

FAECAL SLUDGE & SEPTAGE MANAGEMENT (FSSM)

SKILL GAP ASSESSMENT STUDY

Prepared by

Technical Support Unit of Urban Management Centre, Ahmedabad for Deendayal Antyodaya Yojana -
National Urban Livelihoods Mission, New Delhi



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of
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The skill gap report would not have been possible without the dedicated support and gruelling field operations manned by UMC team. We acknowledge their invaluable contribution to this initiative.

It is hoped that this study will act as useful tool for multiple stakeholders to develop an understanding of the current unorganized FSSM sector and identify skill training needs and workforce demand in this sector.

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ABBREVIATIONS

AMOH	Assistant Medical and Health Officer	MLD	Million Liters per Day
AMRUT	Atal Mission for Rejuvenation and Urban Transformation	MoHUA	Ministry of Housing and Urban Affairs
ASCI	Administrative Staff College of India	MSDE	Ministry of Skill Development and Entrepreneurship
BCC	Behavior Change and Communication	NFSSM	National Faecal Sludge and Septage Management
BMGF	Bill and Melinda Gates Foundation	NGO	Non-Government Organization
BOD	Biological Oxygen Demand	NOS	National Occupational Standards
CAPEX	Capital Expenditure	NSDA	National Skill Development Authority
CDD	Consortium for DEWATS Dissemination Society	NSDC	National Skill Development Council
CEO	Chief Executive Officer	NSQC	National Skill Qualification Committee
CEPT	Centre for Environment Planning and Technology	NSQF	National Skills Qualifications Framework
CMOH	Chief Medical and Health Officer	NUHM	National Urban Health Mission
COD	Chemical Oxygen Demand	O&M	Operation and Management
CPHEEO	Central Public Health and Environmental Engineering Organization	OD	Open Defecation
CT	Community Toilet	OPEX	Operation Expenditure
DAY-NULM	Deendayal Antyodaya Yojana – National Urban Livelihoods Mission	ORP	Oxidation Reduction Potential
DEWAT	Decentralized Wastewater Treatment	OSS	Onsite Sanitation System
FS	Faecal Sludge	OWSSB	Odisha Water Supply and Sewerage Board
FSSM	Faecal Sludge and Septage Management	PMAY	Pradhan Mantri Awas Yojana
FSTP	Faecal Sludge Treatment Plant	PMC	Puri Municipal Corporation
GOI	Government of India	PMKVY	Pradhan Mantri Kaushal Vikash Yojana
GPS	Global Positioning System	PPP	Public Private Partnership
GVMC	Greater Visakhapatnam Municipal Corporation	PT	Public Toilet
GWMC	Greater Warangal Municipal Corporation	PUC	Pollution under Control
H & S	Health and Safety	QP	Qualification Pack
HH	Households	R&M	Repair and Maintenance
HRIDAY	Heritage City Development and Augmentation Yojana	RPL	Recognition of Prior Learning
IEC	Information Education and Communication	SBMU	Swachh Bharat Mission – Urban
IHHL	Individual Households Latrine	SCGJ	Sector Council for Green Jobs
KLD	Kilo Liters Per Day	SCM	Smart Cities Mission
MAS	Mahila Arogya Samiti	SHG	Self Help Group
MBBR	Moving Bed Bio Reactor	SI	Sanitary Inspector
		SLB	Service Level benchmark
		SOP	Standard Operational Procedure
		SRS	Septage Receiving Station
		SS	Sanitary Supervisor
		STP	Sewage Treatment Plant
		TS	Total Solids
		UASB	Up-flow Anaerobic Sludge Blanket
		UGD	Underground Drainage
		ULB	Urban Local Bodies
		UMC	Urban Management Centre, Ahmedabad
		VTO	Vacuum Truck Operator
		WKS	Ward Kalyan Samiti
		WMC	Wai Municipal Corporation
		WSC	Ward Sanitation Committee

Chapter 1

BACKGROUND OF THE STUDY

1.1 Introduction

According to Census of India 2011, India's urban population is 377 million which is 31% of the total population. The current population is expected to increase to 600 million by 2031. The Census 2011 indicates that the toilets connected with on-site sanitation system (60%) are higher than the toilets connected with sewer network (40%). Weak sanitation has significant health costs and untreated faecal sludge and septage from cities is the single biggest source of water resource pollution in India. Human waste has clearly been identified as the leading polluter of water sources in India, causing a host of diseases including diarrhea, agricultural-produce contamination, and environmental degradation.

The bigger cities in India have large centralized sewerage systems with vast underground pipelines, pumping stations and huge treatment plants to treat. These systems are expensive to build and even more expensive to operate effectively, as they require continuous power, a large amount of water, skilled operators and extensive electro-mechanical maintenance. It is for this reason that India's 7,000+ small towns do not have such systems and are unlikely to be covered by centralized sewerage systems soon. The on-site pit latrines and septic tanks account for substantial proportion, its safe emptying/desludging and treatment continues to be a huge challenge.

There are major gaps in safe faecal sludge and septage management across the FSSM value chain including septage collection, conveyance,

treatment and reuse/disposal. To address the same there is a need to explore and understand the labor demand and supply scenario in the FSSM sector, the existing skill gaps, and identification of types of skills that would help bridge the gaps.

1.2 The scope of the FSSM Study

The FSSM skill gap study focusses on the construction of toilet with septic tanks / Soak pits, emptying/desludging and treatment process of the sludge in on-site sanitation system (OSS) and the supporting systems in this ecosystem.

The FSSM skill gap study focuses on



Figure 1 Objectives of the skill gap study

development of an understanding of the FSSM sector, demand and supply scenario of skilled labor, skilling gaps in the existing workforce and recognition of skills of the informal sector labor working in the sector.

The key outcome of the FSSM skill gap study shall include:

- Demand in terms of numbers and skill set of the workforce in the FSSM sector.
- Identification and development of the relevant National Occupational Standards (NOS) and Qualification Packs (QPs) in the FSSM sector covering the FSSM value chain.

The QPs developed in the process will be

- Nationally recognized for skill training purposes
- Eligible for government funding through skill development schemes
- Aligned to Government of India (GoI) mandated National Skills Qualification Framework (NSQF)
- QPs will lead to the creation of curriculum and facilitation of assessments for the courses being developed.

Chapter 2

METHODOLOGY OF THE STUDY

2.1 Methodology of the Study

The methodology of the FSSM Skill Gap Assessment is based on primary and secondary data collection and analysis.

The primary data collection involves direct interactions with the various stakeholders working in the FSSM sector. The primary objective of the survey was to capture information on the construction of toilet with OSS system, prefab septic tank installers, repair and maintenance of OSS system, emptying and

conveyance of sludge, repair, and maintenance of equipment and vehicles and treatment of sludge etc. This information aids in understanding the involvement of various stakeholders in the FSSM sector.

The primary data was collected in the prescribed formats developed for various stakeholders, details attached as annexure ix. The details of stakeholders and methodology of data to be collected from the various stakeholders are presented in the table below:

Sr. No	Component	Competent Authority/ Service providers	Methodology
1	Construction of toilets with On-Site Sanitation (OSS) systems and prefab septic tanks installers	Govt. led (IHHL, PT, CT)	Samples from non-sewer areas
		Private Agency (IHHL)	Identifying Private agencies through Sanitary Inspector (SI) Building Use permission authority Plumber/Mason associations
2	Repair and maintenance of OSS	Govt. led (PT-CT)	Govt. officials (SI)
		Private Agency (IHHL)	Residents Local service providers Urban Clap
3	Emptying and Conveyance	ULB's own team / ULB's outsourced agency	ULB staff (SI)
		Private Agency (Recognized/registered)	ULB staff / residents Manual Scavenging
		Informal sector	ULB staff / residents / NGO
4	Repair and maintenance of equipment and vehicles	ULB	ULB staff (SI)
		Private	Private operators Truck Supplier
5	Treatment	Sludge Drying Bed	Interaction with ULB staff or plant operating agency
		Operators	FSTP plant operators

Table 1 Stakeholders covered and Methodology for FSSM Skill Gap Assessment

The secondary data have also been obtained from the various sources. These sources of the data are Census of India -2011, Swachh Bharat Mission – Urban (target and progress for IHHL, CT, and PT up to 2019).

These data helped in estimating the demand for manpower in, the supply of manpower, an existing gap of workers etc. in the FSSM sector. The secondary information from various reports, policy document, and guideline have also been used in the understanding of FSSM value chain and informal workforce engaged in the construction of toilet with septic tanks, desludging services and operation, and management of FSTP.

2.2 Parameters for selection of sample cities

The FSSM Skill gap assessment study was conducted in 5 cities across the country. Criteria for the selection of the cities is described below:

Head	Description
Geological condition	Coastal; Plain; Plateau; Hilly; Desert
Size of the city/town	Population between 10 to 20 lakhs; Population between 5 to 10 lakhs; Population less than 5 lakhs (Population between 1 to 5 lakhs); Small towns – Population less than 1 lakh
AMRUT cities	Cities/towns will be selected from the 500 cities covered under AMRUT mission
Coverage of sewerage	Cities/towns having coverage of sewer network more than or equal to 70% will be selected for the study purpose

Table 2 Criteria for the selection of the cities for the FSSM study

2.3 An empirical study of selected cities

For FSSM skill gap assessment study, five cities based on various parameters described above were selected namely Udaipur (Rajasthan), Puri (Odisha), Vishakhapatnam (Andhra Pradesh, Wai (Maharashtra) and Warangal (Telangana). Findings from the city were used to draw qualitative inferences on job role wise skill gaps existing in the workforce engaged in the sanitation sector.

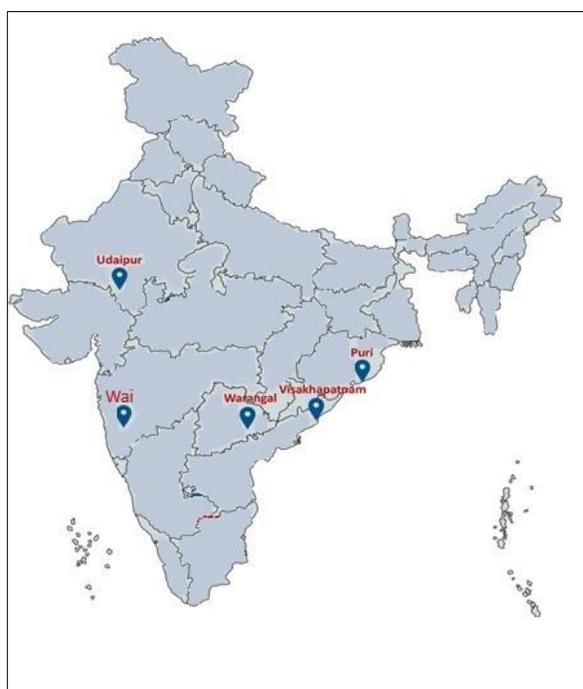


Figure 2 Cities covered for FSSM Skill Gap Assessment

Chapter 3

OVERVIEW OF THE FSSM SECTOR

3.1 Sanitation scenario in Urban India:

In India, according to the 2011 census data, around 81.4 percent of urban households have access to toilet facilities within the household premises, 6 percent access public toilets, and 12.6 percent are doing open defecation amounting to around 10 million households.

The problem of inadequate provision and unsatisfactory operation and management of sanitation facilities is acute in the urban centers of India. 17.4 percent of urban India was estimated to be living in slums. The census of India - 2011 reports on housing stock, amenities and assets in slums reveals that 13.74 million out of the 78.9 million urban households live in slums.

Types of Latrine facilities within the premises	No of HHs	% HHs
Piped sewer system	25775247	32.68
Septic tank	30087437	38.15
Other system	1372544	1.74
Pit Latrine	5597143	7.10
Night soil disposed into open drain	942643	1.20
Service Latrine	387105	0.49
Public Latrine	4743807	6.02
Open Defecation	9,960,011	12.63

Table 3 Sanitation coverage in urban India as per the Census of India -2011

The deficiencies in the existing sanitation infrastructure and services are widespread.

According to Census of India - 2011, coverage of urban households by sewerage and septic tanks was 33 percent and 38 percent, respectively. About 14.6 percent of households were reported to have pit latrines. Further, 6 percent urban households (4.7 million) were reported to be using public/community toilets, with 12 percent urban households (about 10 million households or about 50 million people) are defecating in the open.

3.2 Sector size: On-site Sanitation Systems in India:

Under the Swachh Bharat Mission (SBM), it is envisaged that nearly 6.3 million HHs will meet their sanitation needs through newly-built individual household toilet (IHHT) and the remaining 1.6 million HHs will rely on existing or newly-built community toilets contributing to the OSS systems in India.

The onsite sanitation system (OSS) in which excreta and wastewater are collected and stored in a pit latrine or in the septic tanks. In urban India, around 38.15 percent households are reported to have pit latrines or septic tanks. The states like Uttar Pradesh, Tamil Nadu, Maharashtra, Andhra Pradesh and West Bengal are reported a maximum number of households with on-site sanitation system in their respective cities. The details on states-wise coverage of on-site sanitation system are provided in the table below:

Name of the States	Total No of HHs	Total No of Septic Tanks (OSS System)	OSS System in %
Jammu & Kashmir	517168	196116	37.9
Himachal Pradesh	166043	75239	45.3
Punjab	2094067	417428	19.9
Chandigarh	228276	1954	0.8
Uttarakhand	592223	314277	53.0
Haryana	1751901	416287	23.7
NCT of Delhi	3261423	804480	24.6
Rajasthan	3090940	1409975	45.6
Uttar Pradesh	7449195	3491029	46.8
Bihar	2013671	1061688	52.7
Sikkim	35761	19912	55.6
Arunachal Pradesh	65891	35330	53.6
Nagaland	115054	77394	67.2
Manipur	171400	73875	43.1
Mizoram	116203	82885	71.3
Tripura	235002	88346	37.5
Meghalaya	116102	79781	68.7
Assam	992742	498977	50.2
West Bengal	6350113	2885743	45.4
Jharkhand	1495642	735837	49.2
Odisha	1517073	683396	45.0
Chhattisgarh	1238738	602010	48.6
Madhya Pradesh	3845232	1927886	50.1
Gujarat	5416315	1313454	24.2
Daman & Diu	47631	36975	77.6
Dadra & Nagar Haveli	37655	27013	71.7
Maharashtra	10813928	3096573	28.6
Andhra Pradesh	6778225	3010062	44.4
Karnataka	5315715	906083	17.0
Goa	198139	117575	59.3
Lakshadweep	8180	7676	93.8
Kerala	3620696	2052709	56.6
Tamil Nadu	8929104	3385422	37.9
Puducherry	206143	125466	60.8
Andaman & Nicobar Islands	34346	28584	83.2
Total	78865937	30087437	38.1

Table 4 No of Septic Tanks (OSS System) in the Urban Areas as per the Census of India -2011

3.3 Problem Identification – Where are we heading?

According to the data released in the report “Inventorization of Sewage treatment plants, 2015” by the Central Pollution Control Board, out of the 816 municipal sewage treatment plants (STPs) listed across India, 522 are operational (only 64% are functioning), 79 STPs are non-operational, 145 STPs are under construction and 70 STPs are proposed. The treatment capacity that is available is only for 37% of the total 62,000 MLD (million liters per day) of human waste that is generated in urban India.

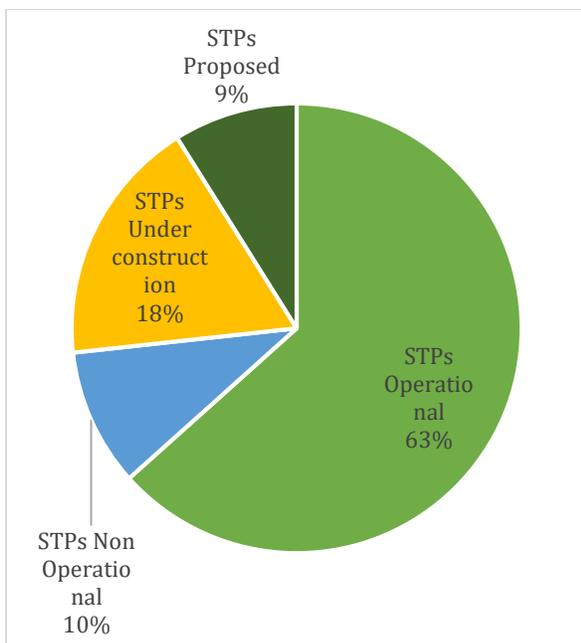


Figure 3 Number of Sewage Treatment Plants Listed in India (Source: CPCB, 2015)

Currently, on-site pit latrines and septic tanks account for a substantial proportion of toilets in urban India – over 38% of urban Indian households depend on onsite facilities (Census 2011) and this is continuously increasing.

Types of Latrine facilities within the premises	No of HHs	% HHs
Piped sewer system	25775247	32.68
Septic tank	30087437	38.15
Other system	1372544	1.74
Pit Latrine	5597143	7.10
Night soil disposed into open drain	942643	1.20
Service Latrine	387105	0.49
Public Latrine	4743807	6.02
Open Defecation	9,960,011	12.63
Total No of HHS	78865937	

Table 5 Households Depends on Onsite Sanitation System

With implementation progress in the Swachh Bharat Mission, there will be an increase in the number of toilets being constructed, leading to the reduction of open defecation. However, without proper collection, transportation and treatment processes, faecal waste from these additional toilets will only aggravate the current problem. This is clearly an area that needs urgent attention.

3.4 Evolution of the FSSM Sector:

Earlier, most of the septic tanks were de-sludge manually. However, manual cleaning has been officially abolished by Manual Scavenging Act - 2013 by the Supreme Court of India.

Nowadays, in Urban Local Bodies (ULBs) the most satisfactory method of sludge removal is by sludge vacuum tankers. The National Faecal Sludge and Septage Management Policy-2018 recommended desludging of the septic tanks once every two to three years. The treatment of sludge will also help in reducing the pollution levels in the liquid effluent, which enters waterways untreated.

3.5 Future trends in the FSSM Sector:

The collected faecal sludge from septic tanks/pits latrines can be treated by using Faecal Sludge Treatment Plant. The FSTPs are designed to be aesthetically pleasing with no odor, located close to the town, hence keeping distances low for desludging operators to dispose and operate on very little mechanical equipment that does not require skilled operators thus keeping operational expenditure low. These features enable the FSTP to be financially sustainable through their own funds.

The treatment process involves multiple steps to convert the sludge into manure or compost for farmers. Faecal sludge is collected in desludging vehicles (Vacutugs). These desludging vehicles bring the faecal sludge to the treatment plant. The solid stream goes into anaerobic digestion and biogas is produced. It is then further treated and stabilized in anaerobic reactors. Finally, it is dried in a drying bed and ready for co-composting, where it is mixed with organic municipal waste and co-composted into useful soil enricher or compost for farmers. This cycle balances the nutrient requirements of the soil that's depleted through agriculture and overuse.

Warangal, Leh, and Devanahalli are currently 3 working FSTPs in India. Apart from Devanahalli, another FSTP is in Leh. The city has witnessed tremendous growth in the last ten years. Being a cold desert region, the majority of households in Leh were dependent on dry toilets which use very little water. Leh witnessed an economic boom and modern style flush toilets become common and so did the building of septic tanks. Overflowing septic tanks began leaching into the ground, resulting in brownish water coming from borewells. The

municipal corporation realized the need for a faecal sludge management system. The current capacity of the FSTP is to treat 12,000 liters of faecal sludge per day.

Case Study: Adoption of FSM at Devanahalli

Devanahalli has a population of 35,000 and is located near the Bengaluru. Around 90% of the households (5800 HHs) are equipped with toilets having a single pit, septic tank, twin pit, and open drain. Rest 10% of the households are without toilets and mostly use open defecation, shared toilets, or public toilets. The FSM service value chain of Devanahalli covers all stages of the faecal sludge treatment, including capture, storage, transport, treatment, and finally, reuse of the faecal matter.

The Devanahalli Town Municipal Council (TMC) partnered with the Bangalore-based not-for-profit Consortium for DEWATS Dissemination (CDD) Society and the German NGO Bremen Overseas Research and Development Association (BORDA) for this project. The FSTP at Devanahalli has 15 KLD capacity. The plant can serve approx. 30,000 people. The plant spread over an area of the 650 square meters. It's a simple and low-cost O&M plant using the technology of gravity based biological treatment. The plant was commissioned with a capital cost of Rs 90 lakhs and has an operating cost of Rs 24 lakhs per year. The lifecycle cost of the plant is Rs 1500 per capita, which is very low in itself. The treatment module comprises of six stages that include screening, sludge-liquid separation, sludge stabilization, dewatering, disinfection, and liquid treatment.

Chapter 4

FSSM VALUE CHAIN

4.1 FSSM Value Chain:

The complete Faecal Sludge and Septage Management (FSSM) value chain is shown in the figure below.

4.1.1 Step 1: Collection of Faecal Sludge:

The customer/user raises the request or the desludging services to either the municipal office or the private operators. After the service fees are submitted at the municipal Office the sludge vehicle with driver, operator and emptier reaches the site. Before the desludging activity starts, the user is requested beforehand to let the cap of the septic tank open for some time, so that harmful gases can escape.

Whenever the desludging of septic tank is undertaken, it's mandatory that a small amount

the scum mat is manually broken up to facilitate pumping. The emptier should also take care from the gas generated due to anaerobic digestion in the septic tank.

4.1.2 Step 2: Transportation of Sludge:

The septage transportation is one of the most important components of septage management. The desludging trucks act as a "Mobile Sewer Network" for onsite sanitation system. They collect the septage from the residential, commercial and institutional areas and safely transport and dispose the sludge to the dedicated or identified sludge disposal sites.

4.1.3 Step 3: Treatment of Sludge:

The most desirable option for treatment of sludge collected from onsite sanitation system is co-treatment plant or Faecal Sludge Treatment Plant (FSTP). When, in a city, the co-treatment plant does not exist. The FSTP is the only option to treat the sludge collected from the onsite sanitation system. The FSTP is

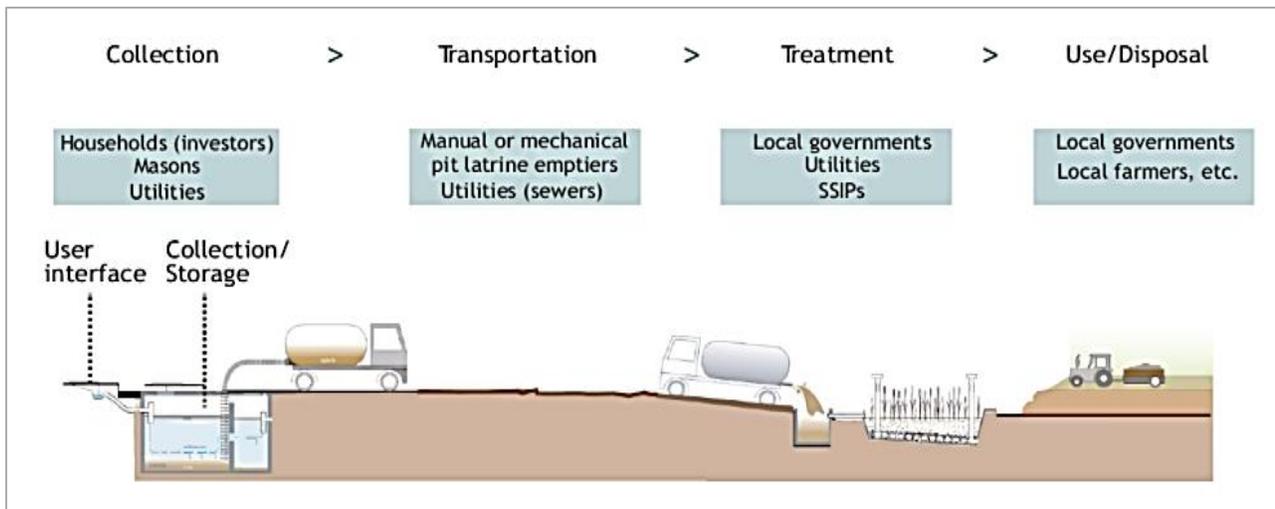


Figure 4 Faecal Sludge and Septage Management Value Chain

of sludge be left in the tank to ensure that a minimum level of the necessary microorganisms responsible for anaerobic digestion remains in the tank. Before desludging the septage from the septic tanks,

specially made for septage treatment in the cities. However, only a few cities in India have FSTP. The cities require more FSTP or co-treatment plants to treat the sludge collected from the OSS. The compost from septage can be

used as a soil amendment to reclaim land or used in landscaping or horticulture.

4.2 Additional critical activities in FSSM Value chain:

The FSSM value chain has many critical activities which need to be addressed in an appropriate manner to increase the efficiency of the value chain such as:

- The repair and maintenance of existing septic tanks from leakage are most critical. The leakage of septic tanks pollutes the groundwater and surroundings
- The operation and maintenance of sludge vacuum tanks are also important. These vacuum tanks need regular maintenance. However, the cost of O&M of sludge vacuum tanks are very high and these facilities are not available everywhere. There is need of vendors who can support the desludging operator in O&M of sludge vacuum tanks and vehicles
- Standard operating procedures (SOPs) are required for pumping, transportation of sludge, disposal of sludge etc. to standardize day to day procedure of desludging services.

4.3 The infrastructure required for desludging services

4.3.1 Vehicles for emptying or desludging septic tanks

The desludging service providers need to deploy septage vehicles as per the requirement of emptying of septic tanks. The septage vehicles should be fitted with sludge tank, vacuum pump, suction hose, control panel and other required accessories. The septage vehicles should also be fitted with the Global Position System (GPS) for monitoring and tracking the routes of the vehicles.

In India, septage vehicles are available in different capacities of 2,000 to 12,000 liters. The requirement of vehicles also varies depending upon the capacity of vehicles and road width. Generally, the bigger cities having sufficient width of roads may have bigger capacity vehicles. The sludge tank installed in the septage vehicles should be cylindrical in shape.



Figure 5 Sewage emptying truck

Vacutugs with Capacity	Demand for Vacutugs	Demand in %
Vacuum Tanks Capacity – 2000	2,915	15
Vacuum Tanks Capacity – 3000	15,545	79
Vacuum Tanks Capacity – 5000	1,166	06
Total demand Vacutugs in 2019	19,626	

Table 6 Demand for Vacutugs, In Indian Cities in 2019

(Source: Projected demand for Vacutugs in Indian cities in 2019)

As estimated, the demand of Vacutugs is 19626. This demand for Vacutugs is based on various assumptions. These assumptions are:

1. 80 % of sludge to be transported by 3000 Liters capacity of Vacutugs.
2. 10% of sludge to be transported by 2000 Liters capacity Vacutugs.

3. 10% of sludge to be transported by 5000 Liters capacity Vacutugs.
4. Each Vacutugs will do average 03 trips in a day.

As assumed, 3000 liters capacity of Vacutugs is most accessible to all kind of roads in the cities. We assumed that 80 percent of sludge to be transported by the 3000 liters capacity of Vacutugs. As estimated 15545 (79 % of total number of Vacutugs) Vacutugs is needed to transport the 80 percent of total sludge.

The inner area of the cities needed the smaller capacity of Vacutugs. These Vacutugs can have entered in the small width of the road. As assumed 10 percent of total sludge to be transported by the 2000 Liters capacity of Vacutugs. The Indian cities needed 2915 (15 percent of total demand for Vacutugs) number of 2000 liters capacity of Vacutugs.

Remaining 10 % of sludge to be transported by the bigger capacity of Vacutugs. The Indian cities needed 1166 (06 % of the total demand for Vacutugs) number of Vacutugs with a capacity of 5000 liters. These Vacutugs can be utilized in desludging of big septic tank located in the public places like hospital, Schools, Community and Public toilets temples etc.

4.3.2 Faecal Sludge Treatment Plant:

The Faecal Sludge Treatment Plant is designed for treatment of sludge collected from the onsite sanitation system. In India, the first FSTP plant was constructed in Devanahalli Municipality of Karnataka. The FSTP plant was constructed with the support of Consortium for DEWATS Dissemination (CDD) Society. The Devanahalli plant is successfully handling 100 percent of the sludge collected in Devanahalli.



Figure 6 Devanahalli FSTP

FSTP with Capacity	The demand of FSTP in 2019
FSTP with 20 KLD Capacity	8744

Table 7 Demand of FSTP, In Indian Cities in 2019¹

Devanahalli is the first town in the country that has implemented end-to-end FSM.

As estimated, the demand of FSTP in the Indian cities is 8744. This demand of FSTP is based on various assumptions. These assumptions are:

1. The capacity of each FSTP is 20 KLD.
2. A city with 50,000 population needed 20 KLD FSTP plant.
3. Each city to implement the mandatory scheduled desludging services (septic tank to be emptied once in three years)

The demand of FSTP may differ from cities to cities. However, the city with a population of 50,000 needed one FSTP with 20 KLD capacity. The 20 KLD capacity of FSTP is projected based on sludge generated in the city per day.

The maximum sludge can be generated in the city with a population of 50,000 is 20,111 liters

¹ Projected demand of FSTP in Indian cities in 2019

/day² (The 60 % of the HHs in the city are connected with OSS system)

4.3.3 Co-Treatment Plants

In Indian cities, the co-treatment of septage along with domestic sewage at a sewage treatment plant (STP), if available, is the most desirable option for treatment of sludge collected from OSS. In co-treatment, FS solids should first be separated by sedimentation or in sludge drying beds. The co-treatment plant has a septage receiving station. The septage vehicle needs to unload the septage at a storage tank in the co-treatment plant. The storage tank is used to store the septage so that it can be discharged to the treatment plant. The septage in storage tank should be properly mixed by mixers, air diffusers for odor control.



Figure 7 FSTP Devenhalli

Discharge of septage at the upstream is preferable for the removal of grit and screenings. If there are no screening facilities ahead of the septage discharge facility, the septage should be transferred from the storage tank to the treatment plant with grinder pumps or transfer through gravity flow.

4.4 Challenges in the FSSM Value Chain

The septage collection, conveyance, treatment, and reuse of sludge are identified as critical challenges in the FSSM value chain. The major issues in the FSSM value chain are:

A. Septage collection and conveyance

- a. Regular cleaning of the septic tanks through systemic extraction and collection procedure
- b. Determination of frequency of cleaning of the septic tank

B. Illegal Manual Scavenging

- a. Implementation of Manual Scavenging Act
- b. Social and cultural acceptance of such practices act against formal and systematic methods of cleaning tanks

C. Limited Access to the Septic Tanks

- a. Septic tanks are often constructed under the toilets or sealed hence making it difficult to clean

D. Inappropriate septic tank size & design

- a. Septic tanks usually do not meet the standards prescribed in the National Building Code, the Indian Standard Codes, and the CPHEEO Manual.
- b. Households typically notice the need for cleaning only once the tanks fill up and call for emptying services.

E. Lack of resources

- a. ULBs are often faced with a lack of financial and skilled workforce for carrying out the desludging services

² - 230 liters/ capita/Year or 0.63 Liters/capita/day (based on USEPA manual)

- b. Lack of sufficient suction emptier trucks, safety equipment, etc. to ensure regular cleaning/emptying of septic tanks

F. Lack of formal private players

- a. Currently, FSSM sector is dominated by the informal contractors making their monitoring difficult
- b. Domination by informal players also makes it harder to institutionalize best practices and regulations

G. Treatment and disposal of sludge

- a. Due to the lack of facilities and designated sites for sewage and septage treatment and disposal, all sewage is dumped without treatment into the rivers, while untreated sludge and septage is disposed of in a dumping ground/any water body available, and often these sites are some distance away from the main city

H. Poor awareness

- a. Lack of awareness faecal sludge and septage management and public health

I. Fragmented institutional roles and responsibilities

- a. There are considerable gaps and overlaps in institutional roles and responsibilities at the national, state, and city levels

J. Lack of an integrated city-wide approach

- a. Investments are currently planned in a piece-meal manner

K. Limited Technology Choices

- a. Lack of environment-friendly, cost-effective waste disposal technologies

L. Gender Sensitive Gap

- a. The burden of poor sanitation (compounded by the lack of FSSM services) disproportionately affects women, especially the urban poor, because this falls along established fault-lines of malnutrition and family health caregiving.

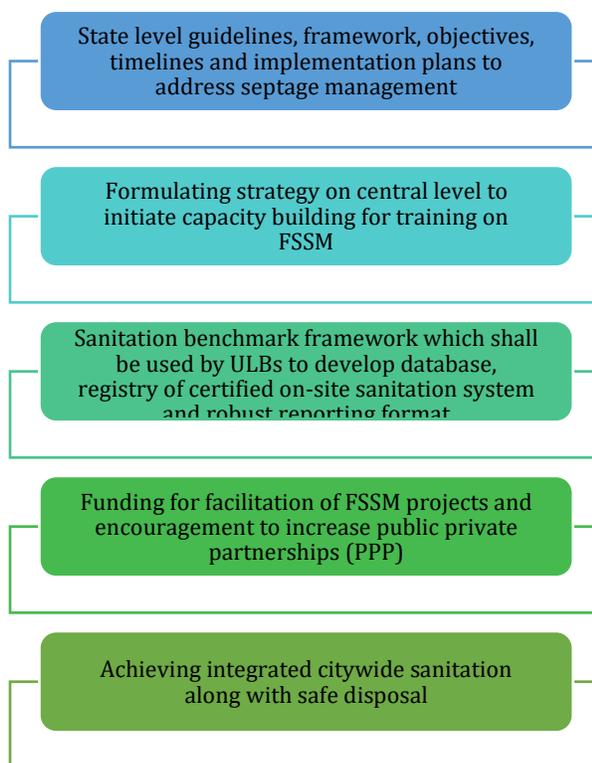
Chapter 5

POLICY REGULATION AND STAKEHOLDERS IN THE FSSM SECTOR

5.1 National Level

5.1.1 National FSSM Policy 2017

The Ministry of Housing and Urban Affairs has prepared and launched the National Faecal Sludge and Septage Management (FSSM) Policy in February 2017. The key features of the National FSSM Policy are:

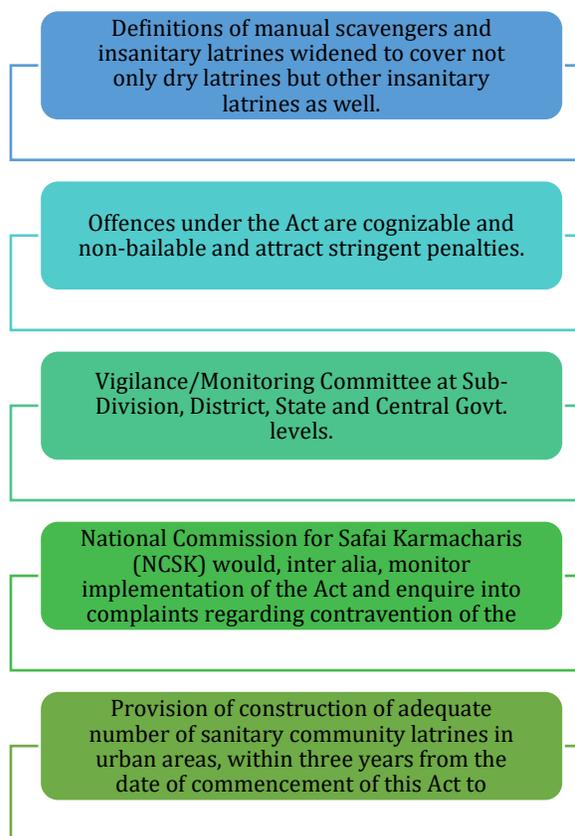


5.1.2 Manual Scavenging Act 2013

The Government of India (GoI) has formulated "The Prohibition of Employment as Manual Scavengers and their Rehabilitation

Rules 2013" or "M.S. Rules 2013". Through the M.S. Rules -2013, manual scavenging has been officially abolished by law. Manual scavenging involves moving the excreta, using brooms and tin plates/metal pans, into baskets, which the workers carry to disposal locations sometimes several kilometers away. While performing duty, the workers or scavengers rarely have any personal protective equipment.

The Government of India has appointed National Safai Karmacharis Finance and Development Corporation (NSKFDC), an apex corporation, for the socio-economic development of Safai Karmacharis and manual scavengers and their dependents as the nodal agency of Government of India for rehabilitation of the identified manual scavengers and their dependents. The key features of M.S. Rules 2013 are following given below:



5.1.3 Central Public Health and Environmental Engineering Organization (CPHEEO)

The Central Public Health and Environmental Engineering Organization (CPHEEO) is the technical wing of the Ministry of Housing and Urban Affairs, Government of India, and deals with all matters related to urban water supply and sanitation including solid waste management in the country. The Institution is responsible for preparing the standards and norms for various services including water, sanitation, construction of septic tanks and twin pits etc. The CPHEEO norms serve- as a standard guide in public health engineering by providing a code of day to day practice for public health engineers to follow.

Water supply and sanitation is a state subject. However, the policies, strategies, and guidelines are being provided by CPHEEO to the States & UTs Governments including Urban Local Bodies. CPHEEO also acts as an advisory body at central level to advise the concerned state agencies and ULBs in implementation, operation & maintenance of urban water supply, sanitation, and Solid Waste Management projects and helps to adopt latest technologies in these sub-sectors.

5.1.4 National FSSM Alliance

A national working group was convened in January 2016 with the support of the Bill and Melinda Gates Foundation (BMGF) with the mandate to build consensus around and drive the discourse on Faecal Sludge and Septage Management (FSSM) forward nationally. The alliance currently comprises of 24 organizations across the country working towards solutions for Indian States and Cities.

The NFSSM alliance is working in close collaboration with the Ministry of Housing and Urban Affairs (MoHUA) helped to design a

National Declaration for a national goal on FSSM and a convergence of the mission programs like Swachh Bharat Mission (SBM-U), Deendayal Antyodaya Yojana - National Urban Livelihoods Mission (DAY-NULM), Smart Cities Mission (SCM) , Pradhan Mantri Awas Yojana (PMAY), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), National Urban Health Mission (NUHM), and Heritage City Development and Augmentation Yojana (HRIDAY) etc.

The NFSSM Alliance works on all aspects from city sanitation plans to regulatory and institutional frameworks across the sanitation value chain. The Alliance is also helping the states and cities in developing the State level FSSM policy. The Alliance members are continuously working with the urban local bodies and state governments in promoting the FSSM agenda and sustainable sanitation for all.

5.2 State level:

Water supply and sanitation is a state subject. The states /UTs government must bring out specific policy/guidelines for better management of FS in their State and the cities. These guidelines would help in creating an enabling environment and provide an opportunity to the ULBs in the implementation of sanitation related projects and management of faecal sludge. As of today, 17 States/UTs have (Annex - I) prepared state level FSSM policy to implement the FSSM in their cities. The policy also recommends the importance of scheduled desludging services of septic tanks. List of the states which have prepared state level FSSM policy is described in Annex -I.

Chapter 6

DEMAND AND SUPPLY SCENARIO OF WORKFORCE IN THE FSSM SECTOR

6.1 Skill Gap Assessment of Five Sample Cities:

The assessment of gaps in the demand and supply scenario in the existing Faecal Sludge and Septage Management (FSSM) sector, was carried out in the sample five cities including Puri, Udaipur, Visakhapatnam, Warangal, and Wai. The entire FSSM value chain was explored by interacting with various stakeholders such as ULB officials, sanitation workers engaged by the ULBs, private operators etc. Across FSSM value chain, the workers are involved in the construction of toilet with the septic tanks, emptying the sludge from the septic tanks and in operating the FSTP or co-treatment plants etc.



Access & Containment	Emptying & Conveyance	Treatment & Disposal	
Toilet (IHHL + CT+PT) with a septic tank to be constructed	Number of the septic tank to be emptied	Number of STP and FSTP	
3882	31248	01	Puri
1183	70056	01	Udaipur
7648	271642	17	Vizag
7440	88765	01	Warangal
112	4571	01	Wai

Figure 8 Status of Sanitation Infrastructure in the sample cities

The diagram describes the status of existing sanitation infrastructure in the sample cities.

The sanitation infrastructure includes the numbers of the toilet with septic tanks to be constructed, number of septic tanks to be emptied and the number of STPs and FSTPs existing in the cities.

Puri is one of the oldest coastal towns of the Odisha. The population of the town is 2 Lakh as per census of India -2011. The Puri has 31,248 septic tanks which require desludging services. Under the Swachh Bharat Mission Urban, toilet to be constructed with the septic tank is 3,882. The city has a 50 KLD co-treatment plant which has started functioning from the October 2017.

As estimated, based on USEPA manual, per day sludge to be generated in Puri Municipal Corporation (PMC) is 1.04 Lakh Liters³.

Par day sludge generated (L/Day Approx.)	104322
No of 2000 Liter Capacity Vacutugs needed	02
No. of 3000 Liter Capacity Vacutugs needed	09
No of 5000 Liter Capacity Vacutugs needed	01
No of FSTP needed with 20 KLD treatment/day	05

Table 8 Per day sludge generation in Puri

The PMC needed 12 Vacutugs with a capacity of 2000 Liters, (02 Vacutugs) 3000 Liters (09 Vacutugs) and 5000 Liters (01 Vacutugs). The city is going to provide scheduled septic tank emptying services to all properties, which will be at an interval of 3 years as suggested by state and national level policies and guidelines.

The 80 percent of sludge generated in the city is to be transported by the 3000 liters capacity

³ 230 liters/ capita/Year or 0.63 Liters/capita/day (based on USEPA manual)

of Vacutugs. The each Vacutugs shall do average three trips in a day for transposition of sludge from the septic tank to dedicated sludge disposal sites.

As estimated, PMC needed, 05 FSTP with 20 KLD capacity of each FSTP. However, the PMC has a 50 KLD co-treatment plant which has started functioning from the October 2017.

In Udaipur Municipal Corporation (UMC), the sludge is managed by the UMC and four private desludging service providers. As per the census of India -2011, 70,056 septic tanks required scheduled desludging services. The SBM – Urban also created sanitation infrastructure in the city. 1,183 toilets with septic tanks to be constructed. At present, the collected sludge is being dumped at the solid waste dump site.

As estimated, based on USEPA manual, per day sludge to be generated in UMC is 2.28 Lakh Liters.

Par day sludge generated (L/Day Approx.)	228043
No of 2000 Liter Capacity Vacutugs needed	04
No. of 3000 Liter Capacity Vacutugs needed	20
No of 5000 Liter Capacity Vacutugs needed	02
No of FSTP needed with 20 KLD treatment/day	11

Table 9 Per day sludge generation in UMC

The UMC needed 26 Vacutugs with a capacity of 2000 Liters, (04 Vacutugs) 3000 Liters (20 Vacutugs) and 5000 Liters (02 Vacutugs). The city is going to provide scheduled septic tank emptying services to all properties, which will be at an interval of 3 years as suggested by state and national level policies and guidelines.

⁴ Census of India -2011

The 80 percent of sludge generated in the city is to be transported by the 3000 liters capacity of Vacutugs. The each Vacutugs shall do average three trips in a day for transposition of sludge from the septic tank to dedicated sludge disposal sites.

As estimated, PMC needed, 11 FSTP with 20 KLD capacity of each FSTP. However, the UMC does not have any treatment plant to treat the sludge.

The Greater Vishakhapatnam Municipal Corporation (GVMC) is the largest city of Andhra Pradesh State with a population of 17.28⁴ Lakhs. As far as sanitation infrastructure is concerned, the GVMC has 2.71 Lakhs septic tanks which require scheduled desludging services. 7648 new toilets with septic tanks have also been constructed under SBM-Urban. The city has 17 STP plants in which 2 STPs are connected the sludge disposal sites. The GVMC has not been providing the desludging services to its citizen. The emptying of the septic tanks is done by the 65⁵ private desludging operators. The private desludging operator disposed the sludge at dedicated sludge disposal sites identified by the GVMC.

As estimated, based on USEPA manual, per day sludge to be generated in GVMC is 8.88 Lakh Liters.

Par day sludge generated (L/Day Approx.)	888323
No of 2000 Liter Capacity Vacutugs needed	15
No. of 3000 Liter Capacity Vacutugs needed	79
No of 5000 Liter Capacity Vacutugs needed	6
No of FSTP needed with 20 KLD treatment/day	44

⁵ As per GVMC, 30 Private desludging operators are registered with the GVMC. The remaining private operators will be in process of registration.

Table 10 Per day sludge generation in GVMC

The GVMC needed 100 Vacutugs with a capacity of 2000 Liters, (15 Vacutugs) 3000 Liters (79 Vacutugs) and 5000 Liters (06 Vacutugs). The city is going to provide scheduled septic tank emptying services to all properties, which will be at an interval of 3 years as suggested by state and national level policies and guidelines.

The 80 percent of sludge generated in the city is to be transported by the 3000 liters capacity of Vacutugs. The each Vacutugs shall do average three trips in a day for transposition of sludge from the septic tank to dedicated sludge disposal sites.

As estimated, GVMC needed, 44 FSTP with 20 KLD capacity of each FSTP. However, the GVMC do not have any treatment plant to treat the sludge. The sludge is disposed at the Sewage Treatment Plant (STP).

The Greater Warangal Municipal Corporation (GWMC) is the second largest city of Telangana State with a population of 6.15 Lakhs as per census of India -2011. The city does not have an offsite sanitation system hence, the city depends on on-site sanitation system. As far as sanitation infrastructure is concerned, 88765⁶ number of septic tanks required scheduled desludging services. The SBMU has also created sanitation infrastructure in the city. Around 7440 toilets with septic tanks to be constructed in GWMC. Recently, GWMC has constructed 15 KLD Faecal Sludge Treatment Plant (FSTP). The plant has started functioning from February 2018 onwards and desludging operator are started dumping the sludge in the FSTP. The GWMC also passed the septage regulation at the city level to manage the faecal sludge in the city.

As estimated, based on USEPA manual, per day sludge to be generated in GWMC is 8.88 Lakh Liters.

Par day sludge generated (L/Day Approx.)	283584
No of 2000 Liter Capacity Vacutugs needed	05
No. of 3000 Liter Capacity Vacutugs needed	25
No of 5000 Liter Capacity Vacutugs needed	02
No of FSTP needed with 20 KLD treatment/day	14

Table 11 Per day sludge generation in GWMC

The GWMC needed 32 Vacutugs with a capacity of 2000 Liters, (05 Vacutugs) 3000 Liters (25 Vacutugs) and 5000 Liters (02 Vacutugs). The city is going to provide scheduled septic tank emptying services to all properties, which will be at an interval of 3 years as suggested by state and national level policies and guidelines.

The 80 percent of sludge generated in the city is to be transported by the 3000 liters capacity of Vacutugs. The each Vacutugs shall do average three trips in a day for transposition of sludge from the septic tank to dedicated sludge disposal sites.

As estimated, GVMC needed, 14 FSTP with 20 KLD capacity of each FSTP. However, the GWMC has recently constructed a 15 KLD FSTP which has started functioning from February 2018.

The Wai Municipal Council is the C class town of Maharashtra. The population of Wai is 36025⁷. In Wai, 4571 number of septic tanks required scheduled desludging services. Around 112 toilets with septic tanks to be constructed. The Council has recently constructed 30 KLD, FSTP which has started

⁶ Census of India -2011

⁷ Census of India -2011

functioning. The city has 01 Cesspool Truck of 5000 liters capacity helped in managing the faecal sludge in the city. As the FSTP is under construction, the collected sludge is disposed at the identified sludge disposal sites near to solid waste dumping sites.

As estimated, based on USEPA manual, per day sludge to be generated in Wai is 0.18 Lakh Liters.

Par day sludge generated (L/Day Approx.)	18920
No of 2000 Liter Capacity Vacutugs needed	01
No. of 3000 Liter Capacity Vacutugs needed	02
No of 5000 Liter Capacity Vacutugs needed	00
No of FSTP needed with 20 KLD treatment/day	01

Table 12 Per day sludge generation in Wai

The Wai Council needed 03 Vacutugs with a capacity of 2000 Liters, (01 Vacutugs) 3000 Liters (02 Vacutugs). The city is going to provide scheduled septic tank emptying services to all properties, which will be at an interval of 3 years as suggested by state and national level policies and guidelines.

More or less of sludge generated in the city is to be transported by the 3000 liters capacity of Vacutugs. The each Vacutugs shall do average three trips in a day for transposition of sludge from the septic tank to dedicated sludge disposal sites.

As estimated, Wai needed, 01 FSTP with 20 KLD capacity of each FSTP. However, the GWMC has recently constructed a 30 KLD FSTP which has started functioning.

Recently, Wai council has also entered into a contractual agreement with a private partner to provide scheduled desludging services. This contract is a performance-based contract. The

contract has also been awarded to the private partner.

6.2 Supply of workers in sample cities:

Estimations of the supply numbers were carried based on the data gathered during the field visits and ULB records.

Name of the cities	Number of workers available in the FSSM value chain
Puri	05
Udaipur	20
Vizag	195
Warangal	28
Wai	08

Table 13 Number of FSSM workers available

Source: Collected through primary survey

6.3 The demand of workforce in the sample cities:

The number of required workers across the FSSM value chain in the cities are estimated based on various assumptions such as:

- i. Number of workers needed in the construction of toilet with septic tanks
- ii. Number of days required to complete the construction of toilet with the septic tanks
- iii. Number of desludging workers required in cleaning the onsite sanitation system (OSS)
- iv. The frequency of the OSS system
- v. Number of OSS can be cleaned in a day
- vi. Number of staff required for O&M of FSTP etc.

Detailed assumptions are described in annexure II.

The workers required in cities are involved in the construction of toilet with septic tanks, desludging the septic tanks, transport the

sludge from septic tank to dedicated sludge disposal sites and operation and maintenance of FSTP / co-treatment plants.

Demand estimation indicates that the maximum number of manpower is required in the construction of toilet with the septic tanks followed by emptying the sludge from the septic tanks and transport the sludge from the septic tank to identified sludge disposal sites. The demand for the number of the sanitation workers is directly proportional to the sanitation infrastructure created.

The city of Visakhapatnam requires a maximum number of desludging workers (505⁸) and in the construction of the toilet with septic tanks (618) as the city has the highest number of the septic tank (2.71⁹ Lakhs). The details of the current demand for workers across the FSSM value chain is given in the diagram above.

In the all the visited cities, the workers engaged in the desludging services are not formally trained. The majorities of workers engaged in desludging services are from the lower strata of the society and from a specific caste. The FSSM sector is dominated by the certain caste workers and has strong entry barriers for other caste people.

6.4 Demand Supply Gap in the sample cities

As estimated, the current average gap of workers in desludging and O&M of FSTP or co-treatment plant demand in the FSSM sector at case study cities is 78 percent. The gap at the city level is varied from 53 (in Wai) to 93 (in Puri) percent.

The details of the gap of workers at the city level in the FSSM sector is described in the table below:



 Access & Containment	 Emptying & Conveyance	 Treatment & Disposal	
Workers needed in the construction of IHHL, community and public toilets with OSS systems	Workers needed in Desludging OSS systems and Conveyance of septage	Workers needed in O&M of faecal sludge treatment plants (FSTP)	
272	60	16	Puri
100	131	34	Udaipur
618	505	133	Vizag
661	164	43	Warangal
14	14	03	Wai

Table 14 Projected number of workers required across FSSM Value in five cities in 2019

⁸ Three Workers required for cleaning one septic tanks (01 driver + 02 emptier). The one team of three workers can clean three septic tanks in a day.

⁹ Census of India -2011

	Puri	Udaipur	Vizag	Warangal	Wai
No of workers required in the construction of toilet with septic tank ¹⁰	272	100	618	661	14
No of workers required in desludging and transportation of sludge	60	131	505	164	14
No of workers required in O&M of FSTP	16	34	133	43	03
Total Required in 2019	76	165	638	207	17
member of workers available	5	20	195	28	8
Existing Gap in the pilot cities ¹¹	71	145	443	179	09
Percentage Gap	93	88	69	86	53
Average gap: 78 percent					

Table 15 Citywise workforce gap

6.5 Demand in FSSM Sector at the National Level:

The SBM- Urban is responsible for constructing the infrastructure like toilets with septic tanks in 4041 cities¹² while AMRUT mission is responsible for managing liquid waste generated by these toilets and laid down the sewer lines in 500 cities¹³. The Swachh Bharat Mission – Urban is to construct 66.42 lakhs IHHL, 2.5 Lakhs community and 2.6 lakhs public toilet seats. Around 60 percent (40.36 lakhs) of these toilets will be connected to the septic tanks.

The demand for FSSM sector at the national level has been estimated for the year of 2019. The estimation of demand is based on the secondary database.

The data of housing Census of 2011 and revised estimation of Swachh Bharat Mission-Urban have been used for demand projections. The projections of required workers across the FSSM value chain at the national is based on the following assumptions:

- a. 60 percent of constructed toilets are connected to the OSS system
- b. Septic tanks to be cleaned once in three years
- c. 3 workers are required per desludging vacuum truck
- d. Average number of septic tanks (03) can be cleaned in a day by one vacuum truck
- e. Average number of toilet seats (10) in the community and public toilets
- f. Average number of the user of one community and public toilet block
- g. Number of working days in year assumed (260 days)

¹⁰ - The toilet with septic tanks are to be constructed by the Masons. The existing Gap of the Masons is being fulfilled by the Masons and toilet with septic tanks is being constructed in the cities. However, these toilets with septic tanks have not been constructed with CPHEEO norms.

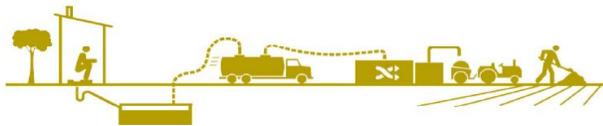
¹¹ - The existing Gap in the pilot cities have not been included the workers involved in construction of toilet with the septic tanks.

¹² - <http://www.swachhbharaturban.in/sbm/home/#/SBM>

¹³ - <http://amrut.gov.in>

- h. Number of person days for construction of one IHHL (16) and Number of person days for construction of a CT or PT seat (12 days)
- i. A number of staff required for operation and management of FSTP in two shifts etc.

As projected, the number of septic tanks to be maintained in 2019 will be 143.01 Lakhs. (this figure is one-third of the 429.03 Lakhs septic tanks). This demand includes a newly constructed toilet with septic tanks, septic tanks as per 2011 Census, septic tanks of community and public toilet as per census of India -2011 and treatment plant etc. The details of sanitation infrastructure across the value chain are given below in the diagram.



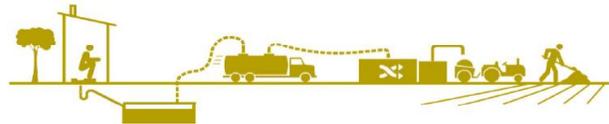
Access & Containment	Emptying & Conveyance	Treatment & Disposal
Toilet (IHHL + CT+PT) with a septic tank constructed during 2014-19	Number of septic tank as of 2011	Number of FSTP
40,36,090	3,88,67,334	8744
Total Number of Septic Tank to be maintained		4,29,12,168

Table 16 Projected total number of septic tanks in 2019

6.6 Manpower Demand in FSSM Sector

As estimated the FSSM Value chain needed 6.48 Lakhs workers¹⁴ up to 2019 to address the issues of faecal sludge and septage management in the Indian cities.

The construction of toilet with septic tanks is the first step, where jobs for Masson are being created. As estimated 2.89 lakhs¹⁵ workers are needed in the construction of these toilet with the septic tanks up to 2019. The emptying & conveyance of the sludge from the septic tanks is the second step of the FSSM value chain, where jobs for desludging operator including emptier are being created.



Access & Containment	Emptying & Conveyance	Treatment & Disposal
Workers needed in the construction of IHHL, community and public toilets with OSS systems	Workers needed in Desludging OSS systems and Conveyance of septage	Workers needed in O&M of faecal sludge treatment plants (FSTP)
2,89,964	3,32,055	26233
Estimated service providers (Organized and unorganized workers)		6,48,252

Table 17 Projected number of workers required across FSSM Value Chain Across Urban India - 2019

¹⁴ - 260 days of jobs/ workers/year

¹⁵ 260 days of jobs/ workers/year

As per the National FSSM policy -2017, the septic tanks to be emptied once in a three year. However, the challenge in desludging services is that septic tanks are to be emptied and there is a scarcity of skilled manpower who can work in the collection, transportation, treatment, and reuse of the sludge. As estimated 3.32 lakhs skilled manpower is needed to fulfill the gap.

The treatment and reuse of the sludge is the third step, where jobs for FSTP operator and repair & maintenance of FSTP are being created. In India, the FSTP is a new concept. As of now only few FSTP Viz, Devanahalli, Leh, Wai, Warangal, Cochin, Bansberia (West Bengal), Karunguzhi (Kanchipuram), Narsapur (Andhra Pradesh), and Tenali (Andhra Pradesh) are being constructed and are operational.

Around 12 more FSTP construction work is in progress. The name of the cities where construction work for FSTP are in progress Viz, Kohima, Periyanaickenpalayam, Trichy, Cuttack, Berhampur, Baripada, Bhadrak, Baleshwar, Sambhalpur, Raurkela, Sinnar, and Sicilla etc.

Now a day, ULBs and State Government have recognized the importance of FSTP for the solution of OSS system. The Andhra Pradesh and Tamil Nadu states are planning to build around 78 and 49 FSTP respectively.

As estimated, In India, 8744 FSTPs are needed to address the issues of faecal sludge. As of now, in a few cities, the Sewage Treatment Plants (STPs) are being used in the disposal of sludge. The sludge is also disposed at the Co-treatment plant. However, as estimated, 26233 workers are needed in operation and maintenance of projected demand of FSTP in urban India.

6.7 Vacutugs Demand in FSSM Sector:

Vacutugs is a portable machine which used to extract sludge from the septic tanks and safely transport sludge from septic tanks to identified sludge disposal sites.

Vacutugs with Capacity	No of demand of Vacutugs	In Percentage
Vacuum Tanks Capacity - 2000	2915	15
Vacuum Tanks Capacity - 3000	15545	79
Vacuum Tanks Capacity - 5000	1166	6
Total No of Vacutugs needed in 2019	19626	100

Table 18 Vacutugs demand

As estimated, urban India needed 19626 Vacutugs with a capacity of 2000 Liters, (2915 Vacutugs) 3000 Liters (15545 Vacutugs) and 5000 Liters (1166 Vacutugs). As per the FSSM Policy -2017, the cities need to implement scheduled desludging of septic tank, which will be at an interval of 3 years.

6.8 Existing Gap of the workers at the National level

The FSSM sector in India is majorly an unorganized sector and cities have not been able to identify workers who are engaged in cleaning of septic tanks and related services. Most of the workers are engaged in this sector are from the specific caste. There is no database of such workers available at the national level or at the Local level. For the purpose of the study, the existing number of sanitation workers is estimated through various assumptions and information gathered during the field visit to the sample cities.

The demand for workers at the national level is 6.16 Lakh¹⁶. This includes worker needed in the construction of toilet with septic tanks, desludging services and O&M of co-treatment or FSTP's. out of this figure worker required for the construction of septic tanks are 289964. This demand is somehow getting met by existing masons (though they need specialized training about septic tank construction) so this figure is not taken while calculating the existing gap of workers for FSSM sector.

As shown in the table "Gap of workers at the national level in FSSM Sector" the total workers required in 2019 for emptying septic tanks and for treatment of faecal sludge comes out to be 358288. The average deficiency of workers observed in the sample cities is (2.79 Lakhs workers) 78 percent. Applying this to the total workers needed one gets an existing deficiency of workers for FSSM sector. the

Heads	In Urban India
No of workers needed in desludging and transportation of sludge	3,32,055
No of workers needed in O&M of STP and FSTP	26233
Total Required in 2019	358288
Number of workers available ¹⁷	78823
Existing Gap in Urban India	279464

Table 19 Gap of workers in Urban India in FSSM Sector - 2019

6.9 Projected workforce required in next five years

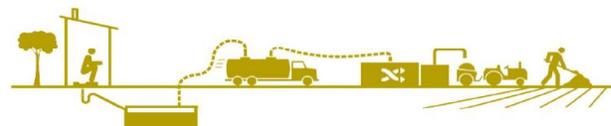
The workforce projections have been made up to 2023 with base year as 2019. The FSSM skill Gap study conducted taking place into account

¹⁶ - 260 days of jobs/ workers/year

the future trends and factor prevalent across the sector in urban India.

The extensive database (Census of India – toilet, septic tank, community and public toilet connected with the onsite sanitation system, Number of toilet constructed with septic tanks under SBM Urban, number of community and public toilet with septic tank constructed under SBM, STP and FSTP plants etc.) have been used for projections of manpower.

The FSSM skill gap analysis has been done considering targets of SBM-Urban up to 2019 and an additional toilet with septic tanks required up to 2023. The snapshot of the overall projected manpower across the FSSM value chain is given in the diagram.



Access & Containment	Emptying & Conveyance	Treatment & Disposal	
Workers needed in the construction of IHHL, community and public toilets with OSS systems	Workers needed in Desludging OSS systems and Conveyance of septage	Workers needed in O&M of faecal sludge treatment plants	
289964	332055	26233	2019
304462	338410		2020
319685	372251		2021
335669	409477		2022
352453	450424		2023

Table 20 Demand for workers in the next five years up to 2023

¹⁷ - The existing Gap in the pilot cities have not been included the workers involved in construction of toilet with the septic tanks

In the projection of manpower, assumptions of current average growth of 10 percent increase in the manpower across the FSSM value chain was considered. The maximum capacity added in the manpower in the last two to three years is because of Swachh Bharat Mission. However, the SBM has a target to construct 66.42 Lakhs Individual toilets in the urban areas by 2019. The 60 percent of targeted toilets are connected to an onsite sanitation system.

The demand in the FSSM sector has been boosted through scheduled desludging of the septic tanks. The most demand generated from existing septic tanks of Individual houses and community and public toilets need scheduled desludging of the septic tanks. The ULBs do not have the skilled manpower for these services. There is tremendous demand for skilled manpower to run the FSSM sector.

The projected demand for the base year (2019) is 6.48 Lakh workers. However, in the next five-

year demand of workers may grow 8 percent per year and projected demand of workers for 2023 would be 8.02 Lakhs.

The details of workers needed across the FSSM value chain are given in the table below:

Year	Projected Manpower in the FSSM sector	Annual Growth Rate
2019	6,48,252	
2020	6,42,872	-0.83%
2021	6,91,936	7.63 %
2022	7,45,146	7.69 %
2023	8,02,877	7.75%

Table 21 The Annual Growth rate of Manpower in FSSM Sector

6.10 Functions of the projected workers

The classification of FSSM workers needed across of FSSM value chain is described in the table below:

Categories	Functions	Occupations
Production of Hardware and construction	Construction of CT, PT, and IHHL, Sewer line, Sanitary pans etc.	Master Masons, Helpers, Artisans, Sanitary pan fitters and mechanical fitters etc.
Operation and maintenance and monitoring	CT and PT Maintenance, CT, PT and IHHL repairing, septic tank cleaning, Timely inspection of CT and PT	Caretakers, sanitation workers, mechanical fitters, Masons, VTO Operators etc.
Septage Management	Septic tank cleaning, Transportation of Sludge	Vacuum Truck Operator (VTO) operators, Sludge cleaner
Disposal, Treatment and composting of sewage/sludge etc.	Safe disposal and treatment of sludge	Sludge Transport
IEC and Social Mobilization	Designing and production of IEC materials- (printed, audio, video etc.) motivating local community, raising their awareness regarding emptying of the septic tanks and safe disposal of sludge.	Community engagement experts, motivators, animators, trainers, designers, videographers, photographers

6.10.1 Production of hardware:

a. Production of sanitary hardware: It consists of the production of concrete rings for the pit lining, square and round plates for water seal latrines, pit covers, mosaic pans, and traps. The SHGs could be engaged for this purpose with the help of trained masons in the urban area. It also includes pipe fittings made from steel, concrete, ceramic and plastic; taps and other fittings etc.

b. Construction of community, public and individual household's latrine with the septic tank: A set of masons who are trained by master mason are involved in this task which starts from digging the pit, constructing the low-cost latrine, tile fitting, plumbing, electrical fittings etc. and ends in the superstructure.

6.10.2 Operation, maintenance and monitoring

a. Monitoring and up-gradation of toilets: Open defecation being an unacceptable practice in the urban area also requires regular monitoring so that people do not go back to their previous habits. However, to sustain OD practices in the urban area, it is mandatory to have a good quality of community and public toilets and IHHL at the home. The toilets must be kept clean and hygienic. These tasks would help in creating occupations for skilled, semi-skilled and unskilled workers.

6.10.3 Sludge/Septage management

a. The onsite sanitation system requires septage management plan in the urban areas. To empty septage from the filled septic tanks and dispose of it in a safe manner would also help in generating jobs for septage or septic tank cleaners in the urban areas.

6.10.4 Disposal and composting

a. The safe collection, transportation and disposal and conversion of disposed of sludge into compost. To compost, the sludge is an alternative method of treating septage. The disposal and composting would also generate jobs for workers who could help in treating the sludge.

6.10.5 IEC and social mobilization

a. To keep our environment clean from the perspective of sanitation and related hazards, more than changing the habits, the challenge lies in changing the mindset for which motivators and trainers are playing a significant role within the community. The posters, pamphlets and awareness rally would also help educate the community for emptying of the septic tanks and safe disposal of sludge.

b. Which has utility in the Indian and global context.

c. 2731l/HHs/3 Years from one septic Tanks.

d. The average per day volume from households is 2.49 l/days

Chapter 7

QUALITATIVE SKILL GAPS IN FSSM SECTOR



ACCESS & CONTAINMENT

Construction of Toilet (IHHL + CT+PT) with septic tanks

- Carelessness to read display sign boards/caution such as “Work in progress” or “Danger”
- Handling of sharp tools and equipment
- Emergency flagging measures at the workplace
- Knowledge about first aid procedures
- Knowledge of personal safety hazards or work site hazards
- Knowledge of personal protective equipment required for specific work activity and location
- Knowledge of use insect repellents and safe drinking water
- Construction as per the standard designs
- Proper disposal of the material after the construction of toilet
- Required instructions that should be given to the customers on usage and frequency of desludging



EMPTYING & CONVEYANCE

Emptying the sludge from the septic tanks and Transportation and disposal of sludge at identified sites

- Lack of knowledge on safety standards for personal safety and others
- Lack of knowledge of the safety equipment
- Response to emergency situations and first aids
- Safe disposal techniques for the sludge
- Lack of Knowledge about Manual Scavenging
- Knowledge to ensure the cover of the septic tank is left open for some time to avoid accidents
- Proper installation of pipe in the septic tank connecting with sludge tank to avoid human contact
- The knowledge that 25 mm deep sludge should be left in the bottom of the septic tank
- Proper uninstalling of the suction pipes from the septic tank
- Proper closure of the septic tanks
- Cleaning their surroundings and pipes before leaving the site



TREATMENT & DISPOSAL
FSTP Operation and Maintenance Technicians

- Lack of awareness on the benefits of the FSTP
- Lack of awareness of the technology usage and operations
- Knowledge to:
 - Collect and deliver sludge samples from sludge vacuum tank to laboratory for verification of system performance
 - Carry out the visual inspection of equipment at FSTP and document the status
 - Carry out the operation of septage receiving station, screening and grit removal, solid and liquid separation unit
 - Operate the pumps, blowers, generators, compressors, and other such machinery/equipment required in operation of FSTP
 - Facilitate the calibration of process control and instrumentation systems
 - Monitor the working of FSTP and fill out daily activity log sheet for reporting any failures
 - Prepare relevant reports, summarize the records and provide recommendations for optimizing the FSTP system
 - Facilitate and support co-workers in site environmental investigations, field surveys,
 - Ensure the cleanliness of work area and equipment

Chapter 8

RECOMMENDATIONS

8.1 Mainstreaming skill training in the FSSM sector

Currently, the skill training ecosystem in the FSSM sector is fragmented with the non-availability of the national standards for the training programs implemented in the sector. The sector is evolving with the introduction of new technologies and methods to reuse of the sludge, hence strengthening the existing skills set of the workforce is critical. Moreover, maintenance of the health and safety standards for the workers working in the FSSM sector is a concern area and needs due focus.

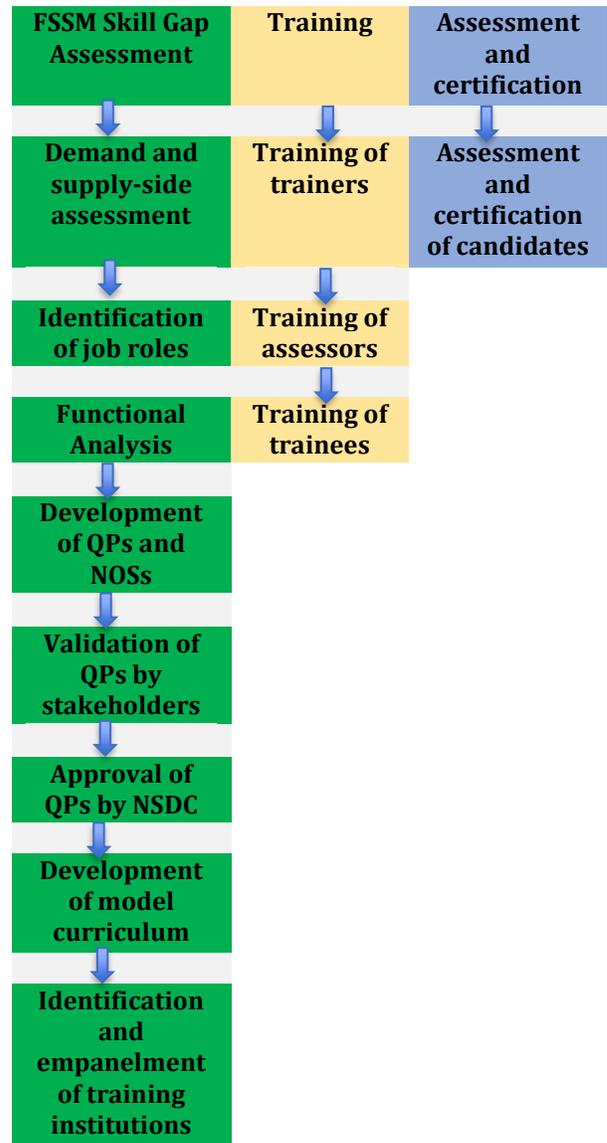
Moreover, the desludging services and construction and management of the FSTP plants have been identified as the potential employment generator in the FSSM sector, there is a need to supply the skilled workforce catering to the needs of the FSTP plant and related desludging. Hence skill development training of the workforce is proposed to cater to the gap.

To mainstream the FSSM skill training, it is critical to establish:

- a) Job roles leading to employment;
- b) National Occupational Standards pertaining to the job roles
- c) Course curriculum in line with NOSs
- d) Modules for the training of trainers and master trainers

- e) Creating a network/identification of skill training providers, master trainers, assessors and certification agencies in the FSSM sector

Suggested roadmap to mainstream the FSSM sector is as follows:



8.2 Proposed models of skill development training programs in the FSSM sector

Inferences from the study conducted in the 5 cities have highlighted the need of the specialized skills either imparted in the form of fresh training or as refresher training to the existing workforce or new entrants in the sector. Most of the current workforce currently engaged in the FSSM sector are not formally trained. They have acquired the skills through the informal means. Hence it is important to recognize these skills and impart the necessary bridge training to fulfill the gaps. Recognition of Prior Learning (RPL) and bridge training courses are proposed for the sanitation workers in the FSSM sector.

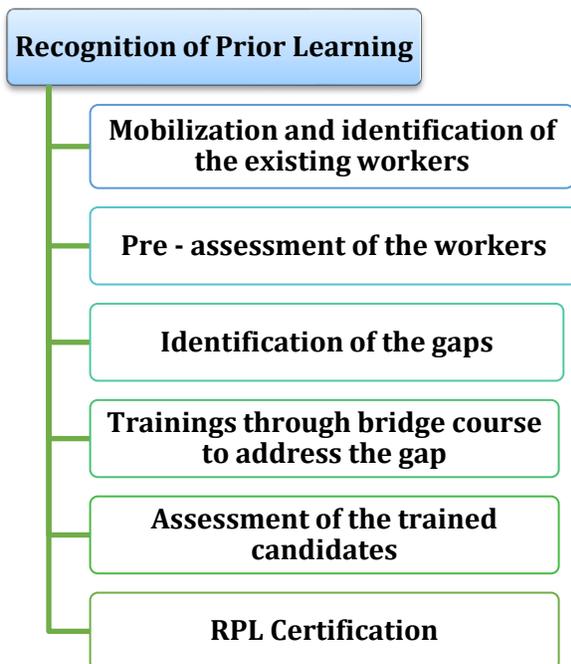


Figure 9 RPL process flow

8.3 Critical job roles in the FSSM sector and suggested models of skill training programs

Construction of the septic tanks and desludging services are the critical activities of the FSSM value chain where the majority of the workers are currently engaged. Mentioned below are critical job roles of the FSSM value chain indicating:

- (i) Workers who are currently engaged and are experiencing a skill gap and
- (ii) Job generators with entrepreneurship potential.

8.3.1 Septic Tank Construction Worker

Septic Tank Technician is responsible for the construction of septic tank or installation of the prefabricated septic tank at the site (commercial/institutional /residential). He/ She is responsible for marking the site and excavate as per the design of the septic tank. He/ She construct the brick wall, concrete slab with a hole to cover the pit, construct the superstructure, junction box, soak pit for effluent and any other activities required to complete the work.

8.3.2 Desludging Operator (Option: Entrepreneur)

The Desludging Operator, also known as Sludge Emptier is an individual, who is responsible for emptying, transport and disposal of faecal sludge from the septic tank to desludging site / FSTP / Co-treatment plant. He /She has to operate Sludge Vacuum tank with trucks, pumps, suction hoses, and other machinery/equipment to empty the septic tank. He / She is an individual having the ability to start a company and venture into desludging services. He/she is responsible for the managing the FSSM business.

8.3.3 FSTP Operation and Maintenance Technicians

The Faecal Sludge Treatment Plant (FSTP) operation and maintenance technician is a person who is responsible for carrying out the

day-to-day technical operations of the plant. He /She is also responsible for repair and maintenance of pumps, engines, motors, filters, bar screens, valves, pipes, and any other equipment at the FSTP

8.4 Strengthening Urban Local Bodies to regularize the FSSM

Recommendations	Details
Regularization of desludging workers	<ul style="list-style-type: none"> • The ULBs to make mandatory to register the desludging worker with the ULBs.
Implementation of health and safety procedure for desludging workers	<ul style="list-style-type: none"> • The ULBs to prepare a health and safety procedure for workers involved in desludging services. • ULBs must adopt mechanized cleaning of septic tanks
Amendment in Building Bye-laws	<ul style="list-style-type: none"> • The existing building bye-laws to add septic tanks and its size in the building plan • The Inspection of quality of control of Septic tanks
Identification of dedicated sludge disposal site	<ul style="list-style-type: none"> • For safe disposal of sludge, ULBs to identify a dedicated sludge disposal site. • The operator must dispose the sludge at the identified sludge disposal sites.
Preparation of database of a septic tank for scheduled cleaning (Once in three years)	<ul style="list-style-type: none"> • ULBs to prepare a database of the septic tank and its location • ULB to fix the schedule desludging of septic tanks • ULB to fix the charges of desludging services for residential, institutional and commercial areas.
IEC Campaign on FSSM	<ul style="list-style-type: none"> • ULB to initiate the IEC campaign on FSSM and encourage people for scheduled desludging services
City Livelihoods Centre (CLC) of NULM window for desludging operator	<ul style="list-style-type: none"> • The ULB to encourage the desludging operator to the registrar with CLC. • CLC to help the desludging operator to reach the beneficiary • CLC to monitor the services of a desludging operator
Fine Mechanism	<ul style="list-style-type: none"> • Fine for people who do not conduct desludging services on a regular basis

Table 22 Recommendations for Urban Local Bodies

Annexure I: States/ UTs have prepared the state level FSSM policy so far

S.N.	Name of the State	Status of FSSM Policy
1	Andhra Pradesh	Prepared (1)
3	Arunachal Pradesh	Prepared (2)
4	Assam	Prepared (3)
5	Bihar	
6	Chhattisgarh	Prepared (4)
7	Goa	Prepared (5)
8	Gujarat	
9	Haryana	
10	Himachal Pradesh	Prepared (6)
11	Jharkhand	Prepared (7)
12	Karnataka	
13	Kerala	Prepared (8)
14	Madhya Pradesh	Prepared (9)
15	Maharashtra	Prepared (10)
16	Manipur	
17	Meghalaya	Prepared (11)
18	Mizoram	Prepared (12)
19	Nagaland	
20	Odisha	Prepared (13)
21	Punjab	Prepared (14)
22	Rajasthan	Prepared (15)
23	Sikkim	
24	Tamil Nadu	Prepared (16)
25	Telangana	
26	Tripura	
27	Uttar Pradesh	Prepared (17)
28	Uttarakhand	
29	West Bengal	

Annexure II: Assumptions used for estimation of FSSM sector demand and supply

General assumptions		
1	Working Days	260
2	No. of days in a year	365
3	Average number of toilet seats in PT and CT	10
4	Average users of one PT/CT in a day	200
5	Per capita septage generation (l/year)	230
6	Additional staff (factor of safety)	10%
7	Additional Staff (Increment per year)	5%
Livelihood for Toilet		
1	Person-days for construction of IHHL	18
	Labour	2
	Mason	1
	Number of days for construction of IHHL	6
2	Person-days for construction of 1 seat of PT/CT	12
	Labour	2
	Mason	1
	Number of days for construction of 1 seat of PT/CT	4
FSSM IHHL		
1	Toilets connected with OSS system under SBM in India	60%
2	OSS systems to be cleaned every year	33%
3	Workers required for cleaning 1 OSS system	3
	Driver	1
	Helper	2
3	Number of OSS system will be cleaned in 1 trip	1
4	Average number of OSS systems can be cleaned in a day by 1 emptier truck	3
FSSM CT and PT		
1	Workers required for cleaning OSS system	3
2	The frequency of cleaning OSS system of PT-CT in days	30
3	Number of OSS can be cleaned in a day	3
4	Septage to be collected from a CT/PT toilet block (liters) in a month	3,781
5	Number caretakers needed for a toilet block	2
6	Number of shifts for all CT blocks	3
7	PT blocks running in 1 shift	35%
8	PT blocks running in 2 shifts	35%
9	PT blocks running in 3 shifts	30%
FSTP		
1	Assuming all ULBs with a population less than 50,000 will establish the FST Plant	
2	Number of staff required for O&M of FSTP in 2 shifts	6
3	The capacity of each FSTP Plant	20KLD
4	Sludge Generation/Person/year	230 L
5	Sludge Generation/Person /Day	0.630 L
6	Sludge Generation/Family/Day (05 Members in One Family)	3.150 L

Annexure III: Skill Training Providers (STPs) in FSSM Sector

S. No	Name of the Proposed STP in FSSM Sector	Name of the States
01	Center for Water and Sanitation (C-WAS) at Centre for Environmental Planning and Technology (CEPT) University, Ahmedabad	Gujarat
02	Consortium for DEWATS Dissemination Society (CDDS), Bangalore	Karnataka
03	National Institute of Urban Affairs (NIUA), New Delhi	New Delhi
04	Centre for Sustainable Environment and Development Initiatives (CSEDI), Mumbai	Maharashtra
05	Centre for Science and Environment (CSE), New Delhi	New Delhi
06	Administrative Staff College of India (ASCI), Hyderabad	Telangana
07	Indian Institute of Human Settlements (IIHS), Bangalore	Karnataka
08	All India Institute of Local Self Government (AI	Maharashtra
09	Regional Centre for Urban and Environment Studies (RCUES), Lucknow	Uttar Pradesh
10	Teri University, New Delhi	New Delhi
11	Urban Management Centre (UMC), Ahmedabad	Gujarat
12	Maharashtra Environmental Engineering Training and Research Academy (MEETRA), Nashik	Maharashtra
13	National Environmental Engineering Research Institute, Nagpur	Maharashtra
14	Yashwantrao Chavan Academy of Development Administration (YASHADA)	Maharashtra
15	TARU	Gujarat
16	Department of Civil Engineering, Manipal University, Jaipur	Rajasthan
17	National Centre for Good Governance	New Delhi
18	Indian Institute of Public Administration	New Delhi
19	India Sanitation Coalition / FICCI	New Delhi
20	WASH Institute	Tamil Nadu
21	Centre for Environment and Development	Kerala

Annexure IV: Existing Demand In desludging of Onsite Sanitation System – 2018

S. No	Name of the State/UTs	Existing (OSS System) Septic Tanks as per Census -2011	CT & PT Blocks connected with OSS system as per census -2011	Demand generated through SBM-U		
				IHHL	PT	CT
1	Andhra Pradesh	3,010,062	132,324	116056	1071	1075
2	Andman & Nicobar Islands	28,584	1,768	230	9	4
3	Arunachal Pradesh	35,330	2,477	7351	25	14
4	Assam	498,977	12,873	45432	267	89
5	Bihar	1,061,688	43,436	229847	903	1741
6	Chandigarh UT	1,954	21,037	2569	77	20
7	Chhattisgarh	602,010	66,386	180000	457	1323
9	Dadra & Nagar Haveli	36,975	2,863	1045	8	6
8	Daman & Diu	27,013	4,989	403	6	2
11	Goa	804,480	10,378	4812	32	18
12	Gujarat	117,575	193,001	243833	1862	1239
13	Haryana	1,313,454	23,381	66000	631	408
14	Himachal Pradesh	416,287	6,641	7536	53	35
15	Jammu & Kashmir	75,239	9,277	56455	236	142
16	Jharkhand	196,116	27,543	97027	426	811
17	Karnataka	735,837	231,249	210000	1780	1704
18	Kerala	906,083	32,425	54592	421	59
19	Lakshadweep	7,676	34	-	-	-
20	Madhya Pradesh	2,052,709	126,871	307427	1507	2516
21	Maharashtra	1,927,886	2,275,164	377891	3756	2214
22	Manipur	3,096,573	3,226	26186	51	11
23	Meghalaya	73,875	2,151	3040	30	6
24	Mizoram	79,781	697	9865	46	3
10	Nagaland	82,885	3,656	14610	41	7
25	NCT of Delhi	77,394	232,372	75239	916	198
26	Odisha	683,396	31,090	170443	479	1301
27	Pondicherry UT	125,466	11,956	5776	60	60
28	Punjab	417,428	17,543	82806	767	325
29	Rajasthan	1,409,975	40,479	236260	1262	1374
30	Sikkim	19,912	939	952	12	2
31	Tamil Nadu	3,385,422	772,012	361217	2395	3597
32	Telangana	-	-	129645	776	779
33	Tripura	88,346	1,988	38009	54	5
34	Uttar Pradesh	3,491,029	154,061	496942	3267	3078
35	Uttarakhand	314,277	10,089	16584	200	61
36	West Bengal	2,885,743	237,431	309251	1694	955
	Total	30,087,437	4,743,807	3985331	25576	25183

Source: Census of India -2011 and demand projected based on SBMU, IHHL, CT & PT targets

Annexure V: Existing Demand in Construction of Septic Tanks with Toilets

S. No	Name of the State/UTs	Toilet (IHHL) with Septic Tank Constructed under SBMU	CT Blocks with Septic Tank constructed under SBMU	PT Blocks with Septic Tank constructed under SBMU
1	Andhra Pradesh	116056	1071	1075
2	Andman & Nicobar Islands	230	9	4
3	Arunachal Pradesh	7351	25	14
4	Assam	45432	267	89
5	Bihar	229847	903	1741
6	Chandigarh UT	2569	77	20
7	Chhattisgarh	180000	457	1323
9	Dadra & Nagar Haveli	1045	8	6
8	Daman & Diu	403	6	2
11	Goa	4812	32	18
12	Gujarat	243833	1862	1239
13	Haryana	66000	631	408
14	Himachal Pradesh	7536	53	35
15	Jammu & Kashmir	56455	236	142
16	Jharkhand	97027	426	811
17	Karnataka	210000	1780	1704
18	Kerala	54592	421	59
19	Lakshadweep	-	-	-
20	Madhya Pradesh	307427	1507	2516
21	Maharashtra	377891	3756	2214
22	Manipur	26186	51	11
23	Meghalaya	3040	30	6
24	Mizoram	9865	46	3
10	Nagaland	14610	41	7
25	NCT of Delhi	75239	916	198
26	Odisha	170443	479	1301
27	Pondicherry UT	5776	60	60
28	Punjab	82806	767	325
29	Rajasthan	236260	1262	1374
30	Sikkim	952	12	2
31	Tamil Nadu	361217	2395	3597
32	Telangana	129645	776	779
33	Tripura	38009	54	5
34	Uttar Pradesh	496942	3267	3078
35	Uttarakhand	16584	200	61
36	West Bengal	309251	1694	955
	Total	3985331	25576	25183

Sources: Projected number of toilets with OSS system in the Indian cities.

Annexure VI: Number of STPs in the Indian Cities

S. No	Name of the States/UTs	Existing number of STPs
1	Punjab	86
2	Maharashtra	78
3	Tamil Nadu	73
4	Uttar Pradesh	73
5	Himachal Pradesh	68
6	Rajasthan	64
7	Karnataka	57
8	Gujarat	52
9	Odisha	47
10	Haryana	41
11	Chhattisgarh	36
12	Delhi	35
13	West Bengal	28
14	Jammu & Kashmir	25
15	Jharkhand	24
16	Uttarakhand	24
17	Telangana	18
18	Madhya Pradesh	17
19	Andhra Pradesh	12
20	Sikkim	11
21	Kerala	10
22	Andaman & Nicobar Islands	8
23	Goa	7
24	Bihar	6
25	Puducherry	6
26	Assam	5
27	Chandigarh	5
28	Tripura	2
29	Meghalaya	1
30	Mizoram	1
31	Arunachal Pradesh	-
32	Daman Diu and Dadra & Nagar Haveli	-
33	Lakshadweep	-
34	Manipur	-
35	Nagaland	-
Total		920

Annexure VII: Projected workers involved in Desludging Services (Organized and unorganized workers)

S. No	Name of the State/UTs	Existing demand for workers to Desludge the (OSS System) Septic Tanks as per Census 2011	Existing demand for workers to Desludge the (OSS System) septic tanks of CT & PT Blocks as per census -2011	Existing demand for a worker to Desludge the (OSS system) septic tanks constructed under SBMU	
				PT	CT
1	Andhra Pradesh	5,571	100	56	56
2	Andman & Nicobar Islands	52	7494	2	1
3	Arunachal Pradesh	77	142	2	1
4	Assam	971	731	14	6
5	Bihar	2,302	2460	48	90
6	Chandigarh UT	9	1193	6	1
7	Chhattisgarh	1,394	3759	25	68
9	Dadra & Nagar Haveli	67	163	2	1
8	Daman & Diu	50	284	2	1
11	Goa	219	588	3	1
12	Gujarat	2,775	10930	98	64
13	Haryana	860	1325	34	22
14	Himachal Pradesh	148	378	3	2
15	Jammu & Kashmir	451	528	13	8
16	Jharkhand	1,485	1562	24	42
17	Karnataka	1,989	13096	94	88
18	Kerala	3,755	1837	24	3
19	Lakshadweep		4	-	-
20	Madhya Pradesh	3,983	7186	79	130
21	Maharashtra	6,191	128825	195	114
22	Manipur	179	184	3	1
23	Meghalaya	148	123	3	1
24	Mizoram	166	41	3	1
10	Nagaland	164	208	3	1
25	NCT of Delhi	1,568	13159	48	11
26	Odisha	1,522	1762	25	67
27	Pondicherry UT	234	679	6	3
28	Punjab	892	995	41	18
29	Rajasthan	2,934	2294	67	72
30	Sikkim	38	54	2	1
31	Tamil Nadu	6,676	43714	124	186
32	Telangana	232		41	41
33	Tripura	226	115	3	1
34	Uttar Pradesh	7,106	8725	169	160
35	Uttarakhand	590	574	11	3
36	West Bengal	5,693	13446	89	50
	Total	60,717	268656.3	1366	1316

Annexure VIII: Projected Existing demand for workers in Construction of toilets with Septic Tanks

S. No	Name of the State/UTs	Workers in Construction of IHHL toilets with Septic Tanks	Workers in Construction of PT toilets with Septic Tanks	Workers in Construction of CT toilets with Septic Tanks
1	Andhra Pradesh	8035	298	297
2	Andman & Nicobar Islands	16	1	2
3	Arunachal Pradesh	509	4	7
4	Assam	3145	25	74
5	Bihar	15913	482	250
6	Chandigarh UT	178	6	21
7	Chhattisgarh	12462	366	126
9	Dadra & Nagar Haveli	72	2	2
8	Daman & Diu	28	1	2
11	Goa	333	5	9
12	Gujarat	16881	343	516
13	Haryana	4569	113	175
14	Himachal Pradesh	522	10	15
15	Jammu & Kashmir	3908	39	65
16	Jharkhand	6717	224	118
17	Karnataka	14538	472	493
18	Kerala	3779	16	117
19	Lakshadweep	-	-	-
20	Madhya Pradesh	21283	697	417
21	Maharashtra	26162	613	1040
22	Manipur	1813	3	14
23	Meghalaya	210	2	8
24	Mizoram	683	1	13
10	Nagaland	1011	2	11
25	NCT of Delhi	5209	55	254
26	Odisha	11800	360	133
27	Pondicherry UT	400	17	17
28	Punjab	5733	90	212
29	Rajasthan	16356	381	349
30	Sikkim	66	1	3
31	Tamil Nadu	25007	996	663
32	Telangana	8975	216	215
33	Tripura	2631	1	15
34	Uttar Pradesh	34404	852	905
35	Uttarakhand	1148	17	55
36	West Bengal	21410	264	469
	Total	275,907	6,974	7,083

Annexure IX: List of meetings and interaction held during the skill gap assessment

Udaipur

1. Mr. Narendra Srimali, Health Officer, Udaipur Municipal Corporation
2. Mr. Arun Vyas, Additional Chief Engineer, Udaipur Municipal Corporation
3. Mr. Babulal, Assistant Engineer, Udaipur Municipal Corporation
4. Mr. Sidharth Sihag, Commissioner, Udaipur Municipal Corporation
5. Interaction with Desludging Workers, Udaipur Municipal Corporation
6. On site visit, Septic tank desludging at Hiran Magari and interaction with the customers
7. Interaction with Mr. Umesh, Private Desludging Operator, Shakti Nagar, Udaipur
8. Dr. Anil Mehta, Principal, Vidhya Bharti, Polytechnic Collage, Udaipur
9. Interaction with Masons and construction workers, Udaipur

Vishakhapatnam

10. M, Hari Narayan, Municipal Commissioner, GVMC
11. Dr. Murali Mohan, Assistant Medical and Health Officer, GVMC
12. Interaction with Masons and construction workers
13. Meeting with Vacuum Truck Operator Association at Kancharam palem, near to Railway Bridge, Ward Number – 43
14. Meeting with Ms. S K M Laxmi, Resource Person – SHG, Ward No - 42 and Mr. R. J. Naidu – RWA President
15. Meeting with Mr. V P Singh, Bhavani Bio Organics Private Limited
16. Meeting with Mr. Appa Rao and Gauri Shankar, Prefab Septic Tank Rings Manufacturers
17. Interaction with Desludging Workers
18. Interaction with Masons

Puri

19. Interaction with Desludging Workers
20. Interaction with Masons
21. Interaction with officials Sludge disposal point at co-treatment plant
22. Meeting with Puri Municipal Commissioner and other officials
23. Interaction with Cesspool truck of Puri Municipal Corporation
24. Interaction with Private Desludging Operator

Wai

25. Mr. Prasad Katkar, Chief Officer, Wai Municipality
26. Mr. Ajay and Mr. Deepak, FSTP Plant Engineers, Tide Technocrats Pvt. Ltd.
27. Mr. Yugal Ghadge, Contractor (Self-employed), For construction of toilet with OSS
28. Mr. Gunwant Khopde, Sanitary Inspector, Wai Municipality
29. Site Visit, Septic Tank desludging from a Community Toilet
30. Site Visit, Interaction with Nalini Ranjan, Staff of Nirmal Foundation, Maintaining Community Toilet
31. Interaction with Household
32. Meeting with Mr. Hussain, Asian Cement Pipes and Mr. Uttam, Mahalaxmi Pipes, Prefab Septic Tank manufacturers
33. Interaction with Masons
34. Interaction with Desludging Operators

Warangal

35. Mr. Raj Mohan, Mr. Avinash and Ms. Aparna (ASCI team) at Municipal Office, GWMC
36. Mr. Prasad, Ms. Manisha and Mr. Ajay at the FSTP site, GWMC
37. Mr. Sampath Rao and Mr. Satyavir Singh - Empanelled desludging operators at Municipal Office, GWMC
38. Site Visit, Septic Tank desludging from a Household Toilet and disposed to the FSTP
39. Meeting with a readymade septic tank manufacturer, Warangal
40. Interaction with Masons
41. Interaction with Desludging Operators