like construction sites or cultural events to clearing and removal of septage for its disposal in the municipal STP.

Proactive support from authorities and the availability of their STPs, as in Pune and Trichy, supports private FSM operators by providing them appropriate mechanisms for the disposal of the collected septage. The Trichy Municipal Corporation, for example, permits registered private tanker operators to dispose the collected sludge into the STP of the corporation.

Ingenuity and leadership on the part of sanitation micro entrepreneurs and service providers, as seen in Pune, Panaji, Trichy, Bengaluru, and Muzaffarpur, plays an equally important role in ensuring the viability of their business. These initiatives are evident in attempts towards diversification, generating demand, understanding social dimensions, marketing strategies, adopting flexible pricing in the face of competition, and balancing revenues through other business activities. For example, the private service provider in Pune has undertaken several initiatives to generate demand, initiate behavior change, and drive toilet use. It is implementing customer-centric pricing models to address local needs and constraints, including pay-per-month (for urban slum dwellers) and pay-per-use (for festivals, concerts, and weddings). The provider is also training 'Sanipreneurs' (sanitation entrepreneurs) to manage toilet complexes.

Elsewhere too, the ingenuity of private operators is at play. An operator in Panaji, for example, generates additional income from, among others, rentals from property and shops, and running a vehicle emission control center. Similar ingenuity is seen in attempts to generate demand. In Muzaffarpur, for example, the private operator has not only attempted branding the business but also engages village cleaners to spread the word. Similarly, operators in Trichy have put up posters and even listed the business on services search website justdial.com.

Increased environmental consciousness and willingness to pay on the part of users/waste generators towards safe treatment and disposal has a significant positive impact on the business, as seen in Panaji, Bengaluru, and Pune. In Panaji, for example, users' willingness to pay relatively higher user charges, including disposal fee for treatment, plays an important role in ensuring the viability of the business and facilitating appropriate practices.

Although unique to the city, the importance of an enabling legal framework is apparent in Panaji. The introduction and strict implementation of the Goa Public Health Act 2002, prohibiting indiscriminate disposal of fecal sludge in the sea, on land, or in water bodies, gave a push to the growth of the FSM sector in the city. The Panaji case study brought forth several other factors that, although unique to the city, point to the possible drivers of FSM business. Panaji's high tourist inflow and the presence of a large number of resorts and hotels in and around the city, which do not necessarily fall in the sewerage coverage area, create a big demand for FSM services. Also to Panaji's advantage is the availability of surplus capacity at the existing sewage treatment plant and its ability to handle shock loads.

2.3.2 Challenges Encountered in FSM Service provision

Challenges to a safe, sustainable, and viable FSM business arose from multiple factors and impacted service provision at the different sites. Lack of regulatory framework and supervision were among the key hindrances in Bengaluru and Muzaffarpur. In Bengaluru, for example, although a number of areas within the city limits and those on the outside in the seven adjoining city municipal councils and one town municipal council have been dependent on on-site sanitation systems for a long time, the concerned urban local bodies (ULBs) — the Bruhut Bengaluru Mahanagar Palike (BBMP; Greater Bangalore Municipal Corporation) and the Bangalore Water Supply and Sewerage Board (BWSSB), the sanitation service provider — have not specified or introduced a regulatory framework for FSM to address issues related to its safe collection, transport and disposal. Similarly, lack of regulatory provisions and absence of municipal procedures have meant that in Panaji, the ULB, despite the introduction of the Goa Public Health Act (GPHA) in 2002, is not directly involved in the implementation of GPHA, and for that matter any regulatory aspect related to septage management per se.

Lack of access to finances from banks or government subsidies pose a major challenge to businesses, as clearly seen in Bengaluru, Musiri, and Trichy. High private lenders' and equity funding costs adversely impact the profitability of private providers. Further, user charges are dependent on demand and not on O&M costs. In Musiri, for example, the local government responsible for sanitation hires the services of private tanker operators for fecal sludge emptying and transportation. Their charge for emptying and transportation is not fixed based on operating cost but depending upon demand. In this scenario, the operators in Musiri, previously scavengers, find it difficult to repay loans. Similarly, the operators in Bengaluru find it difficult to service the loan for the tanker (for which the EMI is typically in the range of INR 30,000–40,000 per month). For the operators in Musiri and Trichy, operations are further impacted by the fact that the business area is not defined. They have neither information on nor access to a regular and defined market.

Poor returns on investment and increasing competition in the space further erode business viability. Often the providers are forced to augment their income from other sources, as is evident in Panaji, Muzaffarpur, Bengaluru, Musiri, and Trichy. The operator in Muzaffarpur, for example, has found that dependency on the pit emptying business is not viable and income must be supplemented from other sources. The operator is currently doing so by renting out JCBs and plans to enter water tanker supply business. Similarly, increasingly severe competition in Bengaluru's FSM space has significantly brought down user charges and lowered the revenues of operators. This decline in profit, coupled with the increasing coverage of the sewerage network, has most operators perceiving the business to be on the decline. Some of these operators expressed risk of discontinuing operations and desire to switch to some other business.

Several challenges arise from the operations front as well. In this regard, centralized sewage treatment plant (STP) appears to not always be the right solution, as seen in Dhrangadhra and Bengaluru. For a small town like Dhrangadhra, a centralized STP may not be viable due to cost. Safety issues pose another major challenge. Indiscriminate dumping of septage, lack of safety gear, manual handling, exposure to gases, poor understanding of safe practices among the staff working with fecal matter, and its safety for agricultural use were evident at Bengaluru, Panaji, Muzaffarpur, Dhrangadhra, and Musiri. In Panaji, for example, manual interface does take place but the pit emptying crew generally does not use personal protective gear/equipment. Apparently, there is an aversion to the use of masks and hand gloves as they are perceived to be inconvenient. The operation is poorly supervised and carries the risk of exposure to poisonous gases, fatalities from which have been reported.

Poor capacity of the staff responsible for FSM is a major factor. At the Dhrangadhra ULB, the technical staff was not aware of the regulatory or technological aspects for safe disposal of septage and the sense of helplessness was apparent. The staff disposes of the collected septage in specially constructed pits at its site, which is also used for open disposal of municipal solid waste, without any safeguards for leachate, odor, and air borne pollutants.

In the case of Bengaluru, lack of dumping area has been a big issue. Farms are either too far, unwilling to provide their land, or pay for the materials/services. In the absence of a legal regulatory and supervisory framework, the city's service providers have been free to dispose of septage as per their judgment, convenience, and cost considerations. They have been indiscriminately disposing of septage on open plots, in open storm water drains leading to numerous lakes, or on lands belonging to farmers willing to allow disposal of septage on their fields. Indiscriminate disposal of septage into open drains and water bodies across the city has resulted in cancelation of licenses of some private service providers.

The social stigma attached to working with fecal matter is another challenge for the FSM business, which is socially rated as low grade. This factor was seen to be at play in Trichy, Musiri, and Muzaffarpur. In both Trichy and Musiri, people who were previously working as scavengers were operating the tanks. Such is the level of aversion that the operator in Muzaffarpur had to set up his own lathe for manufacturing and repair of tankers as others were unwilling to touch the tankers.

Low toilet usage in rural areas also adversely impacts the scope for FSM business. In Muzaffarpur rural area, toilets had not been constructed or being used very widely. The toilets made earlier were not constructed properly, leading to non-use. Although the pace of toilet construction has slowly been picking up, lack of funds remains an issue, as the government provides funds for a few toilets at a time and not the entire village.

2.4 Proposed Business Model

One of the main objectives of the study was to assess the available business models through an examination of the documented best practices. The Pune and Muzaffarpur field visits and the economic and business detailsshared by Shramik in Pune and the private operator in Muzaffarpur helped the study team conceptualizea business model that could be tested in the field.

Thus, based on the field study and research on Ferro-cement toilets[3] and septic tanks, the following end-to-end model (called 'A to Z model') was proposed for the consideration of prospective rural entrepreneurs. The business has two components: (1) provision of toilets and (2) provision of FSM services. Under the model, 1,200 households within 25 km radius will be provided with a toilet and septic tank each along with septic tank cleaning service.

A. Key players

A tripartite agreement must be signed between the beneficiary, the state government, and the NGO/donor to prevent leakage and ensure commitment to sanitation and hygiene.

In terms of funds, the government will provide Nirmal Bharat Abhiyan (NBA) funding of INR 1.2 crore; NGO of INR 60 lakh, self-financing of INR 60 lakh, bank loan of INR 10 lakh for a commercial vehicle, and small and medium enterprise (SME) loan of INR 3.5 lakh for the Ferro-cement enterprise.

B. Assumptions

- The business includes provision of FSM services and Ferro-cement toilets (only the base, not the superstructure) and septic tanks.
- 1,200 households each will be provided with a toilet and a septic tank. The septic tanks will be cleaned once a year.
- Each septic tank will have 1,000 liter capacity.
- Cost of toilet + septic tank = INR 20,000
- Four septic tanks cleaned per day
- Rate of cleaning = INR 1,200
- Monthly payment (INR 100) from the household to the private service provider for the annual cleaning (FSM)
- Radius of operation = 25 km

[3]Based on extensive research by Auroville Building Centre (AVBC), at Auroville near Puducherry, with support from HUDCO.

C. Stages of business operations

Stage I

Entrepreneur buys a truck and sets up 1,200 Ferro-cement toilet and septic tank units in the first year.

Stage II

The entrepreneur starts FSM services and transforms his truck chassis, mounting a sludge tanker (3,500 liter) and a water tank (1,000 liter) and equipping it with other support systems like sludge pump, water pump, air compressor, etc.

D. Finances for the model

Total number of toilets to be constructed = 1,200

Capital investment cost for FSM = INR 1,000,000

Particulars	Amount (INR)
Support through NBA	12,000,000
NGO / donor	6,000,000
Beneficiary contribution	6,000,000
Bank loan for truck	1,000,000
RSM* lean @ zero interest for toilet business and FSM	350,000
Total project cost	**25,350,000**

*INR 3.5 lakh interest-free loan is available from NBA for setting up a rural sanitary mart (RSM).

E. Cost for setting up precast/modular Ferro-cement toilet and septic tank units

Particulars	Amount (INR)
Cost of one septic tank (capacity of 1,600 liters)	12,000
Toilet pan, transportation, piping, etc.	3,000
Superstructure	5,000
Total cost of toilet + septic tank	20,000
Source of funding per toilet = INR 10,000 (NBA), INR 5,000 (NGO / donor); INR 5,000 (user)	
Total cost for 1,200 toilets	**24,000,000**

F. Cost workings of the proposed FSM model

(i) Capital cost

Particulars	Amount (INR)
TATA 709 chassis	680,000
Sludge tanker, water tank, sludge pump, water pump, air compressor, mounting, etc.	270,000
Insurance, road tax, etc.	50,000
Total capital cost	**1,000,000**

(ii) Running / operations cost (monthly)

Particulars	Amount (INR)
Salary of driver (self)	16,000
Salary of assistant	8,000
Fuel coat @ INR 10/km assuming two trips / day covering 100 km/day for 25 days. (Each trip to clean two household septic tank units)	25,000
Repair and maintenance @ INR 2/km	5,000
Equipment maintenance	2,500
Disposal charges INR 50/per trip	2,500
Cleaning / house / sundries (INR 200 / household for 100 house holds)	20,000
Total cost of operations	79,000
Rounding off to	80,000
Annual FSM cost	**960,000**

(iii) Cost of capital

Loan from bank = INR 10 lakh @ 12.5 % interest

Monthly payback = INR 30,000

Time period = 30 months

(iv) Income

Particulars	Amount (INR)
Cleaning of four septic tanks in a day or 100 in a month (25 working days) @ INR 200/per household per month	120,000
Annual income	**1,440,000**

(v) Net income

Particulars	Amount (INR)
Total annual earning	1,440,000
Annual running / operating expenses	960,000
Net annual income before tax	480,000
Monthly income	**40,000**

(vi) Monthly savings

Particulars	Amount (INR)
Monthly earning for the first 30 months after repayment for loan (Including INR 16,000 salary for self)	26,000
Monthly earning after payback period(after deducting maintenance and depreciation expenses of INR 10,000 after 3 years)	46,000

2.5 Points for Advocacy

Based on the insights gained from the study of best practices across the country, the following are proposed as key points for advocacy of a more sustainable FSM business model:

1. Developing the market

A sanitation marketing analysis of the local area could help in understanding the scale of potential business, identify the effective modes of raising awareness and demand, and the best possible market strategy. It could help bring greater awareness about the O&M components and the availability of FSM services.

2. Reaching out for funds

Advocacy with funding agencies is needed to provide the new entrants with easy funding for setting up their enterprises, at least to meet the one-time capital costs.

a) Advocate with governments/banks to give subsidies/loans for setting up the business

b) Explore the possibility of using the funds under the RSM component of NBA

c) Explore funds from corporate social responsibility (CSR) initiatives

3. Tapping into existing FSM entrepreneurs

A good strategy would be to engage with the local entrepreneurs already in the business, build on their experience/expertise, and enhance their operations, perhaps with a trial project in the service area.

4. Exploring the model developed by 3S Shramik (Ferro-cement toilet + FSM services)

3S Shramik has been operating an end-to-end FSM model in six cities. The company manufactures portable restrooms/toilets made from recyclable materials and provides total sanitation and waste management services. Such a service provides a viable and comprehensive solution to the sanitation problem.

The proposed FSM model (A to Z model) has a payback period of 30 months.

5. Emphasizing on health and safety issues

Health and safety issues are largely ignored with respect to waste handling and dumping. Given the poor knowledge and awareness about safe and hygienic practices and the fatal repercussions of unsafe handling, safety takes a back seat. To overcome this challenge, the safety practices being employed by 3S Shramik in Pune and by the provider in Trichy can be adopted. These include training of vehicle drivers and other staff and fully mechanizing the cleaning process. One technology-based option is to use gear-operated compressor mounted in the tanker to mix the liquid and solid in the septic tank and sucking the septage. The emptying process must also adhere to a proper safety procedure, as employed in Trichy.

2.6 Conclusion

Our best practices study has highlight the various factors that play out on the ground to facilitate or hinder FSM service provision. Taking this improved understanding into account, an effective approach could be to develop a detailed business plan based on local conditions, perhaps using the proposed 'A to Z model'. Provision of an end-to-end solution — right from installation of toilets to clearing of septage, and its disposal in STPs — is critical to comprehensively address the sanitation problem, put in place a sustainable solution, and ensure positive public health outcomes.

Financial support would be critical for new rural entrepreneurs in the FSM space. In this regard, if the capital expenditure (capex) can be met by a donor or government agency, it would be a major support in setting up the business. With regard to toilet/septic tank units, the first component of the proposed end-to-end solution, there are companies in India that provide Ferro-cast bio-toilets and septic tanks; these could be explored for collaboration by prospective rural entrepreneurs. Further, to ensure viability of their FSM business, the entrepreneurs must also be made aware of the importance of their own ingenuity and initiative.

Equally important as the supply side is the demand side of the FSM business. Concerted efforts must be made to increase toilet usage in rural areas. Awareness and behavior change communication campaigns are required to increase users' awareness and consciousness about the need for proper FSM and enhance their willingness to pay for such services.

3

FSM

A Study of Demand and Supply Side Behaviors and Practices

Executive Summary

Notwithstanding its place of prominence in India's developmental priorities, sanitation continues to remain one of the biggest challenges the country faces today. Although the efforts to combat open defecation and unimproved toilets have succeeded in improving sanitation coverage and increased usage of improved toilets in peri-urban and rural communities, the crucial provision of FSM as a service to households has largely been ignored. Waste disposal is a big concern for rural households due to lack of connections with modern sewer systems. Proper management of fecal sludge from on-site technologies is critical for the protection of human health and environment. Presently, the rural households have few options to clear the fecal sludge and mostly engage manual scavengers for the service, resorting only infrequently to private operators using mechanized techniques.

In-depth understanding of the demand and supply side of FSM services is imperative for the development of effective, sustainable solutions to the FSM challenge. To this end, WASHi, with financial and technical support from PSI and Water For People, undertook a detailed study in selected districts of Bihar and West Bengal. On the demand side, the study sought information on the current practices, barriers, drivers, and attitudes towards FSM. The supply side focus was on getting information about the various FSM service providers, their roles, and the challenges in providing fecal sludge disposal services in rural areas.

The study was conducted among households that were already using single pit toilets or septic tank toilets in three selected districts of Bihar (Patna, Samastipur, and Begusarai) and one district of West Bengal (South 24 Parganas). It captured community behavior and practices relating to demand and supply of FSM services through personal interviews (questionnaire surveys), 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, laborers involved in the service, Gram Pradhans (village heads), Nirmal Bharat Abhiyan (NBA) officials, and government or private sludge treatment plant operators.

The study's first set of findings pertain to the current practices in installing, using, and clearing the single pit or septic tank toilets that require fecal sludge disposal once the pit or tank is full. Although there were differences across states and the type of toilet, overall a majority of the households constructed the toilets using their own resources and less than a tenth of the sample could avail government support for this purpose. This is a gap the government must address, as the lowest socio-economic category households' need for outside support for toilet construction is apparent. The type of toilet constructed largely correlated with the socio-economic category of a household, with the financially better off favoring septic tank toilets. Looking at how much the household toilet was being used, the findings are largely encouraging, especially with regard to the women's access to the household toilet, but the comparatively lower percentage of toilet usage by children raises concerns. Overall, at least 4–10 people use the toilets regularly in most households; high usage levels, especially of single pit toilets, significantly reduce the time interval between sludge clearing.

One of the most critical and somewhat expected finding is about the widespread use of manual scavengers for fecal sludge clearing. More than half of the respondents reported using manual laborers for the service. Given that a significant number of respondents did not answer the question about who clears the sludge and the new users have not availed the service so far, it is entirely plausible that the proportion of people using manual scavengers for fecal sludge clearing may be much higher than is currently reported. As such, private operators appear to be only small players in rural areas, and their use broadly correlates with the financial well being of respondents, possibly due to their higher charges. Notably, government agencies were found to have a negligible presence in FSM, a finding of key relevance to the long-term sustainability of FSM solutions.

The study also lent some important insights into customers' knowledge, attitudes, and perceptions about toilets and FSM. In terms of users' perceptions about the utility of toilets, while a majority (79 percent) reported finding their toilets effective, issues of frequent maintenance and difficulty in clearing sludge emerged as major reasons for discontent among those who did not see their toilets as effective. Respondents' awareness about where the sludge is disposed of was highly disparate, and a tenth of the sample even considered it an acceptable or prescribed practice to dump the sludge in a water body. Poor knowledge levels are a matter of grave concern and strongly indicate the need for awareness drives on sanitation and FSM issues.

Overall the study firmly established the need for improvement in FSM, with a clear majority (96 percent) of respondents across categories saying that FSM is in need of improvement. A majority considered the existing FSM infrastructure potentially harmful to themselves and their families and linked poor sludge disposal to health problems. Frequent and timely sludge disposal, together with proper construction of toilets and better service after construction of toilets, were seen as important to improve FSM.

Examination of customers' service requirements and expectations shows that a majority of the households see the government as the best bet for providing FSM services. Private operators come second in the minds of respondents, and a majority is willing to pay private operators for the service. However, the amounts they reported being comfortable paying are very low, indicative of the limited purchasing power of residents of rural and poor regions and their disinclination to spend on what they see as non-essentials. Hence, a private operator who wishes to start a service in rural area would perhaps need to price it so that it is affordable to the poor. Qualitative examinations as part of the study also revealed that people are willing to pay small amounts at regular intervals instead of a large amount at one go. Private players could, thus, explore an equated monthly installment (EMI) type of pricing structure.

On the supply side, manual scavengers and private operators dominate the FSM landscape. Government agencies have hardly any presence and require fulfillment of procedures, which are considered cumbersome and not very cheap. A majority of households call on the nearby-located relatively cheap manual laborer(s) when an emergency arises and the pit or tank is filled to the brim. Although private operators are perceived to offer higher quality service, using trucks/tankers and a mechanized approach to clear the sludge, most customers see them as a very expensive option. Further, there is poor availability of proper FSM vendors/operators in rural areas. There is hardly any private player dedicated to the rural sector. For private operators, all of whom are based out of cities, the costs increase if they have to travel the extra distance when a rural customer asks for their service. The extra costs are passed on to customers, making the service unaffordable to

most. Another important finding pertains to the unsafe sludge disposal practices of private operators. Most operators dispose the sludge in some barren land or in nearby water bodies, primarily to save on the cost of transporting the sludge to the STP, where present, and to avoid paying the STP for treating the sludge.

To conclude, the study has clearly shown that rural households currently have little demand for private providers' FSM services. The major barriers to demand are financial constraints, lack of knowledge/awareness, and unavailability of proper vendors in rural areas. There is, however, already a clear appreciation among customers of the need to improve FSM, and understanding about the requirements of frequent and timely disposal of sludge, financial support, proper construction of toilets, and better service after construction of toilets. If the existing barriers can be broken and requirements met, the demand for private providers' FSM services will increase and fecal sludge disposal and management in rural areas will take place in a timely and efficient manner.

The existing private operators or entrepreneurs who seek to enter the rural FSM sector must keep these barriers in mind. Pricing is the key, and if they can offer the services at lower prices, comparable to manual scavengers, then the demand for their services, considered by customers to be of higher quality, will increase. Further, use of some innovative pricing structures like EMIs could bolster the demand for their services in resource-constrained rural areas.
Also of great importance is the need to persuade private providers to adopt proper sludge disposal practices. Among rural communities as well, there is a clear need for building awareness about sanitation and FSM issues. Awareness building and behavior change communication campaigns could leverage mediums like television and mobile phones, which have substantial reach in rural areas.

3.1 Background

Sanitation is a critical component of India's development paradigm. Inadequacies in sanitation infrastructure, services, and practices are linked to a host of negative consequences for people's health and well-being. The WASH for India program estimates that India's sanitation crisis leads to nearly 1,000 children dying daily of diarrhea; 25 percent women reporting violent sexual assault while going to defecate in the open; 25 percent girls dropping out of school; and 6 percent loss to India's GDP. The negative environmental consequences of poor sanitation are equally far reaching, including degradation of surface water bodies and contamination of groundwater resources.

Given the importance of sanitation to human and environmental health and well-being, the Government of India has made efforts to improve sanitation coverage across the country. It is encouraging to note that sanitation coverage in India has increased from 1 percent in 1981 to over 60 percent in 2013[4]. The trend of increasing toilet usage is evident among peri-urban and rural communities. One of the most critical barriers preventing such uptake previously was the availability of suitable waste collection and disposal technology. Safe management of fecal sludge continues to remain a major challenge, as the provision of FSM as a service to households has received little attention.

The toilet technology choices today vary from simple, low-cost pit latrines to high-cost septic tank models. Both single pit and septic tank toilets require timely clearing, as the fecal sludge needs to be removed after a certain duration, depending on the size of the pit or tank and the usage. In the case of pit toilets, although the rural sanitation campaign focuses on building twin pit toilets, the capital investment required at the time of construction forces households to build only single pit toilets. The average depth of these pits varies from 3–6 ft. While the water from these pits leaches out into the ground depending on the geographical and climatic conditions of the area, the sludge gets accumulated in the pit itself. This makes it necessary for the pits to be emptied out at an interval ranging from three to six years depending on the number of users in a household. In the case of septic tanks in peri-urban and rural areas, the sealed tanks rule out any possibility of leaching, making it important to empty the tank at frequent intervals. Given the rural areas' lack of connections with modern sewer systems, waste disposal continues to remain a big concern. Presently, the rural households have few options to clear the fecal sludge and mostly employ the services of manual scavengers. Services of private operators using mechanized techniques are used only infrequently.

In-depth understanding of the demand and supply side of FSM services is crucial for developing effective, sustainable FSM solutions. To this end, WASHi, with financial and technical support from PSI and Water For People, conducted a detailed study of the demand and supply of services around FSM. Social and Rural Research Institute (SRI), part of IMRB International, supported the study and offered its services for conducting the research. This report presents a concise picture of the methodology and key findings from the study.

[4]Based on 1981 Census data and NBA reports

3.2 Study Objectives and Methodology

The study of the demand for and supply of FSM services at the customer front was conducted in three selected districts of Bihar (Patna, Samastipur, and Begusarai) and one district of West Bengal (South 24 Parganas). The objectives the study, its research design, project implementation, and ethical considerations are discussed in detail in this section.

3.2.1 Objectives of the study

The study was undertaken with the following stated objectives:

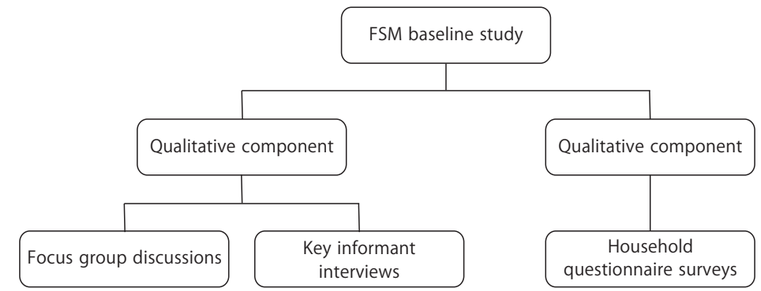
- Mapping end consumers' behavioral practices relating to FSM and demand for improved services
- Identification/mapping of service providers (right from collection to disposal), covering technical and human resources and economic aspects of FSM services
- Conducting/organizing focus group discussions (FGDs) among men, women, and adolescent girls to map the social norms around FSM, including gender roles
- Conducting in-depth interviews (IDIs) with various key stakeholders to understand the issues, opportunities, and challenges for effective FSM services

3.2.2 Research Design

3.2.2.1 Research methodology and tools

The research methodology and tools for the study were designed in view of the abovementioned objectives. The study consisted of two main components — quantitative and qualitative. The quantitative component involved conducting a household survey using a structured questionnaire. The qualitative component involved FGDs with the general population and IDIs with key stakeholders. The data from these various sources was sought to be triangulated to arrive at the findings of the study.

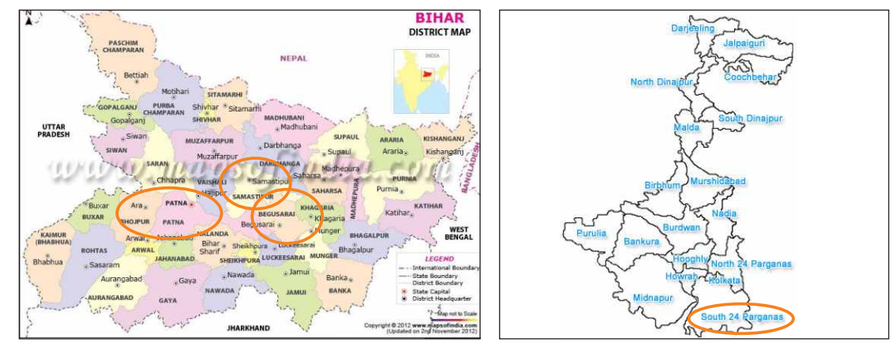
Figure 1: Research design for the study



3.2.2.2 Geographical coverage

Three districts from Bihar (Patna, Samastipur, and Begusarai) and one district from West Bengal (South 24 Parganas) were pre-decided as they were the core areas for the study. Hence, the states and the districts were purposively sampled.

Figure 2: Geographical coverage of the study



3.2.2.3 Target respondents

Given the objectives of the study and the variety of tools employed, a number of target groups were approached to gather the requisite information. The key target groups are listed below.

- The household quantitative survey component sought to target the following:

General population respondents, defined as any person above 18 years of age who fulfills the following criteria:

- The respondent must be the primary provider of healthcare needs in the family (head of household or primary care giver of children).
- The household should be using a single pit or septic tank toilet.

Apart from households, the following respondent groups were also covered through different data collection activities:

- Key village leaders and members, including Gram Pradhan, and other decision makers
- Pit emptying service providers (private operators using mechanized techniques)
- Corporation/municipal officials
- Laborers involved in fecal cleaning services (laborers working with private operators)
- NGOs working in the field of manual scavenging
- Related NGOs (those involved with issues of sanitation in general)
- Sanitary Inspectors
- State Nirmal Bharat Abhiyan (NBA) Coordinator/Director
- Community toilet operators

3.2.2.4 Sample size

The sample size for the quantitative survey was 800 respondents, that is, 200 from each of the four districts. The breakup of the sample is shown below.

State	District	No. of Villages	Personal Interviews per Village	Total Personal Interviews
Bihar	Patna	20	10	200
Bihar	Samastipur	20	10	200
Bihar	Begusarai	20	10	200
West Bengal	South 24 Parganas	20	10	200
Total		**80**	**10**	**800**

In each of the selected rural villages and urban wards, information about private providers was gathered by speaking to key informants from random intercept points, providing a complete picture of the sampling point and, thereby, leading to the development of sampling frames.

Sample size for the qualitative component of the study is presented below.

Action	Respondent	Total (4 districts)
Focus Group Discussion (Gram Panchayat (GP) level	Male	20
	Female	
	Key village members (decision makers like Gram Pradhans and elderly people)	
Key Informant Interview (GP level)	Pit emptying service providers (private operators using mechanized techniques)	25
	Corporation / municipal officials	
	Laborers involved in FSM services (laborers working with private operators)	
	Gram Pradhans	
Key Informant Interview (District level)	NGOs working in the field of manual scavenging	14
	Community toilet operators	
	Sanitary Inspectors	
	Related NGOs (those involved with issues of sanitation in general)	
Key Informant Interview (State level)	NGOs working with manual scavengers	4
	State Nirmal Bharat Abhiyan Coordinator / Director	
Total Qualitative Activities		**63**

3.2.2.5 Sampling methodology

A multi-stage systematic random sampling method was used to sample respondents for the study. The method is briefly described below.

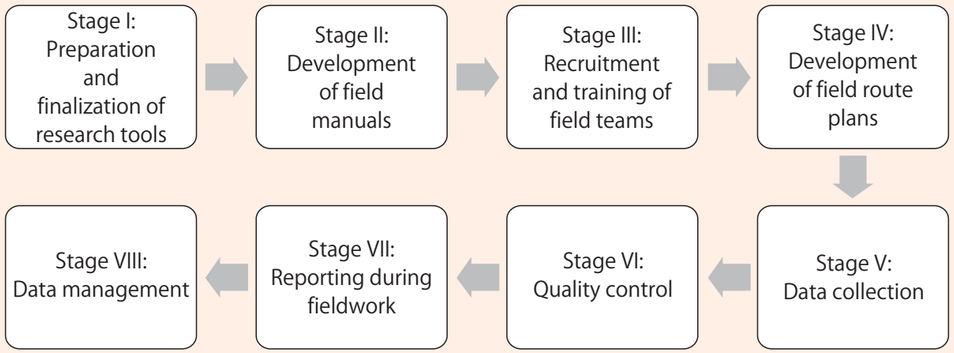
- In the first stage, the two states of Bihar and West Bengal as well as the four districts were selected as per the study requirements.
- In the second stage of sampling, for each selected district, rural villages were selected based on probability proportional to size (PPS), in a proportion equal to the district's urban/rural population distribution. It was decided that the villages chosen must have a population of at least 5,000 people.

The households within the primary sampling unit (PSU) were randomly selected, using the right hand rule. The interviewer went to a household, and if a prospective respondent was satisfied and gave his/her consent, the interview was conducted.

3.2.2 Project Implementation

The flowchart below illustrates the various stages of project implementation. These stages are briefly described ahead.

Figure 3: Stages of project implementation



Stage I: Preparation and finalization of research tools

- Development of research tools

Research tools for the study were drafted based on program indicators. A total of one quantitative questionnaire and 11 discussion guides were designed, as listed below.

1. Household survey questionnaire
2. Discussion guide for FGD at the village level
3. Discussion guide for corporation official at the village level
4. Discussion guide for Gram Pradhans at the village level
5. Discussion guide for laborers involved in FSM services at the village level
6. Discussion guide for pit cleaning operators at the village level
7. Discussion guide for community toilet operators at the district level
8. Discussion guide for NGOs working with manual scavengers at the district level
9. Discussion guide for related NGOs at the district level
10. Discussion guide for Sanitation Inspectors at the district level
11. Discussion guide for NGOs at the state level
12. Discussion guide for state NBA coordinators at the state level

All the research instruments were developed by a team of researchers under the direct supervision of the project leader. The tools were finalized based on findings of the pilot exercise and the areas of information.

- Translation of research tools into local languages

The draft research tools were translated into Hindi and Bengali and reviewed by a team of reviewers to ensure accuracy of translations. The Hindi research tools were prepared for administration in Bihar and the Bengali research tools for use in West Bengal.

The translation process was completed in two stages. The research tools were first translated from English to Hindi and Bengali. They were then translated back from Hindi and Bengali to English in order to ensure translation quality. This two-stage process ensured that there was no loss of information during the translation of research tools to local languages. The research tools were bi-lingual, so as to maintain standardization across languages as well as to support quality checks at the time of data collection and data entry.

- Pre-test/pilot test of research tools

After the finalization of their first draft, the research tools were pre-tested in rural areas around Patna. Pre-testing helped improve the research tools in the following areas:

- Flow of questions
- Comprehensiveness in terms of information coverage
- Appropriateness of skip patterns and instructions for field investigators
- Ease in recording responses and the appropriateness of response codes
- Understanding of translations
- Length of questionnaire and the impact of questionnaire length on response clarity and respondent fatigue
- Logistics planning for data collection, based on observations during the pre-test exercise

Based on the experience of the pre-test exercise, the research tools and the study protocol were modified and finalized in consultation with PSI.

Stage II: Development of field manuals

Manuals for training purposes were developed with the primary objective of standardizing interpretations across geographic locations. The field manuals included the following sections:

- A brief introduction to the study, its purpose, and objectives
- Introduction to the specific components of the study
- Survey design (flow chart of activities)
- Detailed sampling methodology

- Ethical considerations and instructions for conducting field work
- Canvassing of the questionnaire and coding related instructions
- Scrutiny instructions
- Overall field work plan

Stage III: Recruitment and training of field teams

- Team structure

The field teams' structure was designed keeping in mind the need to ensure reliable and valid data collection. Each field team therefore consisted of one supervisor overseeing four field investigators.

- Training of field teams

The field teams recruited for each state were trained through an extensive training session to ensure that the investigators were fully adept at administering the survey tools, adhering to the study protocol, and explaining the background and objectives of the study to the respondents. Trainings were conducted in a participatory manner, and trainees were given adequate practice in scrutinizing the filled-in questionnaires. Due emphasis was placed on the importance of informed consent and ethical considerations during the training.

Stage IV: Development of field route plans

Prior to the start of the fieldwork, the state coordinators developed route plans for the movement of data collection teams across the selected enumeration centers. These route plans were adhered to by all data collection teams.

Stage V: Data collection

Data collection began once the teams reached the assigned sampling units for administering the questionnaires. The overall process is described in brief below.

After training and selection of field surveyors, a detailed field plan explaining the teams' field movement was developed and shared. The field plan included the following steps:

- **Step 1:** On arrival in the village, the field team was required to draw a detailed map of the entire village with the help of key informants in the village, such as Panchayat members, senior citizens, school teachers living in the area, or any other responsible member of the society who was familiar with the area. This map allowed the team to get a reliable estimate of the number of households in the village.

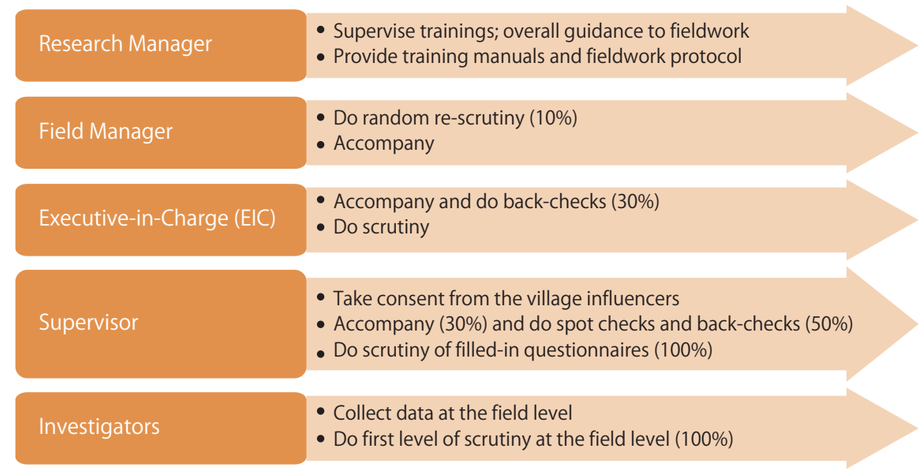
- **Step 2:** Ten households were chosen at random, and those matching the selection criteria were interviewed after they gave their consent.

- **Step 3:** The same selection criteria was used to select respondents of male and female categories for FGDs. Key members of the village were chosen for the third category of FGD. Also, the Gram Pradhans of some villages were chosen for interviews.

Stage VI: Quality Control

The data collected from the field passed through several different levels of scrutiny before data entry. At the field level, the quality control mechanism had a five-layered structure, as presented below.

Figure 4: Five-layered structure to ensure quality control



At the base, the investigators had the primary responsibility of interviewing the respondents and filling in the questionnaires for data collection. The first level of scrutiny (100 percent) of the questionnaires was done by the Investigator before leaving the respondent to ensure that all questions were answered and marked appropriately.

The questionnaires were then handed over to the Supervisor, who carried out 100 percent re-scrutiny of these questionnaires. The Supervisor also accompanied the interviewers for 30 percent of the interviews and ensured that the questions were being asked as per the desired quality standards.

The following methods were used to ensure data quality at each level:

- **Scrutiny:** Investigators, Supervisors, and the field executive in-charge inspected each and every question in each completed questionnaire for coding and logical checks.
- **Accompanying:** The Supervisor, EIC, and Field Manager attended interviews with the Investigator to ensure that the Investigator was comfortable with the flow of the questionnaire, in putting forward the questions as they should be, and in recording the responses correctly.
- **Back-checks:** These were done after an interview had been completed and the questionnaire reviewed by the Investigator and handed over to the Supervisor. The Supervisor visited the same respondent and ensured that the respondent had indeed been interviewed. The Supervisor also asked key questions from the questionnaire to ensure correctness and accurate recording of responses.

Stage VII: Reporting during fieldwork

The field work was constantly monitored, and the field progress report was shared on a regular basis, right from the initiation stage to the completion of field work.

Stage VIII: Data management

Processes for data entry and analysis began as soon as the research tools were designed. The finalized questionnaire(s) was handed over to the analysis team, where the analyst in charge of data management assigned column positions to each question for data entry, data validation, and tagging purposes. This helped the data entry operator relate the column position with each question. Thus, even in a flat data file, it became possible to locate the field position of the data once it was entered.

After the receipt of filled-in and scrutinized questionnaires from the field, they passed through several stages, like scrutiny at the data entry level, data coding, data entry, and cleaning before running data analysis.

3. 2.4 Ethical considerations

The following ethical considerations were observed while conducting the study:

- **Informed consent/assent:** The study warranted a free and fair execution of each respondent's right to know the purpose of the Investigator's visit. The Investigator clearly informed the respondents about the nature and purpose of the study, and took prior consent of the respondents before interviewing them. In some cases, as in case of female farmers, the consent of the husband was also taken. For caregivers under 18 years of age, the interviewer sought verbal informed assent from the caregiver as well as verbal informed consent from an adult in the household, such as husband, parent, or mother-in-law.
- **Freedom to terminate the interview and to not respond to questions:** Respondents were given complete freedom to not respond or to terminate the interview at any point during the course of the interview. Participation in the survey was voluntary, and all respondents were presented with an opportunity for non-participation if they did not feel comfortable.
- **Privacy and confidentiality:** Interviews were conducted in a safe setting and privacy of the respondents was maintained. Respondents were informed that although their names were recorded, they would not be disclosed, and only the information (based on their responses) would be shared with others.
- **Respect and dignity of the respondent:** The investigators, moderators, recruiters, and researchers were respectful of the rights and dignity of all respondents.
- **Addressing power imbalance:** The respondents were treated as being engaged in a process, and not mere information givers. Gender roles and cultural factors were taken into account while conducting the fieldwork.

3.3 Profile of Sample Households

Before we proceed to the findings of the study, it would be pertinent to first consider the background characteristics of the study population so as to contextualize their responses. Seeking to improve this understanding, information about the respondents' education, socio-economic status, and other demographic details is provided below. It should be noted that since there was only one district from West Bengal, the state data is to be considered equivalent to the district data.

Age and gender

As can be seen in the Table 1 below, about two thirds of the respondents were male, with the male percentage being far higher in West Bengal (83 percent). This is understandable given the nature of the subject under study, as there is greater involvement of the men of the household in decision making on FSM.

Table 1: Gender of respondents

Figures in %	All	States		Districts			Type of Toilet in Bihar	
		Bihar	WB	Patna	Begusarai	Samastipur	Single Pit	Septic Tank
Base (n)	802	597	205	198	199	200	211	384
Male	66	60	83	57	58	66	58	62
Female	34	40	17	43	42	34	42	38

Information about the age of the respondents is important to establish their decision-making credentials. Table 2 below shows the fairly normal age distribution of the respondents covered by the study, with the bell curve peaking between 35–45 years or the prime earning age. No significant difference was noted across states or districts in this regard. The mean age of 43 years suggests that the respondents in question were key decision makers in their households.

Table 2: Age of respondents

Figures in %	All	States		Districts			Type of Toilet in Bihar	
		Bihar	WB	Patna	Begusarai	Samastipur	Single Pit	Septic Tank
Base (n)	802	597	205	198	199	200	211	384
18-25 years	10	11	7	11	12	11	10	12
26-35 years	23	24	20	25	21	28	25	24
35-45 years	27	26	30	26	26	26	29	24
46-55 years	18	18	20	15	21	18	18	18
56 years and above	20	20	19	23	20	18	17	22
Mean age	43	43	44	43	43	42	42	43

Family status

The family status of the respondents is important to further establish their role as decision makers in their household.In the study, the majority of respondents across all centers were found to be currently married (87 percent). Less than 10 percent reported that they had never been married. See Table 3 for details.

Table 3: Marital status of respondents

Figures in %	All	States		Districts			Type of Toilet in Bihar	
		Bihar	WB	Patna	Begusarai	Samastipur	Single Pit	Septic Tank
Base (n)	802	597	205	198	199	200	211	384
Never married / Single	7	7	7	6	9	6	6	8
Married	87	86	89	86	83	90	89	85
Separated/ divorced	0	0	0	0	1	1	0	0
Widowed	5	6	3	8	7	4	5	7

Further, 95 percent of those who reported being married also had at least one child. While this data point allows us to suggest homogeneity of the sample to some extent, it also indicates that the respondents' views and decisions on FSM and sanitation will impact the different members of the household. Table 4 provides district-wise breakup on this aspect.

Table 4: Whether respondents have children

Figures in %	All	States		Districts			Type of Toilet in Bihar	
		Bihar	WB	Patna	Begusarai	Samastipur	Single Pit	Septic Tank
Base (<n)	747	556	191	187	181	188	199	355
Yes	95	95	96	95	96	94	94	94
No	5	5	4	5	4	6	6	6

Social category

Although the respondents' social category, viz., religion and caste, is as such relevant only in some measure and is primarily used to understand the sample spread, it becomes rather important to consider when dealing with a subject like sanitation and waste disposal. Given the historical and ongoing struggle against caste-based manual scavenging, the social category of a person becomes a pertinent indicator of his/her other views. Information about the respondents' social category is presented in Table 5 below.

Understandably, a majority of the respondents reported being from the 'general' category. Bihar had a significantly higher percentage of respondents belonging to other backward classes than West Bengal. In Bihar, more households from the general category were using septic tank toilets (55 percent). Whereas the 'others' category households, those belonging to other backward classes, were mostly using single pit toilets (44 percent).

Table 5: Social category of respondents

Figures in %	All	States		Districts			Type of Toilet in Bihar	
		Bihar	WB	Patna	Begusarai	Samastipur	Single Pit	Septic Tank
Base (n)	802	597	205	198	199	200	211	384
General	51	51	50	45	56	53	45	55
Scheduled caste	17	9	41	10	10	7	10	8
Scheduled tribe	2	1	7	0	1	1	1	0
Others	30	39	1	44	33	40	44	36

Here, it is also important to establish the religion of the sample and understand the conformity of this sample with the state figures.As seen in Table 6, a majority of the covered households were Hindus in their religious persuasion. The district in West Bengal had the highest number of Muslim respondents (31 percent), considered a reasonable proportion given South 24 Parganas district's proximity with the Sunderbans and the Bangladesh border. In Patna, the number of Hindu respondents was extremely high (98 percent). Among the Muslims respondents in Bihar, the use of single pit toilets was slightly more (17 percent) than septic tank toilets (11 percent).

Table 6: Religious persuasion of respondents

Figures in %	All	States		Districts			Type of Toilet in Bihar	
		Bihar	WB	Patna	Begusarai	Samastipur	Single Pit	Septic Tank
Base (n)	802	597	205	198	199	200	211	384
Hindu	81	86	67	98	82	79	82	88
Muslim	18	86	67	98	82	79	82	88
Christian	0	0	0	0	1	0	0	0
Sikh	0	0	1	0	1	0	0	0

Socio-economic categorization

As the final component of the respondents' household profile, this section looks at the indicative proxies for socio-economic category. The two indicators considered here for socio-economic classification[5] (SEC) are education and house structure, which would allow us to gain at least a perfunctory understanding of the socio-economic status of the respondents as well as the feasibility and barriers in installation of toilets. Table 7 below presents data on the education level of respondents.

Overall, the education level of the sample showed a fairly normal distribution, with a bulge toward the middle. However, there were spikes on either ends, with close to 20 percent respondents who were illiterate and close to 15 percent who had at least a Graduate degree. The number of septic tank users rose as the education level increased — 20 percent of the septic tank users were Graduates/Post-Graduates, while the percentage of Graduates/Post-Graduates stood at only 9 percent among single pit users. Also, a higher percentage of single pit users were illiterate (27 percent), compared to septic tank users (15 percent).

[5]SEC classification is done based on two variables: education of the chief wage earner (head) of the household and the number of consumer durables owned by the family. There are 12 grades in this system, starting from A1 to E3. It divides the population into three classes: upper most segment of the consuming class (A1, A2, and B1); middle segment (B2 and C); and the lower most segment (D, E1, and E2).

Table 7: Education level of respondents

Figures in %	All	States		Districts			Type of Toilet in Bihar	
		Bihar	WB	Patna	Begusarai	Samastipur	Single Pit	Septic Tank
Base (n)	802	597	205	198	199	200	211	384
Illiterate	18	19	13	24	20	14	27	15
Semi-literate (no formal schooling)	6	6	6	6	8	5	8	5
Schooling for up to 4 years	7	3	18	3	4	3	5	2
Schooling for 5-9 years	26	21	39	16	22	26	22	21
Senior Secondary /Higher Secondary	25	27	19	28	25	29	22	30
Attended some college but not Graduate	3	4	0	7	4	2	5	4
Graduate / Post-Graduate (General)	13	16	4	16	14	20	9	20
Graduate / Post-Graduate (Professional)	2	3	0	2	4	3	1	3

Looking at house structure, as detailed in Table 8, a majority of septic tank users (77 percent) had pucca[6] houses, compared to a much lower percentage for single pit users (39 percent). In fact, majority of the respondents using single pit toilets had semi-pucca houses (53 percent). Thus, it is clear that septic tank technology is more likely to be installed by those who are financially better off, and it seems to require a pucca construction of the house. It is also evident that the South 24 Parganas district, known as one of the poorest regions in the country, is significantly worse off than the Bihar districts in terms of structures of residences, with more than half of the South 24 Parganas respondents living in kuccha[7] houses. This factor could have a bearing on the plans for expansion of individual technologies in each of these districts.

[6]Refers to structures that are designed to be solid and permanent
[7]Usually refers to small, simple one-story mud structures

Table 8: Structure of the house

Figures in %	All	States		Districts			Type of Toilet in Bihar	
		Bihar	WB	Patna	Begusarai	Samastipur	Single Pit	Septic Tank
Base (n)	802	597	205	198	199	200	211	384
Kuccha	16	3	54	3	6	2	8	1
Semi-pucca	31	33	25	26	39	34	53	22
Pucca	53	64	20	71	55	65	39	77

3.4 Key Findings

This section presents the key findings of the study from both the demand as well as the supply side of FSM services. It covers the respondents' current practices, awareness levels, and expectations on issues pertaining to sanitation and FSM, their media usage, as well as the supply side dynamics playing out on the side of FSM service providers.

3.4.1 Current practices

The study covered households that had installed one of the two types of toilets — single pit or septic tank toilets. The household toilet's usage pattern, the respondents' satisfaction with their toilet, and their sludge clearing practices are indicative of the drivers and barriers for adoption of the technology and have important implications for FSM. This information about rural households' current habits and infrastructure in rural areas is vital for designing sustainable business models for the rural sector and improving sanitation. In this section we will discuss the current practices of the households with regard to toilet usage and management of fecal sludge.

First and foremost, it is important to consider the break-up of the sample by the type of toilet installed. Thus, while the overall sample is split in the middle by the type of toilet installed, more than half (60 percent) of the respondents from Bihar had installed the septic tank toilet. In West Bengal, on the other hand, a very high percentage of respondents (91 percent) owned a single pit toilet. There was, of course, a clear correlation between the SEC status of a household and the type of toilet, given the price differential and the relatively higher cost involved in constructing septic tank toilets. Thus, the presence of single pit toilets declined steadily from 73 percent in the case of SEC E to 6 percent for SEC A. See Table 9 for details.

Table 9: Type of toilet installed

Figures in %	All	Bihar	WB	SEC E	SEC D	SEC C	SEC B	SEC A
Base (n)	802	597	205	165	235	186	153	63
Single pit	49	35	91	73	61	47	26	6
Septic tank	51	65	9	27	39	53	74	94

One of the key constraints in installation of toilets is the cost of construction. Although the government offers financial support under certain schemes for this purpose, the uptake of these schemes is not well established. As seen in Table 10, a majority of the toilets in the current sample were constructed by the households themselves, using their own resources (89 percent). This percentage is higher in Bihar than West Bengal, further establishing the trend evident from the previous table, where the Bihar sample seems more socio-economically stable than its West Bengal counterpart. Notably, despite the fact that the septic tank toilet is relatively more expensive than the single pit toilet, more households used their own resources for setting up septic tank toilets than in the case of single pit toilets.

The clearest indication of poorer families needing support from outside sources can be seen from the correlation between SEC status and the support sought. In the study sample, only around 73 percent of the respondents from SEC E category (lowest socio-economic classification) built the toilet in their house from their own pocket, compared to 100 percent for SEC A category respondents. The percentage of self-financed toilet construction steadily increased as the SEC level increased. Less than a tenth of the sample had availed government support. However, the government is still seen to play a role in construction of toilets, especially for poorer households. The percentage of respondents who sought government support for constructing toilets was higher for SEC E (16 percent) and SEC D (11 percent). Overall, despite the comparative difference, the number of households seeking or receiving government support for toilet construction was quite low, and the poorest households still had to pay for constructing their own toilets.

Table 10: Who constructed the toilet

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	SEC E	SEC D	SEC C	SEC B	SEC A
Base (n)	802	597	205	211	384	165	235	186	153	63
Self-financed	89	91	82	80	97	73	87	94	97	100
Government	8	8	7	19	2	16	11	5	1	0
NGO	2	1	7	1	0	8	1	0	1	0

One of the major concerns for improving sanitation in rural and peri-urban locales, where open defecation percentages are high, is that despite the availability of toilets, usage may be low in some cases due to a variety of factors. In this study, given that a majority of the households had spent their own money in installing the toilets, it would be interesting to note their usage pattern. The initial data on toilet usage in sample households is presented in Table 11 below.

In a majority of cases, about 4–10 people used the toilets regularly. In a significant number of cases (19 percent), more than 10 people were seen to be using the household toilet. Given the basic nature of the technology, especially for single pit toilets, such high usage could significantly reduce the time intervals between sludge clearing. There were no major differences in this trend across the various sample categories, except in the case of West Bengal, where on average fewer people tended to use the toilet than in Bihar. This could, of course, be due to the size of the households.

Table 11: Number of members using the toilet

Figures in %	A	State		Gender		Age					SEC				
		Bihar	WB	M	F	15-25	26-35	36-45	46-55	>56	E	D	C	B	A
Base (n)	802	597	205	531	271	83	186	216	147	161	165	235	186	153	63
1 -3	11	9	17	11	12	12	10	7	13	14	7	13	17	8	6
4 -6	37	36	43	37	38	41	39	43	38	27	42	40	36	31	35
7 - 10	32	35	26	33	31	31	37	32	28	32	33	31	27	37	40
>10	19	21	14	19	18	16	15	18	21	26	18	17	19	24	19

Here, it is equally important to understand whether each member of the household was able to use the toilet or whether usage was restricted to some members. Understanding access to toilets is especially relevant with regards the female members of the households. The next three tables present information on this aspect.

As Table 12 shows, female members in almost all the households were reported to be using the toilet in their house. A complete 100 percent of the West Bengal households reported usage by all female members; the figure stood at 98 percent for Bihar households. The type of toilet did not have any bearing on toilet usage by female members. The percentage was almost consistent across SEC categories as well. Notably, in around 3 percent of the SEC A category households, all the female members were not using the toilet present in their house.

Table 12: Do all female members use the toilet?

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	99	98	100	98	98	98	100	98	99	97
No	1	2	0	1	2	2	0	2	1	3

Similarly, the percentage of all male members of the household using the toilet was high overall (96 percent). As with usage by female members, here also West Bengal emerged as a better performer despite the mostly socio-economically weaker households in the state sample. The figure for toilet usage by all male members was 100 percent for West Bengal households, whereas Bihar reported 5 percent households where all male members were not using the toilet in their house. This could be of some concern over the long run. Toilet usage by male members was found to have some link with the type of toilet in the household. For single pit toilets, around 91 percent of the households had all male members using the toilet present in their house, compared to a figure of 97 percent for households with septic tank toilets. This difference could likely be due to an awareness of the limited span of time within which the toilets need to be emptied. See Table 13 for details.

Table 13: Do all male members use the toilet?

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	96	95	100	91	97	93	97	96	98	97
No	4	5	0	9	2	7	3	2	2	3

In terms of toilet usage patterns, of even greater importance is the usage by children, who are more prone to diseases like diarrhea that are directly associated with open defecation. In what is a finding of concern, the study has shown that the percentage of children using the household toilet was much lower than that for adult members. Only about 84 percent households had all the children using the toilet present in their house, compared to 96 percent for all male members and 99 percent for all female members. While this proportion was flat across all categories, it was lowest among respondents belonging to SEC C and SEC A (78 percent for both). Also, more than 5 percent of the respondents in the SEC A category did not respond to this question at all. Data on this aspect is presented in Table 14 below.

Table 14: Do all children use the toilet?

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	84	83	86	85	81	88	85	78	86	78
No	8	7	9	6	8	6	8	11	5	8
No Response	2	3	0	3	3	2	1	2	3	6

Following the discussion on family members' toilet usage, the next important piece of information pertains to the clearing of the fecal sludge from the toilet in the house. The means and regularity of fecal sludge clearing can have a clear impact on usage over a period. The next few tables present information on the current practices relating to FSM.

One of the most critical, if not entirely surprising, finding from the study (see Table 15) was that most respondents reported using the services of manual scavengers to clear the fecal sludge from household toilets. More than half of the total respondents and over 60 percent respondents from West Bengal reported this practice. Private operators were only small players in the rural FSM landscape, while government agencies had a negligible presence. A broad correlation existed between the use of the relatively more expensive private operators and the respondents' SEC category, suggesting that hiring of private operators is a function of a household's financial well-being. The lack of government agencies in this area is a matter of concern, as it has a bearing on the sustainability of FSM methods.

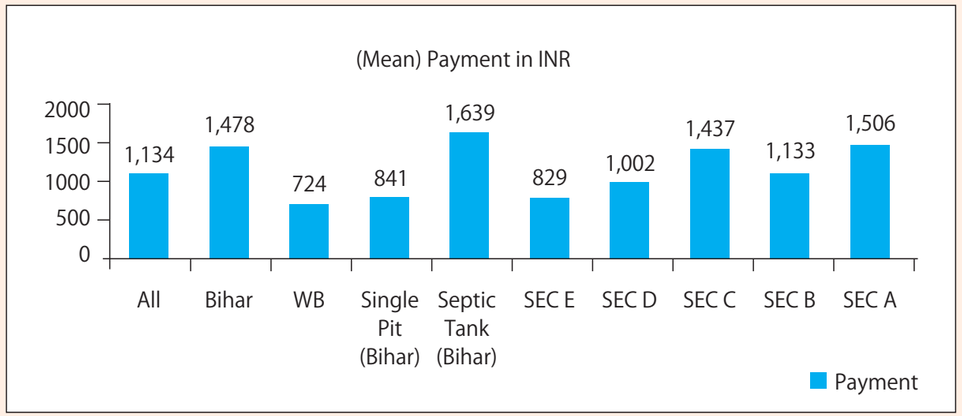
It must be noted here that the question about who clears the sludge was only applicable to those who had undertaken fecal sludge clearing in the past. The overall trends are also likely to hold for the new customers seeking this service in the future. It is also important to note that overall 15 percent respondents did not give any answer to this question; the 'no response' percentage was higher in Bihar. It is, thus, entirely plausible that the proportion of people using manual scavengers for fecal sludge clearing may be much higher than is currently reported.

Table 15: Who clears the sludge

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	168	83	85	19	64	37	50	40	26	15
Private operator	13	13	13	5	16	14	12	10	12	27
Government agency	1	1	0	5	0	0	0	3	0	0
Manual scavengers	55	48	62	63	44	57	62	58	46	40
Self	2	2	1	5	2	3	0	3	4	0
No response	15	28	4	21	30	11	8	18	27	27

To understand whether the cost involved is a barrier in clearing the sludge and, more importantly, in hiring an agency for the purpose, the study examined the average last payment made by the respondents for clearing the sludge from their household toilets. See Chart 1 for details. The average last payment made was INR 1,134 (about US$18), but a big difference was noticed between the average last amounts paid in Bihar (INR 1,478 or about US$23) and West Bengal (INR 724 or about US$11). The different could be attributed to the much larger percentage of septic tank users in Bihar, unlike West Bengal where almost all sample households used single pit systems. This factor becomes evident again when we compare within Bihar the last payment made by households with single pit toilets versus the households with septic tank toilets. While the average last payment by single pit toilet users in Bihar was INR 841 (about US$13), septic tank users had paid INR 1,639 (about US$26). As expected, a similarly large difference was noted between the payments made by SEC E households (INR 829 or about US$13) and SEC A households (INR 1,506 or about US$24).

Chart 1: Last paid amount for sludge clearing



Equally important to this examination are the current practices regarding fecal sludge disposal. One of the most productive ways of disposing of fecal sludge is to use it in making natural fertilizers like manure. While this option is not relevant to all users, especially those residing in urban areas, the utility of this approach could be very high for farmers and those involved with the agricultural sector. Before we examine whether the respondents were using the fecal sludge in this manner, it is important to first contextualize and understand the proportion of agricultural workers in the study sample.

As Table 16 shows, more than half (61 percent) of the respondents were involved in farming. The percentage was lowest for SEC E and highest for SEC A. Between the two states, Bihar had a higher percentage (64 percent) of households involved in farming, compared to West Bengal (54 percent). Given the direct impact of landholding on a household's SEC status, the direct correlation between SEC category and involvement in farming is understandable. Let us now look at what proportion of the sample was using fecal sludge as manure.

Table 16: Whether involved in farming

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	61	64	50	54	71	40	54	63	80	87
No	37	35	41	46	28	56	43	33	20	11

Among the 487 respondents who reported being involved in farming, only 7 percent were using fecal sludge as manure. The percentage was highest for SEC E category, where 17 percent of the households were using fecal sludge as manure. The low overall percentage points to the need for greater education and awareness about the ways in which waste can be put to use. See Table 17 for details.

Table 17: Whether fecal sludge is used as manure

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (<n)	487	385	102	113	272	66	126	118	122	5
Yes	7	3	23	4	3	17	6	9	2	7
No	92	97	75	96	97	82	94	91	97	93

3.4.2 Perception, attitude, and knowledge

The previous section examined the current practices of the study sample with respect to installing, using, and clearing of their household toilets. It raised some pertinent questions about the respondents' awareness and attitudinal inclination about the technology and its utility. These factors can be significant drivers or barriers in the uptake and continued use of toilets. This section delves deeper into the respondents' current knowledge levels, attitudes, and perceptions about toilets and FSM.

In terms of sludge disposal, a majority of respondents (69 percent) believed they were aware of how sludge is disposed. Between states, a higher percentage in Bihar (73 percent) claimed to be aware of how sludge is disposed, compared to West Bengal (55 percent). The percentage was marginally higher for Bihar households with septic tank toilets (76 percent) than those with single pit toilets (68 percent). See Table 18 for details.

Table 18: Awareness of sludge disposal

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	69	73	55	68	76	64	68	63	78	75
No	30	25	43	30	22	32	30	34	22	25

As for the method of sludge disposal, a majority (61 percent) believed that the sludge is dumped in a nearby pit, while about one-fourths (31 percent) said that sludge is taken to a sewage disposal unit. The state-wise data was highly disparate, with the percentage of respondents answering that sludge is taken to a sewage disposal unit at only 2 percent for West Bengal, compared to 39 percent for Bihar. Conversely, a higher percentage of West Bengal respondents (84 percent) believed that sludge is dumped in a nearby pit than the Bihar respondents (54 percent). Around 43 percent of the SEC A category respondents answered that sludge is disposed in a sewage disposal unit; the comparative figure was 22 percent for SEC E respondents. Notably, a majority of SEC E category respondents (68 percent) believed that sludge is dumped in a nearby pit.

Interestingly, 6 percent of the total respondents believed that some farmer buys the sludge and stores it as manure, while 10 percent overall said that sludge is dumped in a nearby water body. The fact that a tenth of the sample considers it an acceptable/prescribed practice to dump the sludge in a water body is a matter of grave concern and draws attention to the need for awareness building on sludge disposal. See Table 19 for details.

Table 19: Awareness of sludge disposal methods

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (<n)	550	437	113	144	291	106	159	118	120	47
It is taken to a sewage disposal unit	31	39	2	31	43	22	27	34	38	43
It is dumped in a nearby pit	61	54	84	63	50	68	65	64	53	40
Some farmer buys it and stores it for using it as manure	6	6	6	3	7	7	5	5	7	5
It is dumped in a nearby water body	10	12	4	12	12	6	6	11	18	13

Given the need to scale up sanitation coverage programs as well as to ensure sustained usage of toilets, it is important to understand users' perceptions about the utility of toilets. Data on this point is provided in Table 20 below.

Overall, a majority (79 percent) of respondents reported finding their toilets effective, with Bihar reporting a higher percentage (85 percent) than West Bengal (63 percent). As Bihar has a higher proportion of septic tank users, the state sample's higher satisfaction level suggests that septic tank toilets may be more effective than single pit toilets. This is further borne out by the fact that in Bihar itself, many more households with septic tank toilets (92 percent) found their toilets to be effective, compared to households with single pit toilets (71 percent). A similarly significant difference in the perceived effectiveness of toilets was noted based on SEC status, with SEC A category percentage at a high of 94 percent, significantly more than SEC E percentage of 65 percent. This difference could again be attributed to the fact that SEC A households had been able to spend more on constructing better (septic tank) toilets. Thus, the type of toilet could have a major impact on its perceived effectiveness.

Table 20: Whether the toilet is effective

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	79	85	63	71	92	65	74	84	91	94
No	20	15	37	28	7	34	26	16	9	5

Of great import in this discussion are the reasons for discontent among those who did not see their toilets as effective, as that could have a direct bearing on future program activities. These reasons have been examined in Table 21 below.

Most respondents who saw their toilets as being ineffective believed that the toilet was not constructed properly (61 percent), followed by the problem of the toilet needing frequent maintenance (41 percent) and the difficultly in clearing the sludge (33 percent). The role of the type of toilet again comes into play. In Bihar, a greater number of single pit toilet users (73 percent) felt that their toilets were not properly constructed, compared to septic tank toilet users (54 percent). The frequency of maintenance activities emerged as a major concern for septic tank toilet users, while sludge clearance was a big issue for single pit toilet users. Improper construction was, however, the primary complaint for both types of toilets. It must be remembered, though, that construction issues are not necessarily a function of the toilet itself, but of its installation quality. There is a clear need to ensure proper construction of toilets, even when there is limited money available. The function of money in this aspect, however, was evident from the inverse correlation between SEC status and reporting of improper construction (73 percent for SEC E and none for SEC A).

Table 21: What issues make the toilets seem ineffective

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (<n)	163	88	75	60	28	56	60	30	14	3
Not properly constructed	61	67	55	73	54	73	62	50	50	0
Need frequent maintenance	41	32	52	28	39	21	47	60	43	100
It is very difficult to clear sludge	33	32	33	38	18	23	37	43	36	0

While a majority of the respondents believed their own toilets to be effective, the same did not hold true when they were questioned on whether there was scope for improving the toilets in the locality. Data on the respondents' response to this question is presented in Table 22 below.

An overwhelming percentage (97 percent) of respondents across all categories believed that the toilets in their locality needed improvement. The figure was constant across all segments, be it by state, type of toilet, or SEC category. This sentiment points to the significant scope for improvement, even when accounting for people's general desire for improvement in local infrastructure.

Table 22: Whether toilets in the locality needed improvement

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	97	97	98	97	97	96	97	97	99	94
No	3	3	2	2	3	4	3	2	1	6

In order to decipher these responses and understand whether they reflect only the general will and desire for improvement, the respondents were asked whether they considered the current state of the locality's toilets to be harmful to the health and well-being of the people in the area. Their responses are presented in Table 23 below.

A significant percentage (80 percent) of respondents felt that the current state of toilets could cause harm to them. This belief was held most firmly in Bihar (83 percent); West Bengal reported the same sentiment, albeit at a comparatively lower percentage (73 percent). This finding clearly suggests the urgent need for improvement in toilets beyond the generic demand for infrastructure improvement.

Table 23: Whether the current state of the toilets can cause harm

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	80	83	73	84	82	79	80	80	82	76
No	20	17	27	16	18	21	20	19	17	24

Having taken specific feedback on the issue of toilets and related sanitary concerns, the study also tried to capture the respondents' overall understanding of the more overarching concept of sanitation. To this end, the respondents were questioned on their current understanding of the problems that they considered as being related to sanitation. Some of the findings on this aspect are presented in Table 24 below.

A multiple response question that sought to identify the associations that respondents make when they think of sanitation found that a majority of respondents (63 percent) associated sanitation with garbage disposal. Although not wrong, the overwhelming response associating sanitation primarily with garbage disposal suggests that people are still concerned about the basics of urban sanitation. More than half of the respondents (51 percent) identified drainage facilities as another key area of concern; this finding is critical as this is one area where sustained governmental effort would be necessary and where urban infrastructure development has lagged behind in most parts. Only one-fourths (25 percent) of the respondents had mentioned toilets as a sanitation concern, indicating the need for generating greater awareness on the link between sanitation and toilets. This data was fairly stable across categories and, thus, indicative of the general views held by a large section of people.

Table 24: Problems perceived as being related to sanitation

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Solid waste management	35	32	42	38	29	37	34	33	35	37
Closed and cleanliness of toilets	25	21	39	19	22	32	26	27	18	21
Garbage disposal	63	67	54	63	68	55	65	66	63	71
Drainage Facilities	51	55	38	55	55	44	45	49	58	76
Lack of clean water	34	34	35	33	35	38	27	37	35	43

As seen in Table 25, when questioned specifically on management of fecal sludge, a clear majority of respondents (96 percent) across categories believed that FSM needed to be improved. This response was consistent across states and categories, including SEC. Given that it is an infrastructural issue impacting everyone, irrespective of socioeconomic status, the need for improving FSM was firmly established by this response.

Table 25: Whether fecal sludge management was in need of improvement

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	96	95	97	95	96	97	97	96	93	95
No	4	4	4	4	4	2	3	4	7	5

When asked whether the FSM infrastructure as it exists today could potentially harm them or their family, a significant percentage (88 percent) said they believed so. This percentage was much higher for Bihar (93 percent) than West Bengal (75 percent). Given that the South 24 Parganas district is close to the Sundarbans region and replete with water bodies and greenery, it is possible that the people living in this region feel less affected by inadequate FSM infrastructure, which usually manifests as open drains, etc. Interestingly, the SEC category did not have any significant impact on this belief. See Table 26 for details.

Table 26: Whether the current FSM infrastructure could cause harm

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	88	93	75	96	92	89	86	88	93	87
No	9	4	24	2	5	9	13	10	5	8

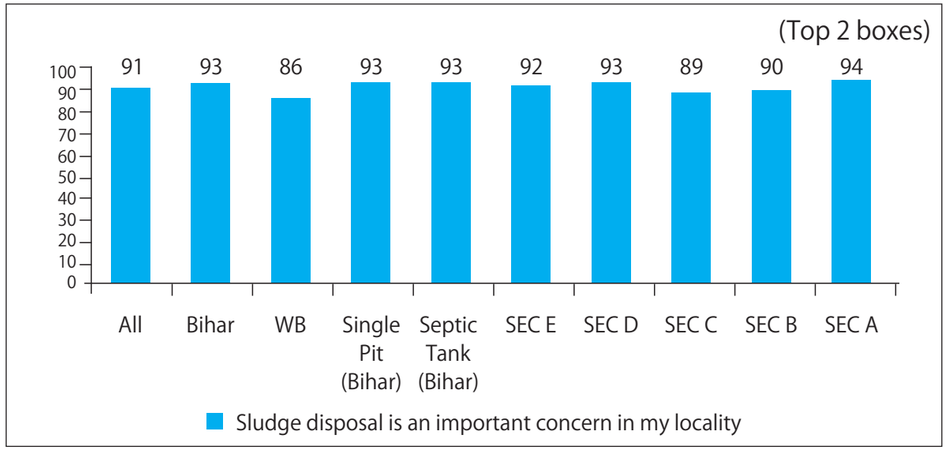
When asked about improper FSM's possible ill effects on health, a high percentage of respondents mentioned diarrhea (76 percent) and malaria (71 percent) as the major consequences, followed by cholera (51 percent). In Bihar, most respondents (80 percent) felt that malaria spreads due to lack of proper FSM; the comparative figure for West Bengal was lower (43 percent). In West Bengal, half of the respondents (50 percent) linked dysentery with improper FSM. When it comes to SEC, a major difference was found in the case of diarrhea, with most from SEC A (94 percent)linking it to improper FSM, compared to a lower percentage from SEC E (68 percent). During the qualitative study also, many respondents mentioned malaria and diarrhoea as the major health problems associated with improper FSM. See Table 27 for details.

Table 27: Health hazards due to lack of proper FSM

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Diarrhoea	76	78	71	80	77	68	74	76	82	94
Cholera	51	54	44	54	54	43	44	58	59	63
Dysentery	21	12	50	13	11	28	21	24	17	8
Typhoid	18	16	25	8	20	13	14	21	24	22
Stomach complications	20	13	41	14	13	24	20	20	17	16
Malaria	71	80	43	77	82	67	68	69	76	84
Dengue	16	18	9	18	18	14	16	14	15	25

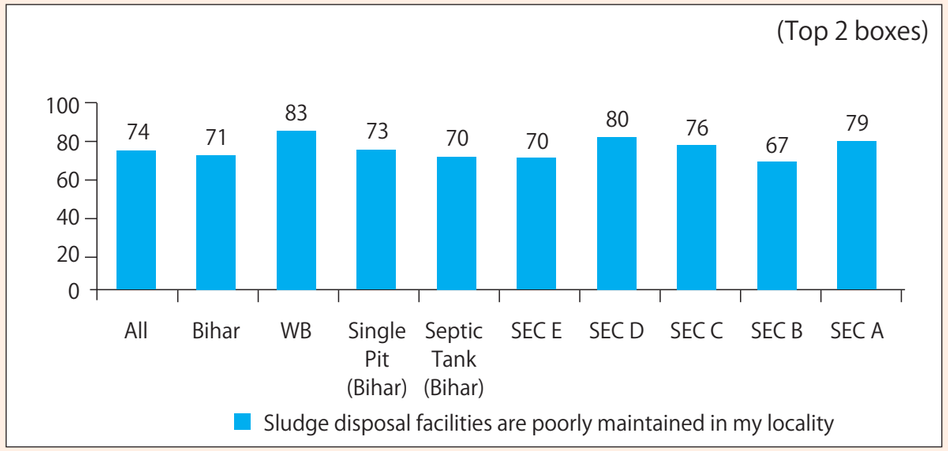
A majority of the respondents (93 percent from Bihar and 86 percent from West Bengal) considered sludge disposal an important concern in their locality. The findings here are presented in Chart 2 in the form of top 2 box percentages on a 5-point scale question; this effectively means that all respondents who agreed or strongly agreed with a series of statements were counted and their percentage presented here. Hence, Chart 2 shows as top 2 box percentages the figures for all those who agreed with the statement that sludge disposal facilities were poorly maintained in their locality.

Chart 2: Sludge disposal is an important concern in my locality



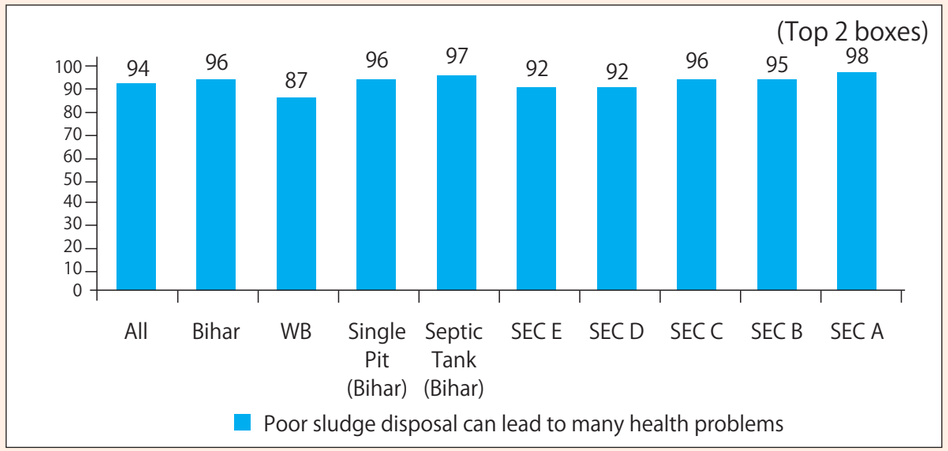
Overall, a majority (74 percent) of respondents felt that sludge disposal facilities were poorly maintained in their locality. The figure was slightly higher in the case of West Bengal (83 percent) than Bihar (71 percent). See Chart 3 for details.

Chart 3: Sludge disposal facilities are poorly maintained in my locality



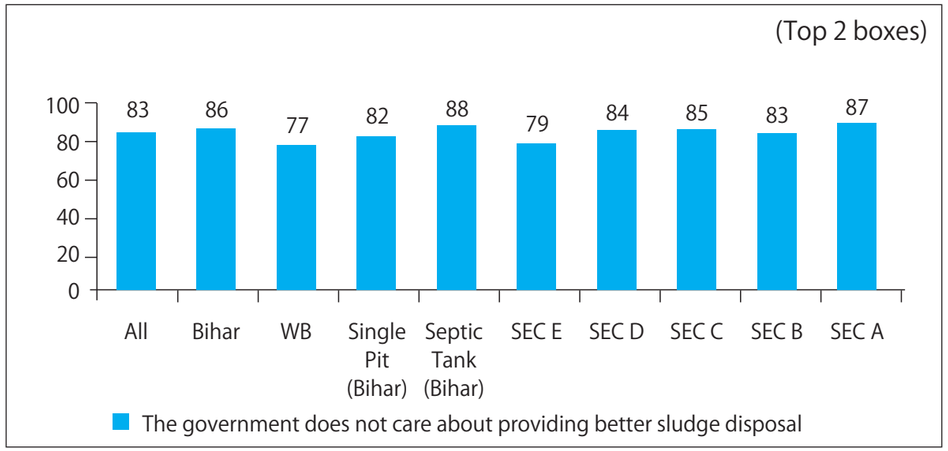
A majority of respondents (94 percent) agreed with the statement that poor sludge disposal can lead to many health problems. Even though the figures on this count appear encouraging, the sample households had taken very few actions for sludge disposal or adoption of proper sanitation habits. These findings, presented in Chart 4, once again point to the need for bolstering people's awareness.

Chart4 : Poor sludge disposal can lead to many health problems



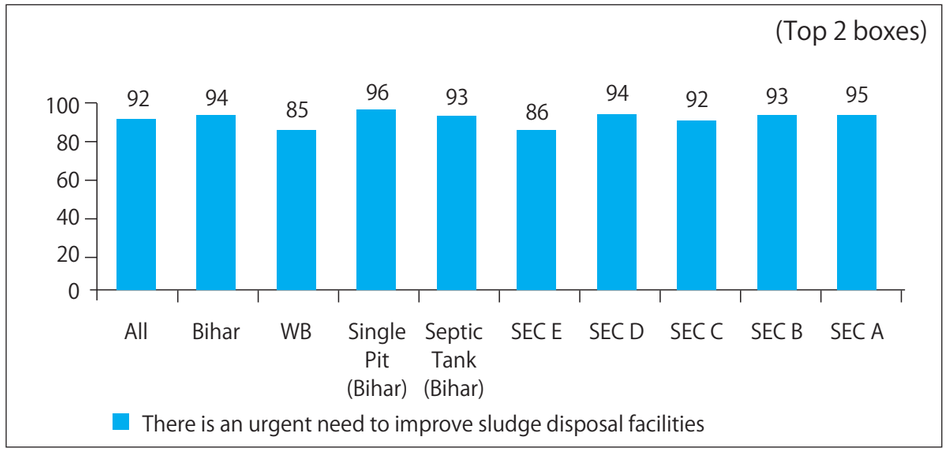
Given that FSM is a key component of the urban infrastructure that the government is charged with providing, it is important to understand whether people see the government as doing enough. As seen in Chart 5, the study data seems to indicate a negative sentiment on this count. A majority felt that government does not care enough about providing better sludge disposal services. This percentage was higher in Bihar (86 percent) than West Bengal (77 percent). SEC E respondents showed a little more trust in governmentactivities, with 79 percent of them saying the government did not care enough, compared to 87 percent SEC A households reporting this sentiment.

Chart 5: The government does not care about providing better sludge disposal services



In line with the other findings on this issue, a clear majority (92 percent) of the sample households also believed that there was an urgent need to improve FSM facilities. See Chart 6 for details.

Chart 6: There is an urgent need to improve sludge disposal facilities



Nonetheless, how much action the respondents themselves would take on this issue remains in doubt. This aspect is elaborated in Table 28 below.

Although a large majority had reported that they saw the current FSM infrastructure as lacking and in urgent need of improvement, an equally large majority also reported that they had not been involved in any activities on the issue. Here, SEC A (10 percent) emerged as the category with the highest number of reportedly active respondents. As only a small proportion of respondents reported having been part of any activities on this issue, the nature of those activities becomes largely secondary and difficult to verify.

Table 28: Involved in any activity to improve FSM

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	5	6	5	4	7	5	5	5	6	10
No	94	94	95	96	93	95	95	95	94	90

In this context, it is vital to identify the reasons and attitudinal barriers that constrain any action on the part of respondents. This aspect was explored by the study, and the data on that is presented in Table 29 below.

Understandably, most respondents felt they needed government support (89 percent) and lacked access to information (73 percent). They also reported not having enough resources (67 percent) to take action on FSM. While these are understandable barriers, it is a matter of concern that a third of the respondents (34 percent) believed that their family would not approve if they got involved. This could be due to the traditional aversion to sanitation work as well as to the casteist undertones associated with sanitation work. However, it is gratifying to note that a majority of the respondents did not hold this view and almost three-fourths reported that they lacked the requisite information about what needed to be done and how they could contribute. Increased access to information could thus be the first action point, and it can be achieved without significant state support or infrastructural investment.

Table 29: Social support system for taking any action

Statements (Figures in %) * Top 2 boxes	All	States		SEC				
		Bihar	WB	E	D	C	B	A
Base (n)	802	597	205	165	235	186	153	63
Don't have enough resources	67	76	40	70	65	70	70	48
Family wouldn't approve	34	31	43	26	36	38	32	19
Lack access to information	73	81	50	68	77	74	78	71
Need government support	89	94	76	92	89	88	94	81

Given the low level of current involvement, a few attitudinal statements were also administered to the respondents to understand the barriers to action. The findings from this exercise are presented in Table 30 below.

Responding to the attitudinal statements, most respondents gave fairly positive responses to taking action. For example, only 14 percent reported agreement with the negative statement that poor sanitation or fecal sludge disposal was not a problem for them; this indicates that most respondents felt that improper sanitation or fecal sludge disposal was a problem for them. Similarly, most respondents believed that it was their responsibility to take action, as only about four-fifths (18 percent) agreed with the

statement that it was not their responsibility. It is equally encouraging to note that few respondents (18 percent) thought of their belief system as a barrier to action; notably, a relatively higher percentage in West Bengal (28 percent) felt that such action contradicted with their belief system.

It is also noteworthy that roughly half of the respondents (48 percent) said they did not know of anyone else who was taking action and were, therefore, not inclined to do so either. A similar figure (42 percent) mentioned that they had other priorities of greater import to them. For sanitation to gain ground among the people, these barriers need to be targeted and overcome.

Table 30: Response to attitudinal statements

Statements (Figures in %) * Top 2 boxes	All	States		SEC				
		Bihar	WB	E	D	C	B	A
Base (n)	802	597	205	165	235	186	153	63
Not a problem for me	14	16	9	8	13	11	20	15
No one I know is acting	48	54	31	44	48	51	48	51
Not my responsibility	18	18	20	23	16	17	17	23
I have other priorities	42	44	37	48	44	39	39	57
Does not fit with beliefs	18	15	28	23	19	15	14	6

Further, as the respondents had earlier highlighted the need for government support, it is also important to understand how confident the respondents felt about the utility of their actions on this issue. Table 31 below presents the self-efficacy scores of respondents.

A majority (61 percent) of respondents believed that they would get an opportunity to contribute meaningfully to improve the issues related to FSM; this was especially true in the case of West Bengal (78 percent). Similarly, more than half believed that they had the power to contribute meaningfully to FSM issues and that their actions will make a difference. This figure was again much higher in the case of West Bengal, where 65 percent of the respondents believed that their actions will make a difference.

Table 31: Response to self-efficacy statements

Statements (Figures in %) * Top 2 boxes	All	States		SEC				
		Bihar	WB	E	D	C	B	A
Base (n)	802	597	205	165	235	186	153	63
Will not make any difference	45	48	35	52	46	43	40	43
Powerless to contribute	46	46	44	49	47	48	40	31
Won't get an opportunity	39	45	22	41	36	36	41	45

3.4.3 Support, service requirements, and expectations

This section presents findings on the rural households' support and service requirements and expectations about FSM. It provides information on what the rural households believe are the best ways to improve FSM and what kind of support they require.

The exploration of this aspect began with a question asking respondents whether their requirements for proper sanitation had been met. Data on the responses to this question is presented in Table 32 below.

Of the total sample, a clear majority (66 percent) of the households believed that their requirements for proper sanitation had not been met. A much greater percentage of households in West Bengal (92 percent) were unsatisfied, compared to Bihar (57 percent). The responses were equally divergent across SEC categories, with a much higher percentage of the SEC E households (82 percent) reporting unmet sanitation needs, compared to SEC A households (33 percent). Responses to this question, hence, appear symptomatic of people's living conditions and access to urban infrastructure.

Table 32: Whether the requirements for proper sanitation have been met

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	34	42	8	34	47	18	29	34	42	67
No	66	57	92	66	52	82	71	63	58	33

Probed further, a majority of the households (75 percent) reported that their requirements for FSM had not been met. This figure is interesting when seen in comparison with the response to the previous question, where a much lower percentage (34 percent) had reported not being satisfied with general sanitation. This shows the importance of FSM issues as separate from overall sanitation. See Table 33 for details.

Here, West Bengal again reported a higher percentage (91 percent) of respondents who were unsatisfied with regard to FSM. This finding is understandable, given the known infrastructural shortcomings in the South 24 Parganas district. In terms of SEC status, while SEC A households had earlier reported higher levels of satisfaction with general sanitation, possibly due to their better living conditions and access to urban infrastructure, the same feeling of satisfaction was missing when it came to FSM, with 49 percent of the SEC A households reporting unmet FSM needs.

Table 33: Whether the requirements for proper FSM have been met

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	25	30	9	24	34	15	21	26	31	49
No	75	69	91	75	66	85	79	73	69	49

On the question of the key requirements for proper FSM, a majority of the sample (61 percent) pointed to the need for proper construction of toilets. In Bihar, the percentage was once again higher for single pit toilet users (72 percent) than septic tank toilet users (63 percent). Timely disposal of sludge came up as the second most reported need, with single pit toilet users (39 percent) reporting this need more often than septic tank toilet users (29 percent). Better service after toilet construction (43 percent) and financial support to build proper toilets (40 percent) were the other frequently stated requirements. Comparing the two states, while a majority of West Bengal households (65 percent) stated financial support for building toilets as a major requirement, most Bihar households (66 percent) mentioned proper construction of toilets. These findings make the hierarchy of needs fairly evident. See Table 34 for details.

Table 34: Some key requirements for proper FSM

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Proper construction of toilets	61	66	49	72	63	59	57	69	62	59
Financial support to build proper toilets	40	31	65	34	29	48	40	35	37	33
Timely disposal of fecal waste	47	47	47	46	47	38	44	50	52	59
Better service after construction of toilets	43	40	51	37	41	44	40	42	41	51
Better and prompt service in disposing of fecal waste	23	28	7	25	30	17	21	22	31	25

On the question of who could be the best provider of FSM services, a majority (58 percent) of the households considered government the best bet for providing FSM services. Private operators came second (37 percent) in the minds of respondents. Bihar again presented divergent figures, with more single pit toilet users (61 percent) mentioning government as the best service provider, compared to septic tank toilet users (49 percent). Conversely, private operators were preferred more by septic tank toilet users (42 percent) than single pit toilet users (34 percent). Overall, 23 percent of the households thought NGOs could provide the best FSM service. See Table 35 for details.

Table 35: Best service provider for FSM

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Government	58	53	73	61	49	69	58	59	51	46
NGO	23	17	40	18	16	25	17	28	23	24
Private company	37	39	31	34	42	32	37	35	42	43
Community driven initiatives	9	10	7	4	13	5	8	14	9	11
Don't know	6	6	4	7	6	5	8	4	5	6

One key study finding was that a majority of respondents (66 percent) were willing to pay private operators for FSM services. This was especially true in the case of Bihar, where an overwhelming majority (79 percent) expressed this willingness. However, West Bengal presented a contrasting picture, with a majority (71 percent) unwilling to pay private operators. As expected, septic tank users were more willing to pay than single pit users. The clear distinction between the needs and priorities of the more affluent respondents and the less well off respondents was amply clear across findings. See Table 36 for details.

Table 36: Willingness to pay private operators

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	66	79	27	70	85	53	60	70	76	84
No	32	18	71	27	14	44	37	28	20	16

Although the households were willing to pay private operators for FSM services, the amounts they reported being comfortable paying were very low. This is understandable, given the limited purchasing power of people in rural and poor areas as well as their disinclination to spend on what they see as non-essentials. A private operator wishing to start the service in rural areas would perhaps need to price it so that it is affordable to the poor. The qualitative study also revealed that people were ready to pay small amounts every year instead of a large amount at the end of 4–5 years. Hence, an EMI type of price structure could be explored to boost demand. The amounts (in INR) that the households were willing to pay for FSM services are presented in Table 37.

Table 37: Amount the households are willing to pay

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Less than INR 100	45	47	30	43	48	45	51	47	40	34
INR 100-300	38	37	45	44	34	41	30	40	41	43
INR 300-500	11	11	13	7	12	7	11	7	15	17
INR 500-800	1	1	4	1	1	0	1	0	2	4
INR 800-1000	1	1	4	1	1	2	3	1	0	0
More than INR 1000	2	1	5	1	1	1	1	2	3	0
Don't know	2	2	0	1	3	2	1	4	1	2

Asked what could improve FSM, a clear majority (71 percent) of households pointed to timely clearing of sludge, followed by more government support (44 percent) and use of new technology (35 percent). The majority of Bihar's septic tank toilet users (79 percent) mentioned the need for timely clearing of sludge. See table 38 for details.

Table 38: What will help to improve FSM

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	284	165	235	186	153	63
Timely clearing of sludge	71	77	54	72	79	65	67	77	69	84
Use of new technology	35	32	45	20	38	32	35	35	36	44
More support from the government	44	36	67	41	34	48	44	43	45	35
Better access of the nearest town	23	27	12	27	27	12	20	24	29	44

When probed about the problems that currently plague toilets, the respondents gave a range of answers, suggesting that multiple issues are at play. Data on this aspect is presented in Table 39.

A majority of households (57 percent) identified the unavailability of proper service as the major problem toilets currently face; this was cited more often by West Bengal households (71 percent). The second commonly identified problem was that of very infrequent service (35 percent), followed closely by the problem of sludge being left behind (30 percent). Quality or technology issues were cited by comparatively fewer respondents, suggesting that gaps currently appear to pertain more to improper implementation and servicing of existing technology rather than any systemic issues. While poor implementation is a matter for concern, a major headway can be made by rectifying these issues on priority.

Table 39: Problems facing current toilets

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	284	165	235	186	153	63
Very poor quality and hence cannot be used	5	3	10	2	4	7	4	7	1	5
Technology problems	18	14	31	14	15	21	16	22	14	22
Current practice is very unhygienic	28	26	31	26	27	22	28	30	26	40
Proper service not available	57	53	71	54	52	59	60	60	52	49
Very infrequent services	35	35	37	30	37	33	33	39	33	44
Sludge left behind	30	37	10	33	39	24	27	31	37	35
Leakages in the tanker itself	8	10	0	12	9	5	5	6	12	17

Overall, most respondents (54 percent) identified frequent sludge disposal as the major requirement for improved FSM; a majority (63 percent) of Bihar households agreed on this point. Better toilet infrastructure was the second most sought after requirement (48 percent) for improved FSM. A majority of single pit toilet users (64 percent) in Bihar stated better toilet infrastructure as the major requirement for improved FSM, whereas most septic tank toilet users (66 percent) pointed to frequent sludge disposal. See Table 40 for details.

Table 40: What can improve FSM

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Better toilet infrastructure	48	52	38	64	45	55	42	46	52	48
Proper services in sludge disposal	35	32	45	30	33	32	34	39	35	40
Frequent sludge disposal	54	63	30	57	66	45	54	55	62	60
Proper maintenance	26	22	36	18	25	27	26	27	24	24

As seen in Table 41, community involvement in FSM issues was found to be very low, quite like the poor levels of personal involvement. About three-fourths (74 percent) of the households believed that community was not involved when it came to proper sanitation and FSM. Bihar reported high percentage (79 percent) on this count.

Table 41: Whether the community is involved

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (n)	802	597	205	211	384	165	235	186	153	63
Yes	20	23	11	16	28	13	20	24	20	27
No	74	73	79	80	69	78	76	72	76	67
Don't know	5	4	10	5	3	9	4	4	4	6

Raising awareness about proper sludge disposal was agreed by most (74 percent) to be the primary means of improving community involvement. Awareness was, thus, seen as critical to give people a clear understanding of the actions they can take. See Table 42 for details on responses about what could improve community involvement.

Table 42: Ways in which the community can be involved

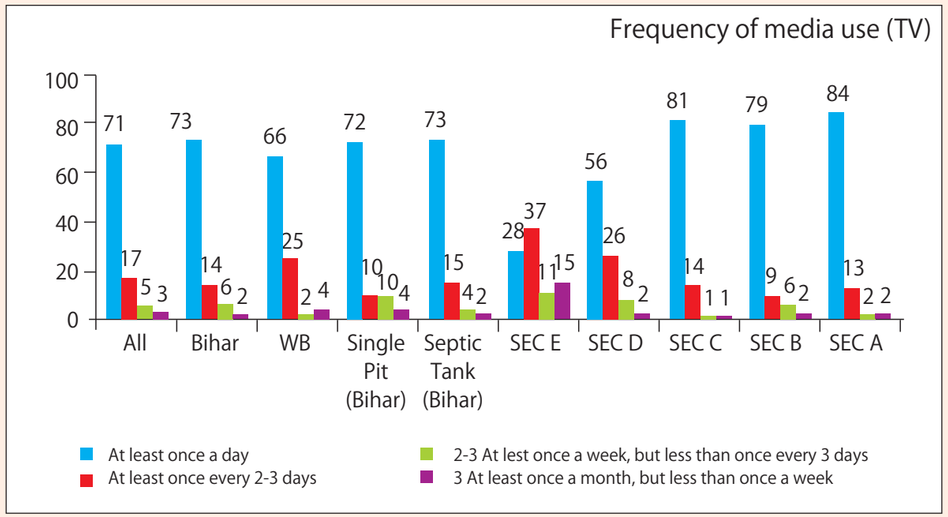
Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (<n)	161	139	22	33	106	22	46	45	31	17
Raise awareness about proper sludge disposal	74	76	59	76	76	68	74	71	74	88
Give support in terms of finance	14	15	9	12	16	14	15	18	16	0
Give support in terms of logistics	7	4	23	9	3	14	7	7	3	6
Organized to discuss local community	1	1	0	0	1	0	0	0	0	6

3.4.4 Media usage

The study also examined the media usage habits of the sample households. Such information would be vital to strategize and build a media campaign, as required, on this issue. However, media usage, as examined by the study and presented in this section, could only be treated as a preliminary groundwork. More detailed understanding of concepts, media slots, etc., is beyond the scope of this current study.

Our examination of media usage found television (TV) to have a very high access among the sample households, with a majority (71 percent) of respondents watching TV every day. Except for SEC E and SEC D categories, all other SEC category respondents reported very high TV usage. Evidently, TV penetration is quite high in all, except the lowest, strata of society in rural Bihar and West Bengal. See Chart 7 for details.

Chart 7: Frequency of media use (TV)

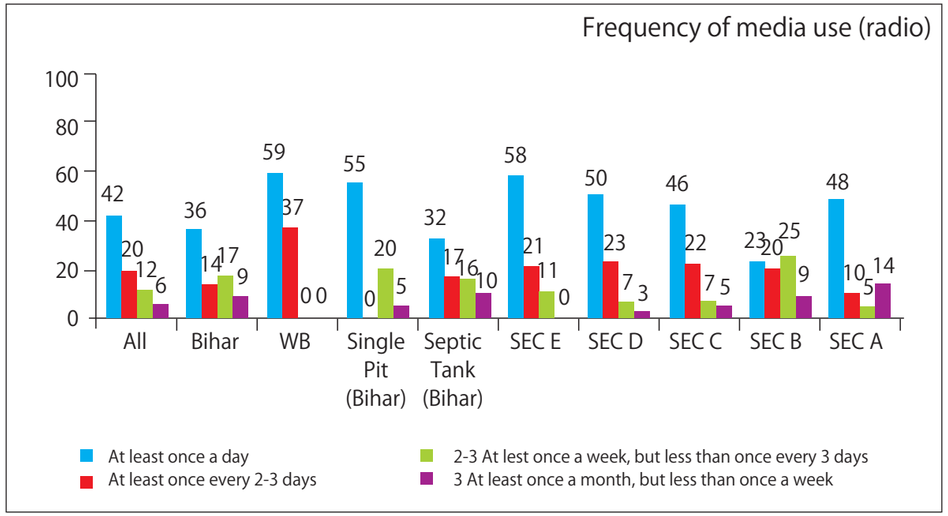


Sample size

State	All	Bihar	WB	Single Pit (Bihar)	Septic Tank (Bihar)	SEC E	SEC D	SEC C	SEC B	SEC A
Base	464	327	137	79	248	46	87	136	132	63

Compared to TV, radio was seen to be used less frequently by respondents. High TV penetration is linked to the decline in usage of radio, particularly as a standalone device. However, West Bengal (59 percent) and Sec E category households (58 percent) reported higher percentage of respondents who listened to radio at least once a day, indicating that radio access is higher where TV penetration is low. See Chart 8 for details.

Chart 8: Frequency of media use (radio)

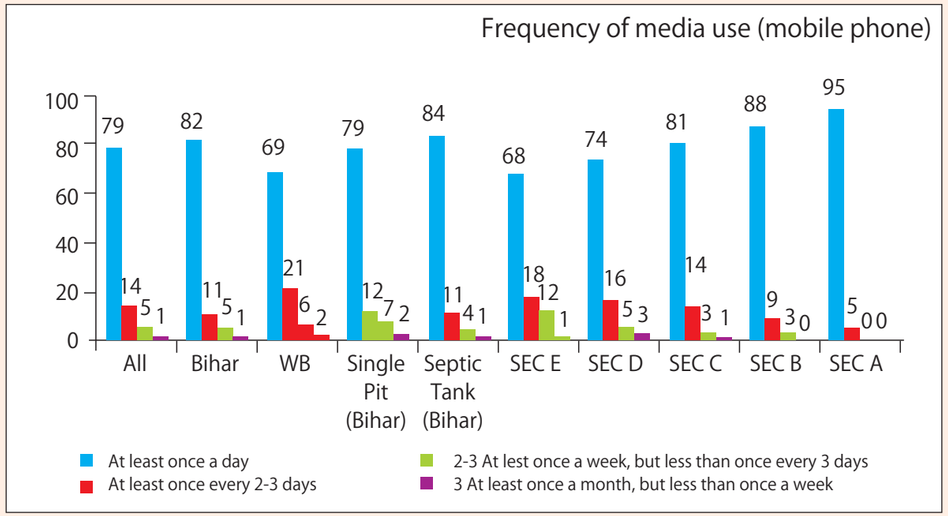


Sample size

State	All	Bihar	WB	Single Pit (Bihar)	Septic Tank (Bihar)	SEC E	SEC D	SEC C	SEC B	SEC A
Base	155	114	41	20	94	19	30	41	44	21

The high level of mobile phone access in the sample was evident, with almost every respondent using a mobile phone. A majority of the respondents with access to a mobile phone used it at least once a day (79 percent); Bihar recorded the maximum number of respondents using the mobile phone at least once a day. As expected, SEC A had the maximum number of respondents (95 percent) using the mobile at least once a day. As a means of communication, mobile phone was found to have the highest penetration and frequency of usage. See Chart 9 for details.

Chart 9– Frequency of media use (mobile phone)

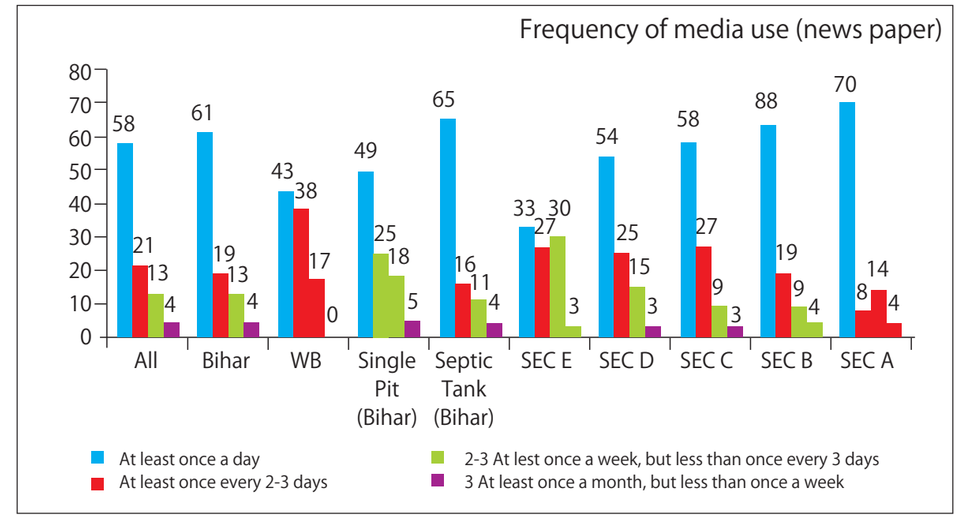


Sample size

State	All	Bihar	WB	Single Pit (Bihar)	Septic Tank (Bihar)	SEC E	SEC D	SEC C	SEC B	SEC A
Base	767	578	189	199	377	148	223	181	152	63

Among those with access to newspapers, a majority (58 percent) read it at least once a day. The frequency of readership was higher in Bihar than West Bengal. Again, as expected, SEC A had the highest percentage of respondents who read the newspaper daily. See Chart 10 for details.

Chart 10: Frequency of media use (newspaper)



Sample size

State	All	Bihar	WB	Single Pit (Bihar)	Septic Tank (Bihar)	SEC E	SEC D	SEC C	SEC B	SEC A
Base	311	269	42	77	190	30	72	66	93	50

Looking at the preferred methods/sources for accessing information, TV, neighborhood meetings, and members of one's own community were found to be the most popular, each reporting an overall percentage of 51 percent. Bihar respondents mostly preferred information from neighborhood meetings (61 percent) or members of their community (67 percent), while TV as a source of information stood third (48 percent). In West Bengal, on the other hand, TV preference was much higher (61 percent). Seeing the responses by SEC category, while SEC A showed an overwhelming preference for TV (89 percent), SEC E category respondents had greater preference for neighborhood meetings (62 percent) and members of their community (52 percent). See Table 43 for details.

Table 43: Method of accessing information

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (<)	802	597	205	211	384	165	235	186	153	63
Televison	51	48	61	34	55	26	37	65	67	89
Radio	12	9	22	11	8	15	9	16	12	10
Newspaper	35	34	37	28	37	24	29	36	46	56
Mobile phone	13	10	22	12	9	15	11	12	14	17
Internet	2	3	0	1	3	2	0	2	4	5
Posters leaflets	11	10	13	13	9	17	7	13	9	8
Neighborhood meetings	51	61	22	71	56	62	50	45	48	54
Schools	13	13	15	14	12	19	11	10	13	19
Film screenings	6	3	13	4	3	6	6	8	3	5
Public events	1	1	2	0	1	1	3	0	1	2
Street theatre	4	3	9	4	2	5	5	6	1	2
Traditional entertainment	1	2	0	1	2	1	0	2	2	2
Religious institutions	11	14	3	20	11	8	11	15	10	10
Local / community radio	5	7	1	11	5	4	6	6	5	5
From member of my community	51	67	4	73	64	52	49	47	56	54
Agricultural extension worker / health worker	22	23	18	27	21	21	18	30	21	19

* Neighborhood meetings can be described as local informal gatherings of people in a neighborhood to discuss local issues affecting them.

To the question of the most preferred media, the respondents gave varied responses. Overall, most preferred TV (26 percent), followed closely by neighborhood meetings (23 percent) and members of their community (21 percent). Bihar was generally in consonance with the overall figures, with preference spread across neighborhood meetings (28 percent), members of their community (27 percent), and TV (20 percent). In West Bengal, however, there was a clear preference for TV (43 percent). See Table 44 for details.

Table 44: Most preferred media

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (<)	802	597	205	211	384	165	235	186	153	63
Televison	26	20	43	8	26	9	19	38	34	38
Radio	3	1	7	1	1	6	3	2	1	0
Newspaper	13	14	11	9	17	6	17	11	16	17
Mobile phone	5	2	13	2	2	6	5	4	5	5
Internet	1	1	0	0	2	1	0	2	1	5
Posters leaflets	2	1	3	1	1	4	1	1	0	2
Neighborhood meetings	23	28	11	40	21	30	27	20	16	17
Schools	2	1	4	2	1	3	2	2	1	0
Film screenings	1	1	1	0	1	0	2	0	1	2
Public events	0	0	0	0	0	1	0	0	0	0
Street theatre	1	0	2	0	0	1	2	0	0	0
Traditional entertainment	0	0	0	0	0	0	0	1	0	0
Religious institutions	0	1	0	0	1	1	1	0	0	0
Local / community radio	1	1	0	1	1	1	1	1	2	0
From member of my community	21	27	2	31	26	27	22	18	20	11
Agricultural extension worker / health worker	3	2	7	2	2	4	4	2	2	2

As to the person seen as the most credible source of information, there was overall a high preference for social activists (44 percent) and community leaders (36 percent). West Bengal again showed a somewhat different preference, with most respondents pointing to politicians or local representatives (55 percent) as the best persons to share information. See Table 45 for details.

Table 45: Best person to share information

Figures in %	All	States		Type of Toilet in Bihar		SEC				
		Bihar	WB	Single Pit	Septic Tank	E	D	C	B	A
Base (<)	802	597	205	211	384	165	235	186	153	63
People like me	22	24	14	23	25	16	22	22	25	30
Community leader	36	42	18	37	45	28	34	40	38	41
Religious leader	9	9	9	9	9	7	11	11	9	3
Politicians or local representatives	21	10	55	8	11	26	25	20	12	21
some one in the family	20	20	18	23	18	22	17	26	18	6
Some one in the locality	25	22	35	28	19	29	26	27	24	14
Film stars	15	19	3	15	21	13	9	13	20	29
Other celebrities like sportsmen	6	8	0	9	7	7	4	6	7	6
Reputed journalist	5	7	0	5	7	3	4	5	4	16
Social activists	44	48	33	56	43	42	40	48	47	44
Foreign experts	0	0	0	0	0	0	0	0	0	2
Scientist or academics	1	1	1	0	1	1	0	1	3	2

3.4.5 Districts snapshot

This section examines the responses by district for the four districts under study — Patna, Begusarai, and Samastipur from Bihar and South 24 Parganas from West Bengal — and identify the differences, if any. The areas where some district(s) behaved in an entirely different way from the others have been explored. As West Bengal had only one district, the state data is to be seen as equivalent to the district data.

Let us begin by looking at the type of toilet technology in use in different districts. A majority of households in the West Bengal district were using single pit toilets (91 percent). There was, however, a big difference between the type of toilet being used in different Bihar districts. Only one-fifths of the Patna households (20 percent) had single pit toilets, compared a much higher number in Begusarai (48 percent) and Samastipur (38 percent). This finding is understandable, given the greater overall affluence in the highly urban district of Patna. Details on this aspect are presented in Table 46.

Table 46: Type of toilet (by district)

Figures in %	All	States		Districts		
		Bihar	WB	Patna	Begusarai	Samastipur
Base (n)	802	597	205	198	199	200
Single Pit	49	35	91	20	48	38
Septic Tank	51	65	9	80	52	62

In terms of awareness of sludge disposal, Samastipur recorded very high awareness levels (96 percent), compared to Patna (65 percent) and Begusarai (59 percent). While the Patna and Begusarai numbers are almost consistent with the overall figure, Samastipur has clearly recorded an exception, which may need to be explored further. See Table 47 for details.

Table 47: Awareness of sludge disposal (by district)

Figures in %	All	States		Districts		
		Bihar	WB	Patna	Begusarai	Samastipur
Base (n)	802	597	205	198	199	200
Yes	69	73	55	65	59	96
No	30	25	43	34	38	3

There was again a big difference in the households' awareness levels about what happens to the sludge. Only about one-fifths of Patna households (19 percent) said that sludge is taken to a sewage disposal unit, unlike the higher numbers in Begusarai (57 percent) and Samastipur (40 percent). Notably, a high percentage of respondents from Samastipur (74 percent) and South 24 Parganas (84 percent) said that sludge is dumped in a nearby pit, compared to Patna (47 percent) and Begusarai (30 percent). See Table 48 for details.

Table 48: What happens to the sludge (by district)

Figures in %	All	States		Districts		
		Bihar	WB	Patna	Begusarai	Samastipur
Base (n)	802	597	205	198	199	200
It is taken to sewage disposal plant	31	39	2	19	57	40
It is dumped in nearby pit	61	54	84	47	30	74
Some farmer buys it and stores it for using it as manure	6	6	6	9	9	1
It is dumped in nearby water body	10	12	4	21	9	7

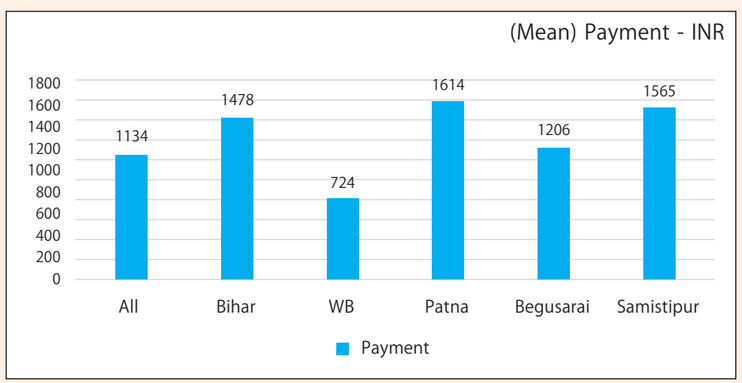
As seen in Table 49, Samastipur was again an exception when it came to clearing of sludge by private operators. While Patna (8 percent) and Begusarai (4 percent) had a very low proportion of households using private operators to clear the sludge, about one-fourths (24 percent) of the Samastipur households were employing private operators to clear the sludge. Manual scavengers were being used by most households in every district.

Table 49: Who clears the sludge (by district)

Figures in %	All	States		Districts		
		Bihar	WB	Patna	Begusarai	Samastipur
Base (<n)	168	83	85	26	23	34
Private operators	13	13	13	8	4	24
Government agency	1	1	0	0	4	0
Manual scavengers	55	48	62	54	52	41
No response	15	28	4	19	35	29

In terms of the last payment made to clear the sludge, all the Bihar districts reported a higher amount than the overall average (INR 1,134 or about US$18), which was pulled down by the lower figure reported from West Bengal (INR 724 or about US$11). Patna reported the highest average cost (INR 1,614 or about US$26), compared to Begusarai (INR 1,206 or about US$19) and Samastipur(INR 1,565 or about US$25). The costs generally seem to be pegged to the standard of living in each individual district. See Chart 11 for details.

Chart 11: Last payment made for clearing the sludge (by district)



The respondents' perception of the effectiveness of toilets was high overall, but Patna (90 percent) and Begusarai (91 percent) had a much higher number of respondents who felt that their toilets were effective, compared to Samastipur (74 percent) and South 24 Parganas (63 percent). As noted before, the higher levels of satisfaction among households using septic tank toilets and the proportion of such toilets in each district seem to be driving these scores. See Table 50 for details.

Table 50: Whether the toilet is effective (by district)

Figures in %	All	States		Districts		
		Bihar	WB	Patna	Begusarai	Samastipur
Base (n)	802	597	205	198	199	200
Yes	79	85	63	90	91	74
No	20	15	37	19	8	27

On the question of whether their needs for proper sanitation were met, the responses were overall not as positive as about the effectiveness of toilets. While a majority of the Patna households (59 percent) said that their requirements for proper sanitation had been met, the percentage dropped for Begusarai (33 percent) and Samastipur (36 percent). Only a few of the households in the South 24 Parganas (8 percent) felt that their sanitation needs had been met. The overall level of infrastructure in a district clearly appears to have an impact on this perception. Details on this aspect are presented in Table 51.

Table 51: Whether the requirements for proper sanitation been met (by district)

Figures in %	All	States		Districts		
		Bihar	WB	Patna	Begusarai	Samastipur
Base (n)	802	597	205	198	199	200
Yes	34	42	8	59	33	36
No	66	57	92	41	65	65

Although there was variation, the requirements for proper FSM seem to not have been met for a majority of households in all the districts. As seen in Table 52, Patna recorded the highest percentage of households (42 percent) who said that their requirements for proper FSM had been met, compared to much lower figures from Samastipur (18 percent) and the West Bengal district of South 24 Parganas (9 percent).

Table 52: Whether the requirements for proper FSM have been met (by district)

Figures in %	All	States		Districts		
		Bihar	WB	Patna	Begusarai	Samastipur
Base (n)	802	597	205	198	199	200
Yes	25	30	9	42	32	18
No	75	69	91	57	67	83

When it came to who could be the best service provider for FSM, Begusarai (77 percent) and South 24 Parganas (73 percent) showed a high preference for a government agency to do the job. Conversely, Samastipur (52 percent) and, to a lesser extent, Patna (43 percent) had a much higher preference for private operators. See Table 53 for details.

Table 53: Best service provider for FSM (by district)

Figures in %	All	States		Districts		
		Bihar	WB	Patna	Begusarai	Samastipur
Base (n)	802	597	205	198	199	200
Government agency	58	53	73	52	77	32
NGO	23	17	40	23	22	7
Private company	37	39	31	43	23	52
Community-driven initiatives	9	10	7	15	14	1
Don't know	6	6	4	7	1	11

As per the majority of households from Patna (60 percent) and the West Bengal district (71 percent), the biggest problem facing the current toilets was the poor availability of proper service; the other districts agreed on this point but to varying degrees. Interestingly, only a minor percentage in Samastipur (2 percent) thought of technology problems as having any impact, compared to higher percentages in Patna (17 percent) and Begusarai (24 percent). In Begusarai, less than one-fifths (16 percent) thought that the current practice was very unhygienic, compared to higher numbers in Patna (30 percent) and Samastipur (34 percent). See Table 54 for details.

Table 54: Problems facing current toilets (by district)

Figures in %	All	States		Districts		
		Bihar	WB	Patna	Begusarai	Samastipur
Base (n)	802	597	205	198	199	200
Very poor quality and hence cannot be used	5	3	10	3	4	3
Technology problems	18	14	31	17	24	2
The current practice is very unhygienic	28	26	31	30	16	34
Proper service not available	57	53	71	60	55	43
Very infrequent services	35	35	37	35	32	38
Sludge left behind	30	37	10	38	29	43
Leakages in the tanker itself	8	10	0	12	18	1

In Samastipur, an overwhelming majority (81 percent) of the households felt that frequent sludge disposal is the best way to improve FSM. Only a few (5 percent) Samastipur households thought proper maintenance could improve FSM, compared to the higher percentages reported from Patna (26 percent) and Begusarai (36 percent). See Table 55 for details.

Table 55: Things to improve in FSM (by district)

Figures in %	All	States		Districts		
		Bihar	WB	Patna	Begusarai	Samastipur
Base (n)	802	597	205	198	199	200
Better toilet infrastructure	48	52	38	41	56	58
Proper services in sludge disposal	35	32	45	42	32	22
Frequent sludge disposal	54	63	30	59	48	81
Proper maintenance	26	22	36	26	36	5

3.4.6 Supply side dynamics

Manual scavengers and, to a lesser extent, private operators dominate the supply side of the FSM landscape. Most rural households employ the services of manual scavengers to clear the fecal sludge. Rural households' use of private operators for the service is constrained by two major barriers — financial constraints and lack of proper vendors/operators in rural areas. Let us examine both these factors in greater detail.

1. **Financial constraints:** A majority of the rural households have little disposable income to spend on securing proper FSM services. Many of the poor rural households just cover the existing pit and dig another pit alongside. If there is not enough space for digging another pit, they are found to revert to open defecation.

Given their resource constraints, most rural householdssee private operators as too expensive an option. A majority of rural households end up using manual laborers, who belong to their village or to a nearby village, can provide prompt service, and are, most importantly, much cheaper than private operators.

2. **Lack of proper vendor/operators in rural areas:** Private operators generally have their base in a city, as most of their business is concentrated in and around the city. Hardly any private player is dedicated to the rural sector.

For most rural households, the need for sludge clearing arises as an emergency, when the pit or tank is filled to the brim, and the service is required immediately. Manual laborers are immediately available as they are local to the area. For the city-based private operators on the other hand, not only does it take longer to reach far-flung villages but the costs are also high if they have to travel the extra distance to rural areas to service a request. These extra costs are passed on to customers. Hence, a village household that is far from the city has to pay more than a city household to avail the same service.

The existing private operators or any entrepreneurs who seek to cater to the rural sector must keep these barriers in mind. Pricing is the key, and if they can offer FSM services at lower prices, comparable to manual scavengers, then the demand for their services will increase. As such, private operators are perceived to offer higher quality service in villages, and even considered better than government providers. Given that villagers consider it easier to pay smaller amounts at regular intervals rather than a large amount in one go, innovative pricing options like EMIs could go a long way in increasing rural households' demand for services offered by private operators.

It is equally important to note here the poor sludge disposal practices employed by private operators. Most of them dispose the sludge in some barren land or in nearby water bodies. An operator covered by the study converted his own land into a dumping ground. It was revealed that cost is a major factor in choosing how to dispose the sludge. It is expensive for private operators to transport the sludge to a STP, wherever present, and also pay the STP to dispose the sludge in each trip.

➢ Private operators in FSM: Current processes and practices

Collection and transportation

Once the private operators get a request from the customer, they send their truck/tractor to clear the sludge from the household's tank or pit. The actual clearing is done by laborers with help of suction machines.Most private operators have trucks and tractors for carrying the machines and the tank in which sludge is stored. On average, operators own 3–4 trucks, which are often newly bought. The capacity of the tank is roughly 4,000 liters. If the sludge from a household exceeds this quantity, more than one trip may be required, which increases the cost. The typical number of trips by an operator is about two trips per day. However, as with any business, there are days when the demand is low and not a single trip is made. As for disposal, the collected sludge is mostly dumped in a nearby empty land or water body. By and large, safe disposal is not practiced by most operators.

Some details about sludge collection, transportation, and disposal practices are presented below:

Clearing process	mechanical
Type of vehicle used for transportation	Mostly tractor; truck in some cases
Type of vehicle ownership	Owned
Number of clearings per day	Usually two clearings per day on average, but not fixed; there are days when no clearing is done
Number of trucks	3 - 4
Size of the business	Medium (2-5 trucks) on a verage
Capacity of tanks	Mostly 4,000 liters
Type of trucks purchased	New
Typical age of truck	10 years
Typical number of trips per day	Two on average, but depends on the distance
Where the sludge is dumped	Mostly in the nearby land or small water body; one operator has created his own dumping site at his own rural land
Reuse for sludge	Gas and fertilizer
Quantity of fecal sludge received per day	Depends on the number of trips and the operator, but ranges from roughly 15,000 -20,000 liters
Is the technology found to be suitable	Operators are happy with the existing technology
When is the highest demand for sludge clearing	Rainy season brings the maximum demand

Cost and revenue

Generally, a customer pays the private operator about INR 1,200 (about US$19) on average for having the sludge cleared. However, the prices are higher for rural customers, as the operators' costs increase when their trucks have to travel a longer distance to service a request from a village far from the city where the private operators are based.

As for cost to the private operator, an initial investment of a minimum of INR 10–15 lakhs (about US$19,026–23,783) is required to start this business. While the approximate cost of a new tractor is about INR 6 lakhs (about US$9,513), running expenses are mostly incurred for labor, machinery, and fuel. If the land is not owned, then the cost of land comes out to be around INR 10–15 lakhs (about US$19,026–23,783) per katha[8]; the cost of land varies depending on the region.

Details about costs and earnings of private operators are presented below:

Labor cost for operations and maintenance	On average INR 300 (US$5) per laborer / per day
Cost of land	INR 10-15 lakhs (about US$ 19,026-23,783) per katha
Ownership of land	Private
Fund assistance from the government	No assistance is received from the government
Investment required to start the business	As per private operators, initial investment of INR 10–15 lakhs (US$19,026–23,783) is required
Main expenses for running the business	Labor, machinery, fuel
Price of a new truck/tractor	Approximately INR 6 lakhs (US$9,513)
Charge for fecal sludge clearing	INR 800–1,500 (US$13–24) per trip, depending on the operator and the distance to be travelled. The rate increases as the distance to the site increases; hence, a rural household has to pay more. With two trips daily on average and an average rate of INR 1,200 (US$19), private operators earn about INR 2,400 (US$38) per day.

[8]One katha may vary from 750 ft² to 2,000 ft², or 32ft by 30 ft in length and breadth, respectively.

3.5 Conclusion

Summing up, the qualitative and quantitative survey has shown that not only is there little demand for private providers' FSM services in rural areas, but the supply is also limited and expensive. The major barriers to demand at the household level are financial constraints, lack of knowledge/awareness, and unavailability of proper vendors in rural areas.

On the supply side, private providers are generally located in cities and towns. Although they do provide FSM services to villages, private operators charge more from far-flung rural households to cover their transport costs. This makes their services even more unaffordable for resource-constrained rural households. Government agencies have a marginal presence in FSM, and their processes are considered both complicated and expensive. Hence, as of now, rural households largely depend on manual scavengers for fecal sludge clearing. Manual laborers are cheaper and, being based in the village itself or a nearby village, they can also provide immediate service.

The current level of demand from rural areas is, hence, too little to be considered lucrative for private operators. However, as the study has shown, there is already a clear appreciation among rural households of the need to improve FSM, and understanding about the requirements of frequent and timely disposal of sludge, financial support, proper construction of toilets, and better service after construction of toilets. If the existing barriers can be broken and requirements met, the demand for proper FSM services will get a boost and fecal sludge disposal and management in rural areas will take place in a timely and efficient manner.

The existing private operators or entrepreneurs who seek to enter the rural FSM sector must keep the barriers to demand in mind. Pricing is the key, and if they can offer the services at lower prices, comparable to manual pit/septic tank emptier, then the demand for their services, considered by customers to be of higher quality, will increase. Further, use of some innovative pricing structures like EMIs could bolster the demand for their services from poor, rural households.

On another front, private providers need to be persuaded to adopt proper sludge disposal practices. Among rural communities too, there is a clear need for building awareness about sanitation and FSM issues through behavioural change communication.

Notes

Notes

Fecal Sludge Management

A Landscape Study of Practices, Challenges, and Opportunities

A research project supported by

Population Service International

Study conducted by

Water, Sanitation and Hygiene (WASH) Institute
Kodaikanal, Tamil Nadu, India
Branch : Patna, Bihar
www.washinstitute.org