WHITE PAPER

SANITATION IN LARGE AND DENSE VILLAGES OF INDIA: THE LAST MILE AND BEYOND

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ABSTRACT:

The aim of this white paper is to explore the nuances of the prevalence of on-site sanitation systems in large and dense villages of India. Villages which have a population of 1000 persons or more and a density of greater than or equal to 400 persons per square kilometre were classified as large and dense villages in an earlier research – *Towards a New Research and Policy Paradigm: An Analysis of the Sanitation Situation in Large Dense Villages*. Stimulated by the findings revealing a preferential pattern for selection of on-site sanitation systems in these settlements, a primary household survey was conducted in large and dense villages from five Indian states - Himachal Pradesh, Punjab, West Bengal, Madhya Pradesh and Tamil Nadu. The survey also included qualitative components – stakeholder interviews and transect walks. In this study the survey data has been canvassed to explore the preference patterns of households and the factors guiding them in their decision making for the construction and maintenance of on-site sanitation systems. We find that these large and dense villages exhibit a higher preference for septic tanks over pits in all states except West Bengal where pits are preferred. A majority of households have reported their toilets were private constructions. We find the preference patterns are manifested not only by the choices of building septic tanks or pits but also through the large variations in their design and sizes which are influenced by socio-economic, technical and behavioural factors. We also find specific trends in demand for desludging services by households which are influenced by internal factors such as their social status and economic well-being and by external factors such as availability of mechanised operators or continued reliance on manual cleaning and their costs which cumulatively constitute the supply side of sanitation services.

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List of Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
CT	Census Town
FSM	Faecal Sludge Management
GWS	Ground Water Sources
IHL	In-house Latrine
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
LDV	Large and Dense Villages
lpcd	Litres Per Capita/ Day
MPCE	Monthly Per Capita Expenditure
NARSS	National Annual Rural Sanitation Survey
OBC	Other Backward Classes
OD	Open Defecation
ODF	Open Defecation Free
OSS	On-Site Systems / On-site Containment Systems
PT/CT	Public Toilet/Community Toilet
SBM	Swachh Bharat Mission
SC/ST	Scheduled Caste/Scheduled Tribe
ST	Statutory Town
UIDSSMT	Urban Infrastructure Development Scheme for Small and Medium Towns
UIG	Urban Infrastructure and Governance
TSC	Total Sanitation Campaign

Introduction:

Economic growth has triggered development in India much as anywhere else. But, as with the growth story, the development story in this vast and populous nation has been fraught with narratives on inequitable distribution of infrastructure and services. Access to infrastructure and services has attained a dominant status amongst the larger set of development indicators, more so than income and wealth growth, with the progression and deepening of democratic institutions. With the evolution of Indian democracy, there has been increasing recognition of the most basic of development indicators – access to water and to sanitation infrastructure and services – which, despite their significance, have been appallingly low and inequitable across the rural and urban spaces in India. The discourse on sanitation has evolved in a piecemeal manner, from looking at access to toilets to addressing the entire value chain of environmental sanitation, which was defined for the first time under the National Urban Sanitation Policy (2008) to include water and waste management (liquid and solid) (NUSP 2008). This was a major inflexion point in the establishment of planning norms at the state and local levels to address a whole range of issues pertaining to the sector.

Over the years, there have been a slew of government schemes and programmes on sanitation targeting improvement of access to toilets in India: Central Rural Sanitation Programme, Integrated Low Cost Sanitation, Total Sanitation Campaign and Basic Services to Urban Poor (under the Jawaharlal Nehru National Urban Renewal Mission – JNNURM). Concomitantly, there have been infrastructure programmes focused on water supply, storm water drainage, sewerage and solid waste treatment plants under the UIDSSMT and UIG programmes of JNNURM. However, the development of water and sanitation infrastructure and services has been sluggish for two primary reasons: (a) the multitude of programmes and schemes targeting different components of the sanitation value chain, and (b) lack of coordination between the stakeholders delivering these schemes and programmes. Despite the horde of ambitious programmes the efforts have somehow diverged from the set goals in the milieu of pre-existing and ongoing programmes and programme-specific institutions. This issue has been somewhat circumvented in the ongoing sanitation programme – Swachh Bharat Mission (SBM) – chiefly through its target-oriented subsidy provision mode to augment toilet construction in both urban and rural areas of India.

The biggest achievements of SBM have been in terms of toilet construction and creating awareness of toilet usage. While the revelation of abysmally low in-house toilet numbers and consequential high open defecation (OD) figures – 48 percent as reported by the Census of India (2011) and the WHO-UNICEF Joint Monitoring Programme's India Report (JMP India Report, 2015) – had occurred earlier, the issue garnered considerable attention when it was made top priority in the election manifesto of the current government and subsequently adopted as a national policy. The two separate components – SBM-Urban (SBM-U) and SBM-Gramin (SBM-G) – have reportedly burgeoned the access to toilets. The SBM – Gramin programme reported the construction of 9.16 crore toilets and the declaration of 5.5 lakh villages as Open Defecation Free as of February 5, 2019. However, transect walks reveal contradictory facts in many areas. The subsidy-driven toilet construction programme has been subjected to many critical analyses based on such transect walks and extensive primary surveys. Without undermining the achievements of the SBM-G, it is pertinent to point out that access to toilets remains short of the 100 percent mark and so does the usage of the existing toilets, old and new. The National Annual Rural Sanitation Survey (NARSS 2018-19) surveyed 92,411 households in 6136 villages across states and UTs of India, revealing that 18.5 percent of rural households still do not have in-house toilets, 11.9 percent of households use shared toilets (including public and community toilets – PTs and CTs), and 6.7 percent households still practise OD. It also reports that approximately 10 percent of the individuals from the survey households do not use their toilets regularly.[1] Similarly the SQUAT survey reports from their panel data (Gupta et.al., 2019), gathered from four states – Bihar, Madhya Pradesh,

1 Includes individuals who often or rarely use toilets and those who never use toilets. This also includes all individuals from households which have reported no access to toilets (public or shared).

Rajasthan and Uttar Pradesh – that much of the reduction in OD in rural areas has been on account of toilet construction. It reduced from 70 percent in 2014 to 40-50 percent in 2018. But the fraction of people who practised OD despite owning toilets did not reduce from 2014 to 2018.

The work on various aspects of the sanitation sector done by CPR's SCI-FI Sanitation team has entailed the investigation of rural sanitation through a different lens. A detailed scrutiny of Census data which resulted in a research report, *Towards a New Research and Policy Paradigm: An Analysis of the Sanitation Situation in Large Dense Villages* (Dasgupta et al. 2017), revealed interesting trends in access to toilets and to on-site sanitation (OSS) systems across villages of different population sizes and density. Disaggregating rural population to include Census Towns (CTs) and deriving, from its Census definition[2], other villages which are large and dense, a roster of large dense villages (LDVs) was prepared for all the states of India. The final roster includes 3892 CTs and 155,056 villages, which in total account for 507 million population – roughly 57 percent of the total rural population. A spatial analysis of these settlements revealed that 53 percent of the CTs and 20 percent of other LDVs are within 15 kilometres of Class I cities. A subsequent analysis of their sanitation situation revealed that 79 percent of CT households and 36 percent of other villages in the LDV roster had in-house toilets, compared to 25 percent for villages which are not large and dense. It was also observed that 61 percent of CT households and 26 percent of other LDVs had their toilets connected to septic tanks and improved pits (pits with slabs). Further analysis revealed a rise in the share of individual household latrines (IHLs) and OSS systems with increase in population of the LDVs and their proximity to Class I cities. This finding substantiates the predominance of on-site systems (which remain largely unserved by sewerage networks) as treatment systems in rural India.

The Handbook on Technical Options for On-Site Sanitation Systems in Rural India, 2016 (GoI, 2016) and *Code for Practice for Sanitation with Leaching Pits for Rural Communities* (2002) have laid down design standards for different viable on-site substructure options based on varying household-level demographic and local-level hydro-geological characteristics in rural areas. But in reality the practice of local and household-level customisation is rampant in rural India. And there is a dearth of data on the kind of substructures that serve the existing toilets and the new toilets built under SBM which has been promoting the construction of twin-leach pits as the substructure. While NARSS 2018-19 sheds some light on containment structures, it does not reveal whether these on-site systems are of sound design and structure and hence whether they can be deemed safe and sustainable. Also scant are studies on access to public infrastructure such as drinking water supply, storm water drainage and waste management services in rural areas and the impact they may have on construction of on-site containment systems. A survey conducted by *WaterAid*(Raman et. al., 2017) discussed on the relative safety of different containment structures across 16 districts from eight states but hardly touched upon desludging services for the assessed systems. Recent studies regard as potential health hazards aspects such as wastewater leaching or overflow from poorly constructed on-site systems into nearby ground and surface water sources (Bancalari and Martinez 2017). However, literature on the overall assessment of the behaviour of people around the construction and desludging of such systems is limited and needs further exploration for a full picture of the last mile in water and sanitation infrastructure and services in India's rural areas.

Given this gap in the data on on-site containment structures and other water and sanitation services in rural India, a rural sample survey was conducted in the identified LDVs in five states of India: Himachal Pradesh, Punjab, West Bengal, Madhya Pradesh and Tamil Nadu. The survey was undertaken with the objective of assessing the demand and supply of water and of sanitation infrastructure and services, as well as the perception towards them, across a spectrum of representative households and villages with diverse socioeconomic and infrastructural characteristics. In particular, the survey was designed to elicit

2 Population is greater than or equal to 5000, population density is greater than or equal to 400 persons per square kilometre and more than or equal to 75 percent of male population is engaged in non-farm activities.

information on the aforementioned issues with the intent of engaging in a cross-sectional analysis to understand the impact of different infrastructure and services on one another. The study also attempts to explore people's preferences for sanitation infrastructure and services such as construction of OSS and periodicity of desludging services in rural areas and how they may be affected by their socio-economic conditions or access to sanitation services.

Survey Methodology:

As mentioned earlier, following the findings from an earlier research – 'Towards a New Research and Policy Paradigm: An Analysis of the Sanitation Situation in Large Dense Villages' – the states of India were broadly categorised into four groups:

i) High OSS and high population share of LDVs – Kerala
ii) Low OSS percentage and high population share of LDVs – UP, Assam, Jammu and Kashmir, Bihar and West Bengal
iii) High OSS percentage and low population share of LDVs – Himachal Pradesh, Maharashtra, Uttarakhand, Andhra Pradesh, Punjab and Haryana
iv) Low OSS percentage and low population share of LDVs – Madhya Pradesh, Rajasthan, Odisha, Jharkhand, Odisha, Tamil Nadu, Gujarat and Chhattisgarh

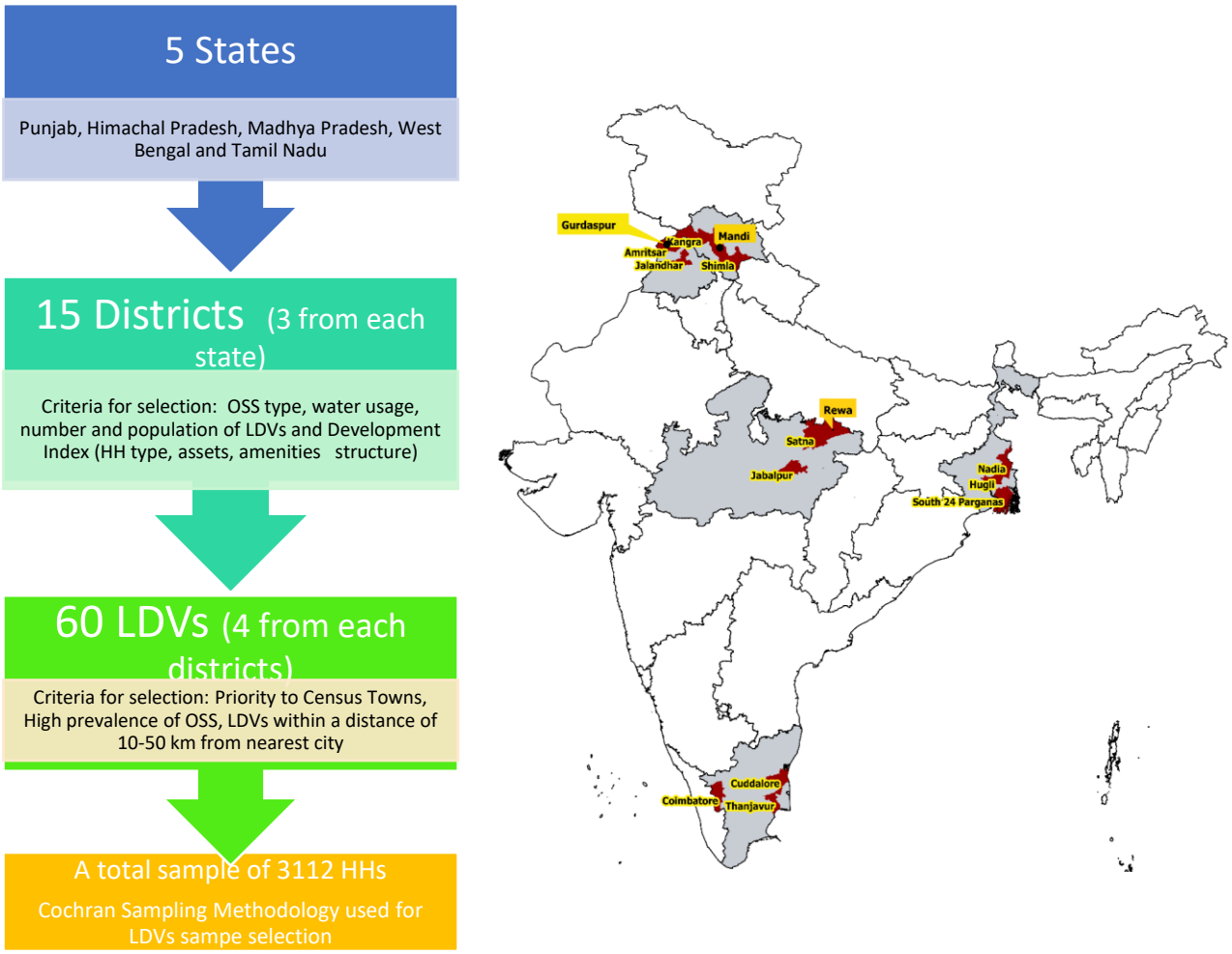
In the first step of the methodology, states were identified from these categories. The states identified for the survey were Himachal Pradesh, Punjab, West Bengal, Madhya Pradesh and Tamil Nadu. They were selected so to represent different parts of India. The other reason for selection of these states was to have a contrasting representation of states with varying numbers of LDVs and diverging percentages of water and sanitation infrastructure. For this purpose and subsequent district and settlement selection there was meticulous examination of Census and SBM data.

In the next step, three districts were identified from each of the aforementioned states. The key selection parameter for this step was the district-specific percentage of households reliant on OSS systems and the number of LDVs. Following the selection of three districts from every state, four LDVs were selected from every district. Hence, from a total of 15 districts 60 LDVs were selected as survey sites.

The selection of LDVs was done relying on the following primary selection criteria:

(i) Priority was given to Census Towns in comparison to other LDVs.
(ii) The median range of population category of LDVs was selected. This was done in order to avoid selection of LDVs which may have become urbanised since the Census 2011 enumeration.
(iii) LDVs with a high prevalence of OSS systems were selected. While priority was given to the percentage of households with septic tanks, higher percentage of pits was considered for LDVs from West Bengal on account of that state's larger reliance on pits.
(iv) Information on distance from a Class I city was utilised while selecting LDVs. LDVs within a range of 10-50 kilometres from cities were selected in order to avoid inclusion of settlements which may have been urbanised since the Census 2011 enumeration.

Subsequently, an overall 3112 households for the survey sampling distribution were targeted commensurately across the selected 60 LDVs applying the Cochran Sampling Method. Table A1 gives a state and district-wise list of LDVs selected for the study and their respective sample sizes.



The study consisted of two essential parts:

a) **Quantitative –** This component of the study comprised 3112 household surveys conducted in LDVs identified in selected districts from the states of Himachal Pradesh, Punjab, West Bengal, Madhya Pradesh and Tamil Nadu.

b) **Qualitative –** In this we aimed to carry out the following tasks:

1. Key Informant Interviews (KIIs): In-depth interviews of key personnel in the same states which included:
   - Gram Panchayat members – 39
   - Masons – 13
   - Sewer cleaning truck operators – 12
   - Manual scavengers – 11
2. Focused Group Discussions (FGDs) with female participants in all of the survey states on menstrual hygiene – 5

For the first component, a detailed household survey questionnaire was prepared with specific sections on:

1. Identification of Households
2. Household Characteristics: This section included questions to elicit information on the occupational, educational, economic and social characteristics of the household.
3. Household Amenities:
   a. Water: This section included questions on both potable and non-potable water.

   b. Latrine and wastewater: This section included questions on access to and type of toilet facilities, distance from such facilities, specifics on the kind of containment structures, and access to drainage.
   c. Containment system cleaning: This section included a list of questions to elicit information on the household's desludging behaviour and reliance on mechanised and/or manual cleaning of containment structures.
   d. Toilet usage and other related questions
   e. Particulars of the household's dwelling structure
   f. Other amenities of the household
4. Public Health and Disaster Management in the Village
5. Political, Social and Technical Awareness of the Household: This included queries to elicit information on the household's perceptions of local leaders and contractors.

The KIIs too were conducted based on carefully designed questionnaires for all of the four types of key informants interviewed: Gram Panchayat members, masons, septic tank desludging truck operators and manual scavengers.

Details of the Survey:

This part of the report shall furnish basic information and findings from the household survey conducted in the selected LDVs. Based on the sequence of sections mentioned in the previous section on survey methodology, broad findings from the household survey have been highlighted here. The first set of questions asked, following the identification of the households, focused on their occupational, educational, economic and social characteristics. The second set of queries, under the broader umbrella of 'Household Amenities', were specifics on drinking water, water for non-potable use, latrine water and wastewater with a focus on OSS systems. This section also includes subsections on particulars of containment structures, toilet usage and desludging services availed by households with toilets with on-site containment structures. Subsequently, questions regarding particulars of dwelling structures and household assets were asked. Ultimately, the political, social and technical awareness of the households was assessed to understand the grievance redressal mechanism in these areas. However, this chapter will only focus on survey findings pertaining to basic household characteristics and water and sanitation services to reveal state-wise trends. The broad results from the analysis of the survey are as follows.

Gender of Respondents

Table 1 Gender of Respondents, Head of Household and Primary Earning Member

State	Gender of Respondent		Gender of the Head of Household		Gender of Primary Earning Member		Total
	Male	Female	Male	Female	Male	Female	
Himachal Pradesh	319	294	527	86	565	48	613
	52.0%	48.0%	86.0%	14.0%	92.2%	7.8%	
Madhya Pradesh	456	173	523	106	543	86	629
	72.5%	27.5%	83.1%	16.9%	86.3%	13.7%	
Punjab	313	297	518	92	552	58	610
	51.3%	48.7%	84.9%	15.1%	90.5%	9.5%	
Tamil Nadu	233	379	573	39	581	31	612
	38.1%	61.9%	93.6%	6.4%	94.9%	5.1%	
West Bengal	339	309	576	72	585	63	648
	52.3%	47.7%	88.9%	11.1%	90.3%	9.7%	
Total	1660	1452	2717	395	2826	286	3112
	53.3%	46.7%	87.3%	12.7%	90.8%	9.2%	

The sample has almost equal number of male and female respondents from Himachal Pradesh, Punjab and West Bengal (see Table 1). However, it is skewed towards males in Madhya Pradesh (72:28) and towards females in Tamil Nadu (38:62). The survey showed 87.3 percent of the households to be headed by a male, with Tamil Nadu reporting the highest figure (93.6 percent). Moreover, 90.8 percent households have a male as the primary earning member, with Tamil Nadu again reporting the highest figure (94.9 percent). The pattern is similar across all states as well as across districts in each state. Among the sampled districts, Jabalpur in Madhya Pradesh shows the highest figure for female-headed households (23.9 percent). It also has the highest proportion of households with female primary earners, at 17.8 percent.

Literacy Level of head of household

Table 2 Literacy level of head of household

State	Not Literate	Literate with no formal Education	Primary	Secondary	Intermediate/ Diploma	Higher	Total
Himachal Pradesh	62	25	166	194	114	52	613

	10.1%	4.1%	27%	32%	19%	8%	100%
Madhya Pradesh	326	16	138	65	56	28	629
	51.8%	2.5%	22%	10%	9%	4%	100%
Punjab	171	101	153	122	57	6	610
	28.0%	16.6%	25%	20%	9%	1%	100%
Tamil Nadu	105	27	165	178	93	44	612
	17.2%	4.4%	27%	29%	15%	7%	100%
West Bengal	166	119	207	78	38	40	648
	25.6%	18.4%	32%	12%	6%	6%	100%
Total	830	288	829	637	358	170	3112
	26.7%	9.3%	27%	20%	12%	5%	100%

Table 2 tabulates the literacy level of head of households for all the survey states. The sampled households had a non-literate household head and a non-literate primary earner in 26.7 percent and 23.3 percent cases respectively. Madhya Pradesh has a majority of households coming under the non-literate category in both the cases. On the other hand, we have the highest figures for above primary education levels (secondary, intermediate and higher education), for both head and primary earner, from two states: Himachal Pradesh followed by Tamil Nadu.

Social background of respondents

Table 3 Social background of survey households

State	Gen Hindu	OBC Hindu	SC/ST	Muslim	Christian	Sikh	Other Minorities	Refused to Say	Total
Himachal Pradesh	345	57	197	11	0	0	1	2	613
	56.3%	9.3%	32.1%	1.8%	0.0%	0.0%	0.2%	0.3%	100.0%
Punjab	35	28	164	9	81	272	3	18	610
	5.7%	4.6%	26.9%	1.5%	13.3%	44.6%	0.5%	3.0%	100.0%
West Bengal	246	41	274	85	0	0	0	2	648
	38.0%	6.3%	42.3%	13.1%	0.0%	0.0%	0.0%	0.3%	100.0%
Madhya Pradesh	78	263	247	35	0	0	3	3	629
	12.4%	41.8%	39.3%	5.6%	0.0%	0.0%	0.5%	0.5%	100.0%
Tamil Nadu	0	331	154	70	16	0	0	41	612
	0.0%	54.1%	25.2%	11.4%	2.6%	0.0%	0.0%	6.7%	100.0%
Total	704	720	1036	210	97	272	7	66	3112
	22.6%	23.1%	33.3%	6.7%	3.1%	8.7%	0.2%	2.1%	100.0%

Table 3 tabulates the social group of the survey households based on caste and religion. The sample consists of 79 percent Hindus and 18.7 percent minorities; the remaining 2.1 percent refused to reveal their social background. Hindus from Scheduled Caste/Scheduled Tribe (SC/ST) and Other Backward Classes (OBC) form 33.3 percent and 23.1 percent of the sample respectively. The Sikh respondents are all from Punjab. Muslim households are mostly from West Bengal and Tamil Nadu. The highest SC/ST population share has been reported from West Bengal (42.3 percent) while that of the OBC is from Tamil Nadu, where a majority (54.1 percent) of sampled households belonged to the OBC.

Status of Water supply

Table 4 Principal source of drinking water

State	Tap water Sources	Ground Water Sources	Surface Sources	Tanker Truck or Drums	Others (Fill from someone else's house)	Total
Himachal Pradesh	564	34	11	1	3	613
	92.0%	5.5%	1.8%	.2%	.5%	100.0%
Punjab	347	260	0	0	3	610
	56.9%	42.6%	.0%	.0%	.5%	100.0%
West Bengal	359	278	4	3	4	648
	55.4%	42.9%	.6%	.5%	.6%	100.0%
Madhya Pradesh	165	459	4	0	1	629
	26.2%	73.0%	.6%	.0%	.2%	100.0%
Tamil Nadu	518	94	0	0	0	612
	84.6%	15.4%	.0%	.0%	.0%	100.0%
Total	1953	1125	19	4	11	3112
	62.8%	36.2%	0.6%	0.1%	0.4%	100.0%

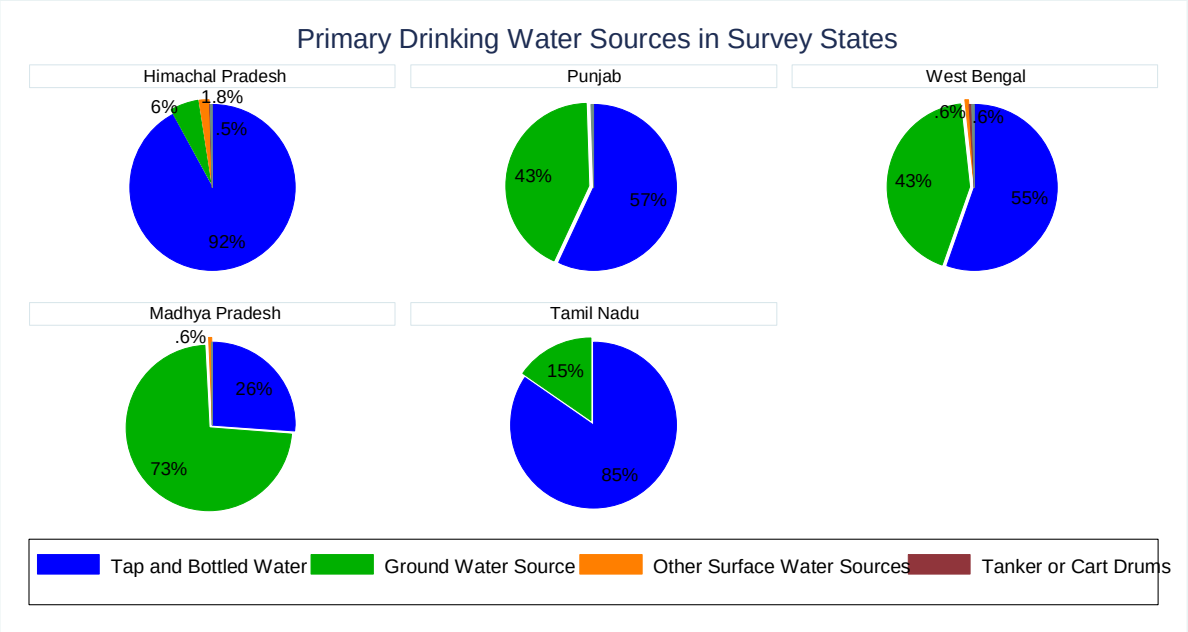


Figure 1 Principal source of drinking water

Table 4 provides the distribution of households for different sources for drinking water source. Tap/piped water and ground water are the primary sources of drinking water across all states (Figure 1). Himachal Pradesh and Tamil Nadu are highly dependent on piped water. For Madhya Pradesh, on the other hand, ground water is the major source of drinking water. Punjab and West Bengal rely on both the sources almost equally.

For supplementary uses such as cleaning, washing and other non-drinking purposes too, tap water is most used, except in West Bengal and Madhya Pradesh. Ground water is the predominant source in Madhya Pradesh for both drinking and supplementary purposes. In West Bengal, drinking water is mainly sourced from taps; for supplementary requirements ground or surface water is primarily used. Himachal Pradesh stores the highest amount of supplementary water (463 litres per supply on average). On the other hand, West Bengal stores the least (116 litres per supply on average).

Table 5 Distance from Principal Source of Drinking Water

State	Within Premises[3]	Near[3]	Away[3]	Total
Himachal Pradesh	560	44	9	613
	91.35%	7.18%	1.47%	100%
Punjab	595	15	0	610
	97.54%	2.46%	0%	100%
West Bengal	503	64	81	648
	77.62%	9.88%	12.5%	100%
Madhya Pradesh	212	294	123	629
	33.7%	46.74%	19.55%	100%
Tamil Nadu	524	75	13	612
	85.62%	12.25%	2.12%	100%
Total	2,394	492	226	3,112
	76.93%	15.81%	7.26%	100%

Overall, 76.93 percent of the households have the water source within their premises (Table 5). However, there are inter-state variations. On the one hand, Punjab shows a high figure of 97.54 percent; Madhya Pradesh, on the other, is the lowest of all, with 33.7 percent. Correspondingly, Madhya Pradesh has the highest share, amongst all states, for 'Near' (46.74 percent) and 'Away' (19.55 percent) categories. Contrary to the trend, West Bengal shows a higher share for 'Away' than 'Near' category.

Table 6 Who fetches drinking water?

State	Male		Female		Others	Total
	Below 18	18 and above	Below 18	18 and above		
Himachal Pradesh	2	16	2	26	7	53
	3.77%	30.19%	3.77%	49.06%	13.21%	100%
Punjab	1	1	2	11	0	15
	6.67%	6.67%	13.33%	73.33%	0%	100%
West Bengal	2	33	15	95	0	145
	1.38%	22.76%	10.34%	65.52%	0%	100%
Madhya Pradesh	1	27	1	383	5	417
	0.24%	6.47%	0.24%	91.85%	1.2%	100%
Tamil Nadu	0	13	1	73	1	88
	0%	14.77%	1.14%	82.95%	1.14%	100%
Total	6	90	21	588	13	718
	0.84%	12.53%	2.92%	81.89%	1.81%	100%

Table 6 presents the distribution of household members by gender and age bracket who fetch water from near and away sources. The responsibility for fetching drinking water lies predominantly on females aged 18 years or above. As much as 81.89 percent of the households have an adult female fetching water compared to only 12.53 percent households with adult males for the same. In Madhya Pradesh 91.85 percent of the

[3] Sources of water for supplementary uses which are within the dwelling or outside dwelling but within the plot are categorised as "Within" sources. Those which are outside dwelling and within 500 metres are "Near" sources. And sources which are more than 500 metres away are categorised as "Away" sources.

households have an adult female to fetch water, highest among all states. Himachal Pradesh has the highest figure for households with adult male fetchers, at 30.19 percent. The proportion of households with water fetchers below 18 years is quite low but here again the share of female fetchers is higher. Punjab reported the highest figures for fetchers below 18 years (both male – 6.67 percent – and female – 13.33 percent).

Table 7 Agency supplying the drinking water

State	Panchayat	Private provider	Community Arrangement	Public Health Engineering Dept.	Natural source	Total
Himachal Pradesh	406	22	145	14	26	613
	66.2%	3.6%	23.7%	2.3%	4.2%	100.0%
Punjab	337	268	3	2	0	610
	55.3%	43.9%	0.5%	0.3%	0.0%	100.0%
West Bengal	491	139	13	0	5	648
	75.8%	21.5%	2.0%	0.0%	0.8%	100.0%
Madhya Pradesh	506	108	10	0	5	629
	80.5%	17.2%	1.6%	0.0%	0.8%	100.0%
Tamil Nadu	511	99	2	0	0	612
	83.5%	16.2%	0.3%	0.0%	0.0%	100.0%
Total	2,251	636	173	16	36	3,112
	72.3%	20.4%	5.6%	0.5%	1.2%	100.0%

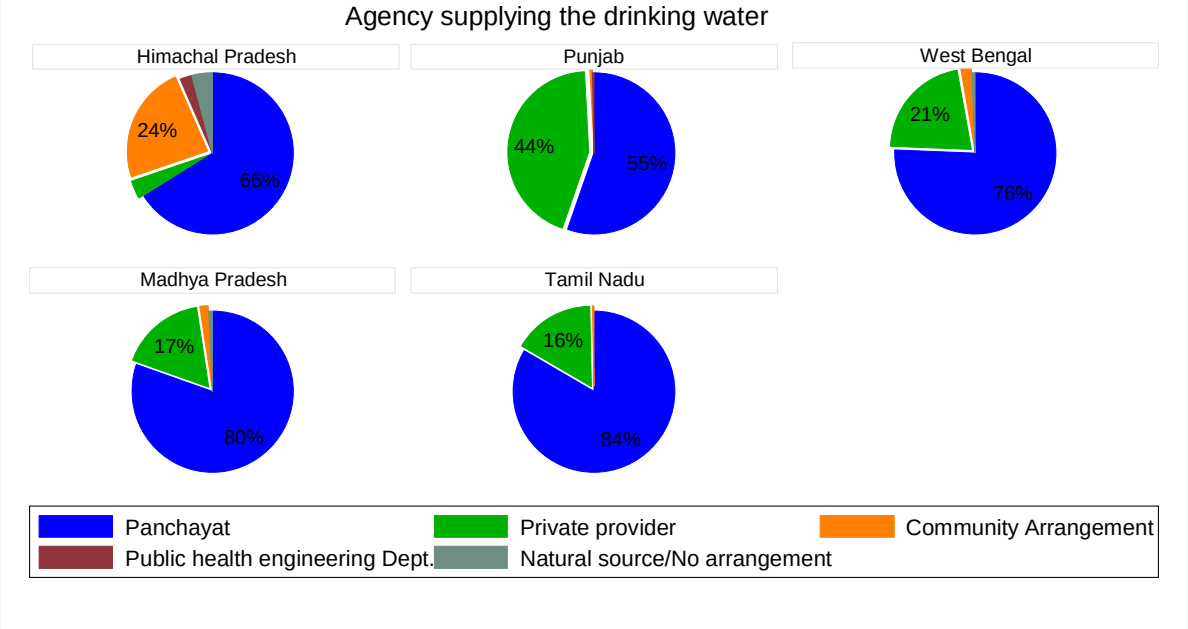


Figure 2 Agency supplying the drinking water

The Panchayat is the major drinking water supplier, serving 72.3 percent of the sampled households, followed by private providers, as can be seen in Table 7 and figure 2. The ratio of Panchayat to private provider in the three states of West Bengal, Madhya Pradesh and Tamil Nadu is around 80:20. However, Punjab relies on Panchayats and private providers almost equally. Himachal Pradesh has a very low share of private providers. Here, community arrangement has a significant share (23.7 percent), unlike other four states.

Panchayats mostly provide tap water to the households (74.5 percent). In West Bengal, the provision of ground water by Panchayats is quite significant. Unlike other states, in Madhya Pradesh, water supplied by Panchayats is predominantly ground water from hand pumps, followed by tap water. Private providers

mainly supply water from ground water sources, mostly private tube-wells. Private tube-wells are significantly higher for Punjab, relative to other states. In West Bengal, private players mostly provide water from hand pumps.

Sanitation

Table 8 State-wise Access to Toilets

State	In-House Toilets	Shared Toilets	Public/Community Toilets	Others	No Access/ Open Defecation	Total
Himachal Pradesh	555	14	4	0	40	613
	90.5%	2.3%	.7%	0.0%	6.5%	100.0%
Punjab	543	4	0	0	63	610
	89.0%	.7%	0.0%	0.0%	10.3%	100.0%
West Bengal	607	5	0	0	36	648
	93.7%	.8%	0.0%	0.0%	5.6%	100.0%
Madhya Pradesh	381	2	0	0	246	629
	60.6%	.3%	0.0%	0.0%	39.1%	100.0%
Tamil Nadu	582	10	10	0	10	612
	95.1%	1.6%	1.6%	0.0%	1.6%	100.0%
Total	2668	35	14	0	395	3112
	85.7%	1.1%	0.4%	0.0%	12.7%	100.0%

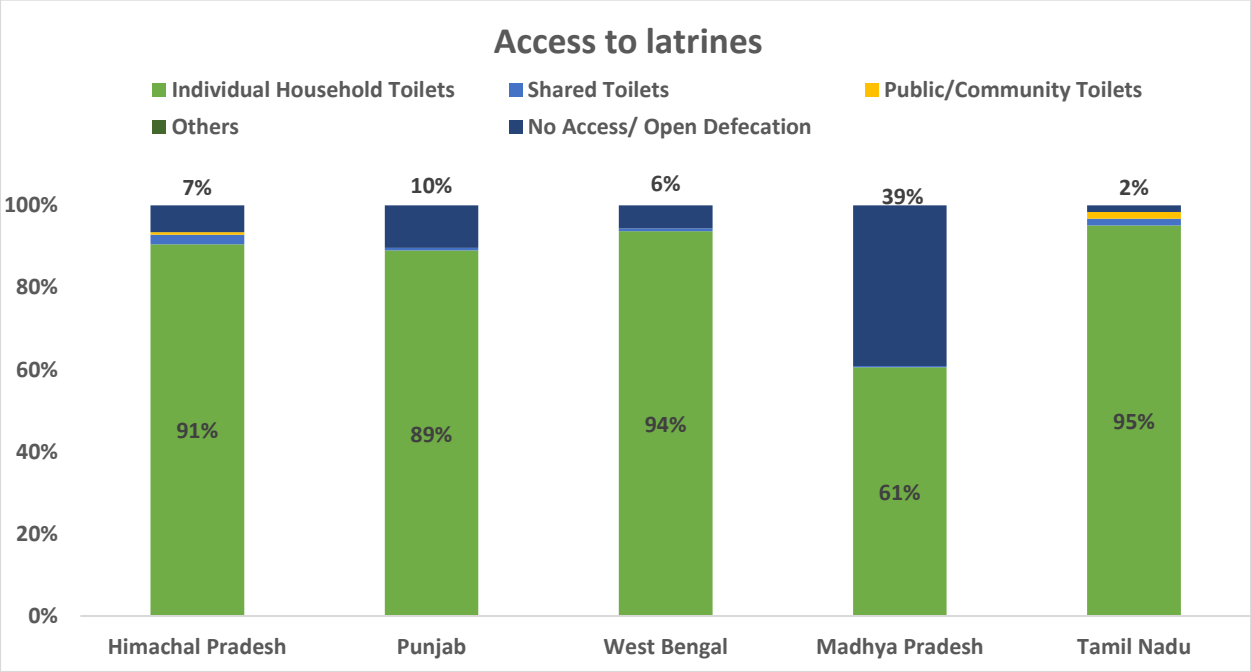


Figure 3 Access to latrines

Of the sampled households, 85.7 percent have an in-house toilets/ individual household toilets (see Table 8 and Figure 3). Tamil Nadu reported the highest figure of 95.1 percent followed by West Bengal at 93.7 percent. Madhya Pradesh shows the lowest IHL level and correspondingly highest OD figure of 39.1 percent. Punjab also shows a double digit OD figure of 10.3 percent. Tamil Nadu has the lowest OD level (1.6 percent). Himachal Pradesh and Tamil Nadu have tried to fill the gap through shared and public toilets. However, for all other states, reliance on shared and public toilets is quite low, despite high OD levels for states like Madhya Pradesh and Punjab.

Table 9 State-wise distribution of type of latrine facility

State	Piped Sewer	Septic Tank	Pits	Others	Total
Himachal Pradesh	56	425	90	2	573
	9.77%	74.17%	15.71%	0.35%	100%
Punjab	127	376	41	3	547
	23.22%	68.74%	7.5%	0.55%	100%
West Bengal	89	43	452	28	612
	14.54%	7.03%	73.86%	4.58%	100%
Madhya Pradesh	4	316	61	2	383
	1.04%	82.51%	15.93%	0.52%	100%
Tamil Nadu	0	439	163	0	602
	0%	72.92%	27.08%	0%	100%
Total	276	1,599	807	35	2,717
	10.16%	58.85%	29.7%	1.29%	100%

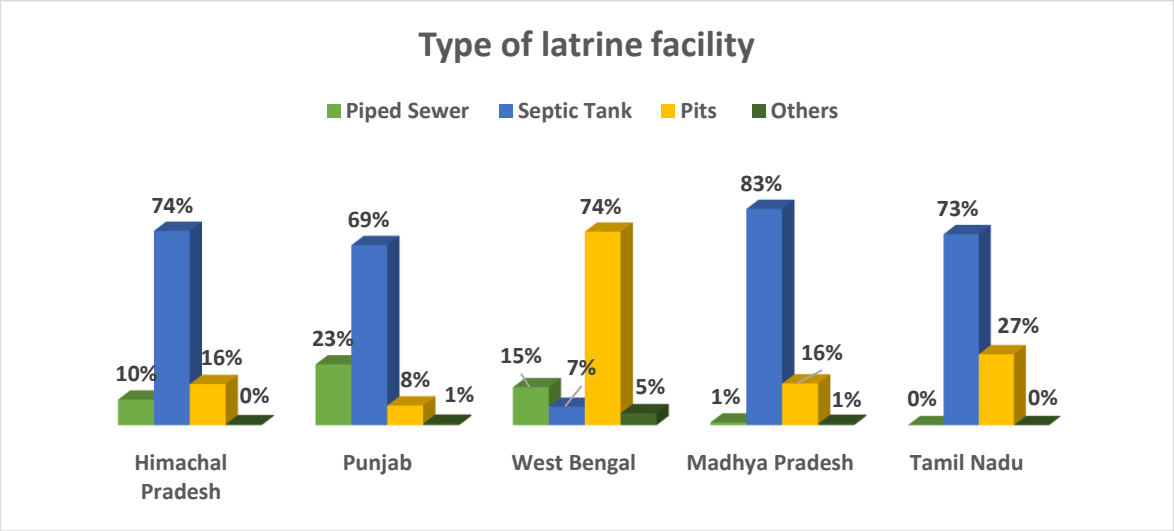


Figure 4 Type of Latrine Facility

Table 9 and figure 4 show the distribution of toilet types across the survey states. The share of piped sewers is low. The little presence of such toilets is on account of the LDVs' to urban areas. It is as low as 0-1 percent in Tamil Nadu and Madhya Pradesh. Punjab shows the highest sewer share, at 23.2 percent. For OSS systems, septic tanks (58.9 percent) and pits with slabs (24.1 percent) seem to be the most preferred. Around 70 percent of the households across four states (except West Bengal) have reported septic tanks as the toilet facility type. Madhya Pradesh reported the highest septic tank share (82.51 percent). West Bengal is an exception, with pits predominating: 53.3 percent households have pits with slabs and 20.6 percent have pits without slabs. The state has a very low share of septic tanks, even lower than that of sewers.

Table 10 State-wise Number of years since the toilet has been constructed

State	Less than 4 years	5-10 years	10-20 years	More than 20 years	Don't know	Total
Himachal Pradesh	60	161	134	143	75	573
	10.5%	28.1%	23.4%	25.0%	13.1%	100.0%
Punjab	131	189	136	43	48	547
	23.9%	34.6%	24.9%	7.9%	8.8%	100.0%
West Bengal	107	130	259	104	12	612
	17.5%	21.2%	42.3%	17.0%	2.0%	100.0%
	197	103	51	28	4	383

Madhya Pradesh	51.4%	26.9%	13.3%	7.3%	1.0%	100.0%
Tamil Nadu	131	352	52	12	55	602
	21.8%	58.5%	8.6%	2.0%	9.1%	100.0%
Total	626	935	632	330	194	2717
	23.0%	34.4%	23.3%	12.1%	7.1%	100.0%

Table 11 Type of latrine facility constructed in last 4 years

State	Pour/Flush to piped Sewer	Pour/Flush to Septic Tank	Pour/Flush to Pits with Slab	Pour/Flush to Open Drains or Open Land	Pour/Flush to Pits without Slab	Dry Latrine serviced by humans	Dry Latrine Serviced by Animals	Others	Total
Himachal Pradesh	1	44	15	0	0	0	0	0	60
	1.7%	73.3%	25.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Punjab	34	85	3	2	7	0	0	0	131
	26.0%	64.9%	2.3%	1.5%	5.3%	0.0%	0.0%	0.0%	100.0%
West Bengal	21	7	62	1	16	0	0	0	107
	19.6%	6.5%	57.9%	0.9%	15.0%	0.0%	0.0%	0.0%	100.0%
Madhya Pradesh	1	158	35	0	2	1	0	0	197
	0.5%	80.2%	17.8%	0.0%	1.0%	0.5%	0.0%	0.0%	100.0%
Tamil Nadu	0	52	79	0	0	0	0	0	131
	0.0%	39.7%	60.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Total	57	346	194	3	25	1	0	0	626
	9.1%	55.3%	31.0%	0.5%	4.0%	0.2%	0.0%	0.0%	100.0%

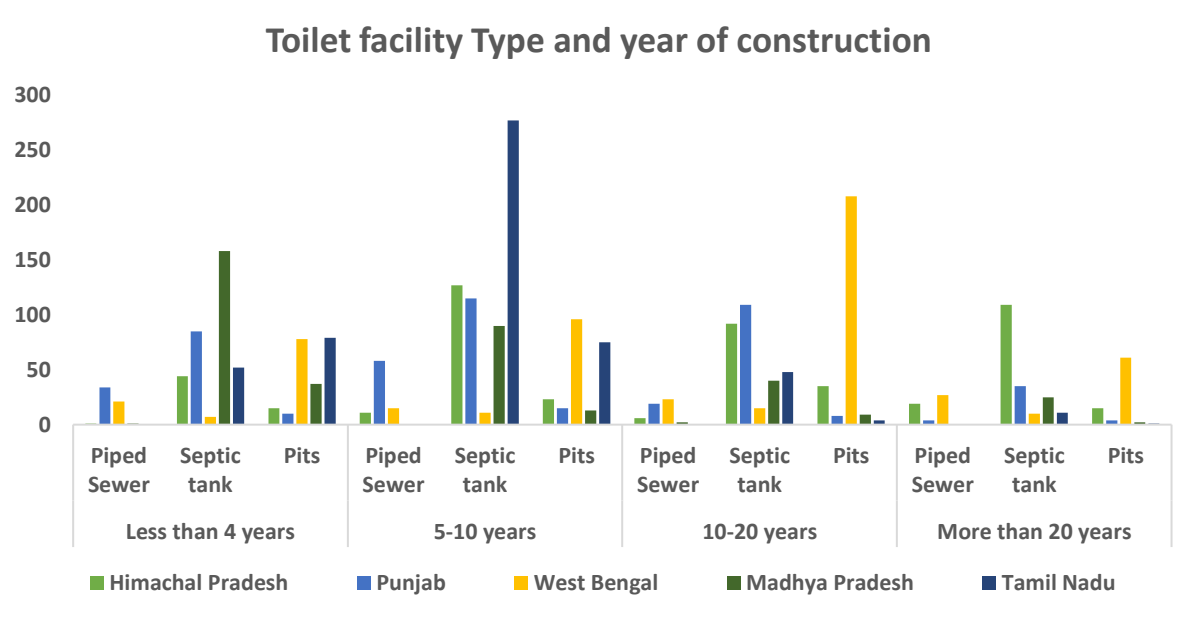


Figure 5 Toilet facility type and year of construction

Around 23 percent of the sampled households constructed the toilets in the last four years, as seen in Table 10 and figure 5 which distribute the households with IHL based on the year of construction of the toilets. However, most of the sampled toilets are 5-10 years old. Himachal Pradesh, Punjab and Tamil Nadu have the highest share of toilets built 5-10 years ago. Madhya Pradesh has constructed the highest number of

toilets (51.4 percent) in the last four years. However, West Bengal has the major share of toilets constructed 10-20 years ago.

The pattern for toilet types for the new toilet constructions (within the last 4 years) is presented in Table 11. It shows a high preference for septic tanks followed by pits with slabs. The state-wise patterns are also similar, with West Bengal showing an inclination for pits. Only Tamil Nadu shows a different trend with a higher number of pits than septic tanks. The septic tank to pit (with slab) ratio was around 66:19 percent for toilets constructed in the last 5-10 years. However, for the last four years, this ratio changed to 55:31. This shows a shift towards pits from septic tanks in recent years, during the implementation of the on-going sanitation programme – Swachh Bharat Mission (SBM).

Table 12 Distance travelled to use toilet

State	Within the dwelling	Within 10 metres	10 - 50 metres	50 - 100 metres	0.1 to 0.5 km	0.5 to 1.0 km	1.0 km to 1.5 km	1.5 km or more	Total
Himachal Pradesh	403	138	41	13	16	1	1	0	613
	65.74%	22.51%	6.69%	2.12%	2.61%	0.16%	0.16%	0%	100%
Punjab	418	107	53	27	5	0	0	0	610
	68.52%	17.54%	8.69%	4.43%	0.82%	0%	0%	0%	100%
West Bengal	516	83	11	29	8	1	0	0	648
	79.63%	12.81%	1.7%	4.48%	1.23%	0.15%	0%	0%	100%
Madhya Pradesh	242	74	74	83	42	104	6	4	629
	38.47%	11.76%	11.76%	13.2%	6.68%	16.53%	0.95%	0.64%	100%
Tamil Nadu	212	377	10	13	0	0	0	0	612
	34.64%	61.6%	1.63%	2.12%	0%	0%	0%	0%	100%
Total	1,791	779	189	165	71	106	7	4	3,112
	57.55%	25.03%	6.07%	5.3%	2.28%	3.41%	0.22%	0.13%	100%

Around 83 percent of the sample households have access to toilets which is less than 10 metres away (see Table 12). The figures are similar or more for all of the survey states, except Madhya Pradesh where only 50 percent of the respondents have access to toilets within 10 metres. This is in consonance with high OD levels being reported here. Interestingly, unlike other states, Tamil Nadu has a higher percentage for 'within 10 metres' than 'within the dwelling' category. This can be related to the social practice of constructing a toilet outside the house.

Table 13 Kind of flush system available for the toilet

State	Cistern Flush	Pour/Flush	Total
Himachal Pradesh	286	287	573
	49.9%	50.1%	100.0%
Punjab	174	373	547
	31.8%	68.2%	100.0%
West Bengal	19	593	612
	3.1%	96.9%	100.0%
Madhya Pradesh	6	377	383
	1.6%	98.4%	100.0%
Tamil Nadu	1	601	602
	.2%	99.8%	100.0%
Total	486	2231	2717
	17.9%	82.1%	100.0%

Pour/flush is the system adopted by more than 80 percent of the sampled households as shown in Table 13. However, in Himachal Pradesh there is equal reliance on cistern and pour/flush. In Punjab the ratio is 30:70,

skewed towards pour/flush. The remaining three states have pour/flush in more than 97 percent of the households.

Table 14 Kind of Drainage available for access near house

State	Underground	Covered Pucca[4]	Uncovered Pucca	Covered Kutcha[4]	Uncovered Kutcha	No drain	Total
Himachal Pradesh	53	58	165	15	38	284	613
	8.65%	9.46%	26.92%	2.45%	6.2%	46.33%	100%
Punjab	145	149	216	19	16	65	610
	23.77%	24.43%	35.41%	3.11%	2.62%	10.66%	100%
West Bengal	141	259	48	32	15	153	648
	21.76%	39.97%	7.41%	4.94%	2.31%	23.61%	100%
Madhya Pradesh	1	84	206	23	42	273	629
	0.16%	13.35%	32.75%	3.66%	6.68%	43.4%	100%
Tamil Nadu	3	32	165	2	9	401	612
	0.49%	5.23%	26.96%	0.33%	1.47%	65.52%	100%
Total	343	582	800	91	120	1,176	3,112
	11.02%	18.7%	25.71%	2.92%	3.86%	37.79%	100%

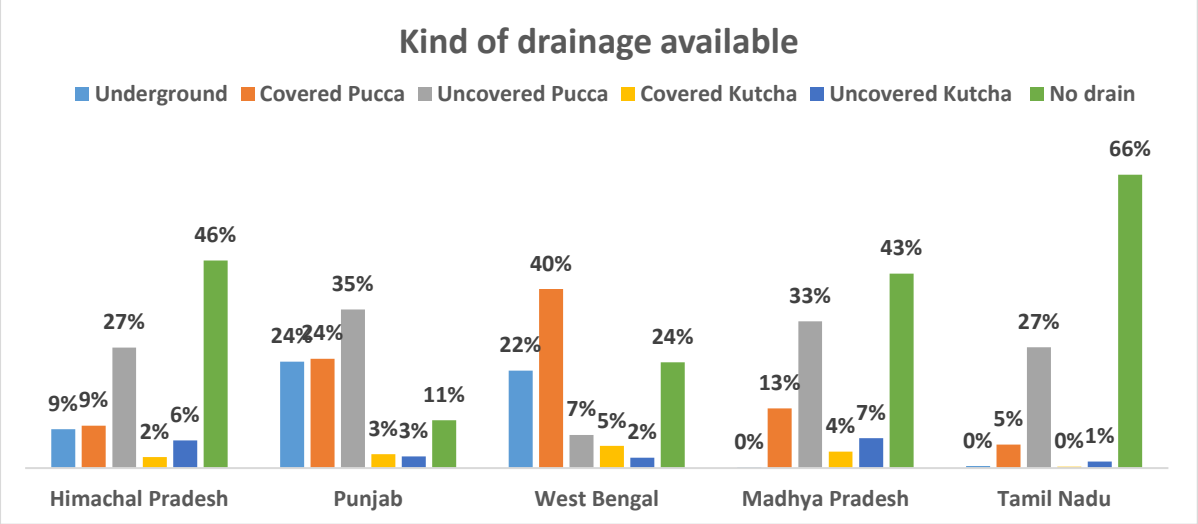


Figure 6 Kind of Drainage available for access near house

Table 14 and figure 6 present the distribution of households based on the kind of drainage available to them. Around 38 percent of the sample reported that no drains were available, the highest figure coming from Tamil Nadu (65.5 percent of the households). The majority of the houses in Himachal Pradesh and Madhya Pradesh also reported the same. In Punjab, however, 35 percent and 24 percent reported uncovered pucca and covered pucca respectively. It also has the highest share, among all states, of underground drains (23.7 percent). For West Bengal, the dominant form of drainage is covered pucca drains (39.9 percent).

Table 15 Distance between OSS containment unit and principal source of drinking water

State	Less than 10m	More than 10m	Total
Himachal Pradesh	119	398	517
	23.0%	77.0%	100.0%
Punjab	220	245	465
	47.3%	52.7%	100.0%
West Bengal	155	351	506
	30.6%	69.4%	100.0%

[4] Pucca – concrete/cemented, Kutcha – nonconcrete/other material such as mud

Madhya Pradesh	149	231	380
	39.2%	60.8%	100.0%
Tamil Nadu	3	599	602
	0.5%	99.5%	100.0%
Total	646	1824	2470
	26.2%	73.8%	100.0%

In 26.2 percent of the cases, the distance between the OSS containment unit and principal drinking water source is less than 10 metres (see Table 15). Punjab shows the highest percentage of this (47.3 percent of the households). Madhya Pradesh and West Bengal, too, reported high figures of more than 30 percent. The situation in Tamil Nadu is relatively better with 99 percent of the houses reporting the distance to be more than 10 metres.

Table 16 Septic Tank Structure

State	Three Chambered Septic Tank	Two Chambered Septic Tank	Single Chambered Septic Tank	Don't Know	Total
Himachal Pradesh	49	198	147	38	432
	11.3%	45.8%	34.0%	8.8%	100.0%
Punjab	32	309	66	17	424
	7.5%	72.9%	15.6%	4.0%	100.0%
West Bengal	26	14	7	3	50
	52.0%	28.0%	14.0%	6.0%	100.0%
Madhya Pradesh	1	115	202	1	319
	.3%	36.1%	63.3%	.3%	100.0%
Tamil Nadu	0	10	379	50	439
	0.0%	2.3%	86.3%	11.4%	100.0%
Total	108	646	801	109	1664
	6.5%	38.8%	48.1%	6.6%	100.0%

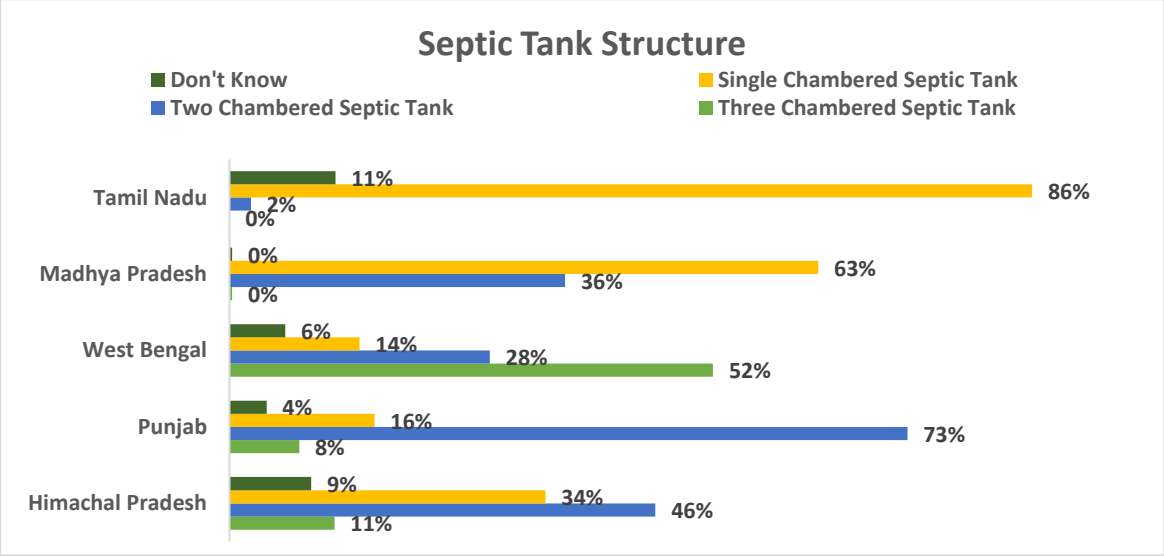


Figure 7 Septic tank structure

Table 16 and Figure 7 provide information on type of septic tanks based on the number of chambers constructed and used by households. Single-chambered septic tanks are being used by 48 percent of the sample households. Tamil Nadu and Madhya Pradesh show a high preference for single chamber whereas for Punjab tends towards two chambers. West Bengal stands out with 52 percent share of three-chambered

septic tanks (when the overall share is only 6.5 percent). Himachal Pradesh has an almost equal share of two- and single-chambered septic tanks.

Table 17 Septic Tank Waste Water Outlet

State	To Soak Pit	To Drains	To Open Land	No Outlet	Total
Himachal Pradesh	278	15	25	76	394
	70.6%	3.8%	6.3%	19.3%	100%
Punjab	29	363	12	3	407
	7.1%	89.2%	2.9%	.7%	100%
West Bengal	35	2	3	7	47
	74.5%	4.3%	6.4%	14.9%	100%
Madhya Pradesh	174	104	35	5	318
	54.7%	32.7%	11.0%	1.6%	100%
Tamil Nadu	14	2	9	364	389
	3.6%	.5%	2.3%	93.6%	100%
Total	530	486	84	455	1555
	34.1%	31.3%	5.4%	29.3%	100.0%

Table 17 provides the disaggregation of septic tank user based on the kind of outlets that these containment units have. Around 93 percent of the households in Tamil Nadu do not have any outlet. Soak pits are highly prevalent in West Bengal and Himachal Pradesh. In Madhya Pradesh, the outlet is a soak pit in 54 percent of the cases, followed by drains. Punjab reported a high percentage of septic tanks connected to drains.

Table 18 Pit Design

State	Twin Leach Pits	Twin-Pits (Lined)	Single Pit (Lined)	Single Pit (Unlined)	Single leach Pit	Others	Don't Know	Total
Himachal Pradesh	16	1	1	2	68	0	3	91
	17.6%	1.1%	1.1%	2.2%	74.7%	0.0%	3.3%	100.0%
Punjab	9	4	5	5	18	0	1	42
	21.4%	9.5%	11.9%	11.9%	42.9%	0.0%	2.4%	100.0%
West Bengal	56	53	36	95	213	0	3	456
	12.3%	11.6%	7.9%	20.8%	46.7%	0.0%	.7%	100.0%
Madhya Pradesh	6	0	0	0	56	0	0	62
	9.7%	0.0%	0.0%	0.0%	90.3%	0.0%	0.0%	100.0%
Tamil Nadu	0	68	93	1	1	0	0	163
	0.0%	41.7%	57.1%	.6%	.6%	0.0%	0.0%	100.0%
Total	87	126	135	103	356	0	7	814
	10.7%	15.5%	16.6%	12.7%	43.7%	0.0%	0.9%	100.0%

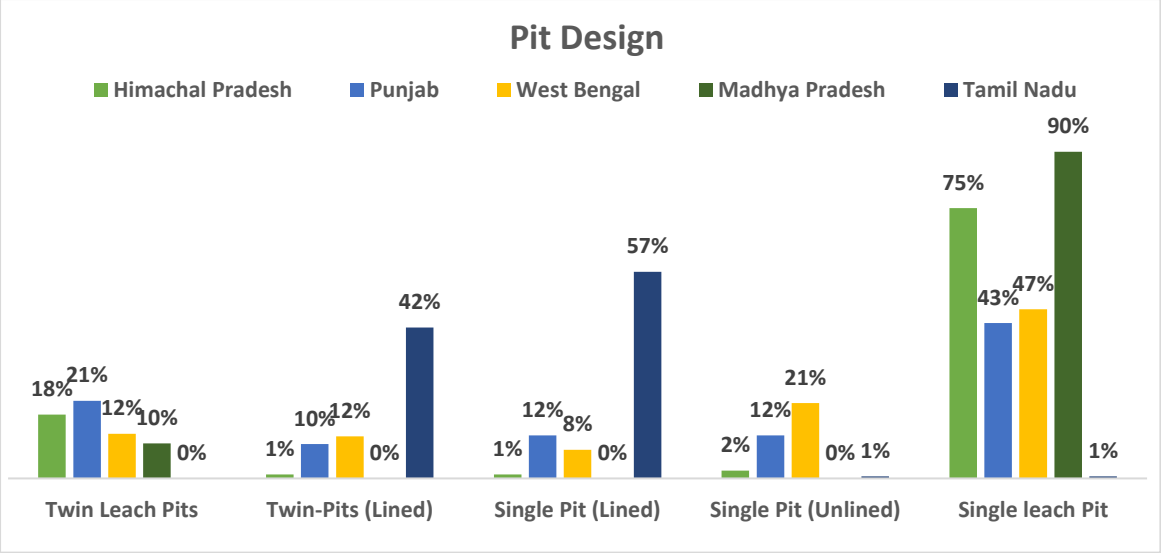


Figure 8 Pit Design

Of the sample population of 3112, 814 have the pit (both with slab and without slab) type of containment system (see Table 18 and Figure 8). And of these 814, most of the respondents have a single leach pit. Tamil Nadu is an exception with 98 percent lined pits (57 percent lined single pits and 42 percent lined twin pits). Himachal Pradesh and Punjab have around 20 percent cases of twin leach pits.

Cylindrical pits predominate in Punjab, West Bengal and Tamil Nadu. Himachal Pradesh and Madhya Pradesh mostly have cuboid ones as shown in Table 19. Generally, cuboid pits have a larger volume size than cylindrical pits.

Table 19 Shape of Pit

State	Cuboid	Cylindrical	Total
Himachal Pradesh	69	22	91
	75.8%	24.2%	100.0%
Punjab	5	37	42
	11.9%	88.1%	100.0%
West Bengal	7	449	456
	1.5%	98.5%	100.0%
Madhya Pradesh	43	19	62
	69.4%	30.6%	100.0%
Tamil Nadu	7	156	163
	4.3%	95.7%	100.0%
Total	131	683	814
	16.1%	83.9%	100.0%

Table 20 Material used for constructing pits

State	Bricks and concrete	Only Bricks	Concrete rings	Rocks and stones	Others*	Total
Himachal Pradesh	10	1	6	73	1	91
	11.0%	1.1%	6.6%	80.2%	1.1%	100.0%
Punjab	16	11	0	9	6	42
	38.1%	26.2%	0.0%	21.4%	14.3%	100.0%
West Bengal	71	152	163	48	22	456
	15.6%	33.3%	35.7%	10.5%	4.8%	100.0%
Madhya Pradesh	3	54	0	4	1	62
	4.8%	87.1%	0.0%	6.5%	1.6%	100.0%

Tamil Nadu	0	0	162	1	0	163
	0.0%	0.0%	99.4%	.6%	0.0%	100.0%
Total	100	218	331	135	30	814
	12.3%	26.8%	40.7%	16.6%	3.7%	100.0%

Table 20 shows the material used for the construction of pits in the survey states. Tamil Nadu prefers concrete rings, Himachal Pradesh mostly uses rocks and stones, and Madhya Pradesh prefers bricks. Punjab uses bricks and concrete or only bricks, while West Bengal relies only on bricks or concrete rings.

Desludging

Table 21 Who empties the containment system

State	Government Septic Tank Truck	Private Septic Tank Truck	Manual Cleaning	Never Cleaned	Total
Himachal Pradesh	3	23	7	490	523
	.6%	4.4%	1.3%	93.7%	100.0%
Punjab	6	34	16	410	466
	1.3%	7.3%	3.4%	88.0%	100.0%
West Bengal	17	14	91	384	506
	3.4%	2.8%	18.0%	75.9%	100.0%
Madhya Pradesh	2	4	11	364	381
	.5%	1.0%	2.9%	95.5%	100.0%
Tamil Nadu	0	311	1	290	602
	0.0%	51.7%	.2%	48.2%	100.0%
Total	28	386	126	1938	2478
	1.1%	15.6%	5.1%	78.2%	100.0%

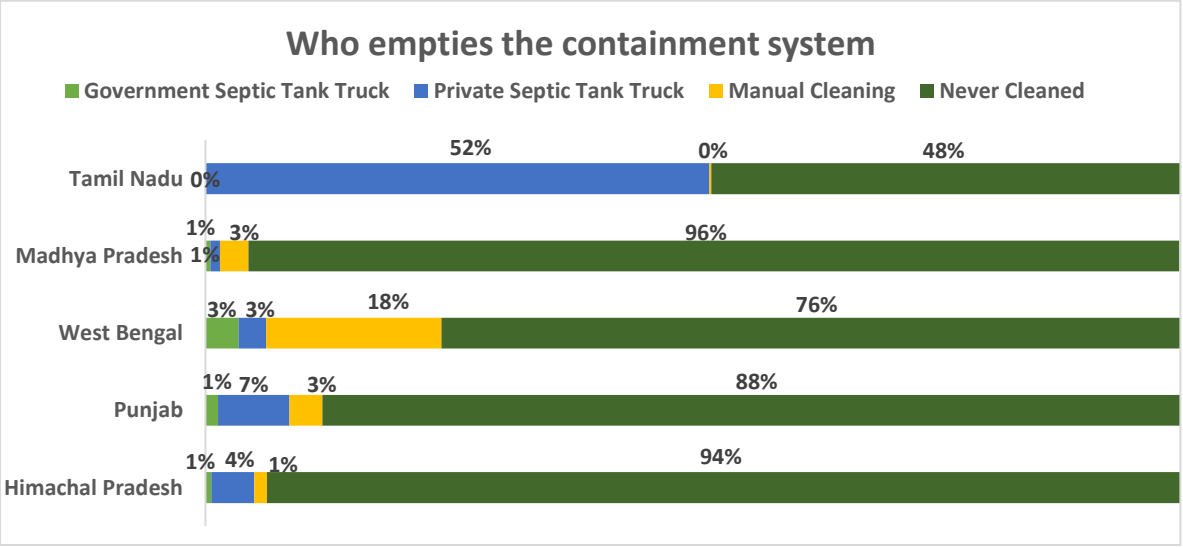


Figure 9 Who empties the containment system

Around 80 percent of the respondents said that they had never had the containment unit cleaned. The number of containment systems never cleaned is high in all the states, except Tamil Nadu (Table 21). Around 52 percent of the households in Tamil Nadu get it cleaned by private truck operators (Figure 9). The highest manual cleaning is reported from West Bengal. In all states, government septic tank trucks play a very small role in cleaning the containment structure.

Table 22 Amount charged by different agencies

State	Indicators	Who empties containment unit			
		Government	Private	Manual cleaner	Never Cleaned
Himachal Pradesh	Frequency	3	23	7	490
	Mean Charges	1000	2104.76	1666.67	
Punjab	Frequency	6	34	16	410
	Mean Charges	1875	1780	1727.27	
West Bengal	Frequency	17	14	91	384
	Mean Charges	1946.67	2750	1408.05	
Madhya Pradesh	Frequency	2	4	11	364
	Mean Charges	5000	2750	1818.18	
Tamil Nadu	Frequency	0	311	1	290
	Mean Charges	0	2387.89	5000	

Table 23 Waiting period for desludging service

State	Median Waiting period for desludging service		
	Government	Private	Manual cleaner
Himachal Pradesh	1 day	1 day	0 day
Punjab	0 day	1 day	0 day
West Bengal	1.5 day	2 day	1 day
Madhya Pradesh	0 day	1 day	1 day
Tamil Nadu	-	0 day	0 day

Mostly, the amount paid for emptying the containment system ranges from INR 1000 to 2500 (see Table 22). Around 20 percent of 540 respondents do not know the amount paid for emptying the containment system. The average desludging charges are higher in Tamil Nadu than other states. If manual cleaning is ever required then an additional amount of around INR 2000 is paid. Out of 540 households, 12 percent said that they required manual cleaning at some point or the other.

In 95 percent of the cases there was never a backflow from the containment unit.

Overall, 80 percent of 540 respondent have cleaned their containment system within the last one or two years. Around 55 percent households got it cleaned within one year in Tamil Nadu. On the other hand, in West Bengal 42 percent got it cleaned within the last three years. Around 27 percent of desludging services are availed when the wastewater of the containment system overflows into open land or the drainage system. There is a short waiting period for availing desludging services. Most of the respondents receive desludging services the same day in Tamil Nadu. West Bengal takes one or two days for the same (Table 23).

Private operators are noticeably charging higher but are provide timely desludging services in Tamil Nadu.

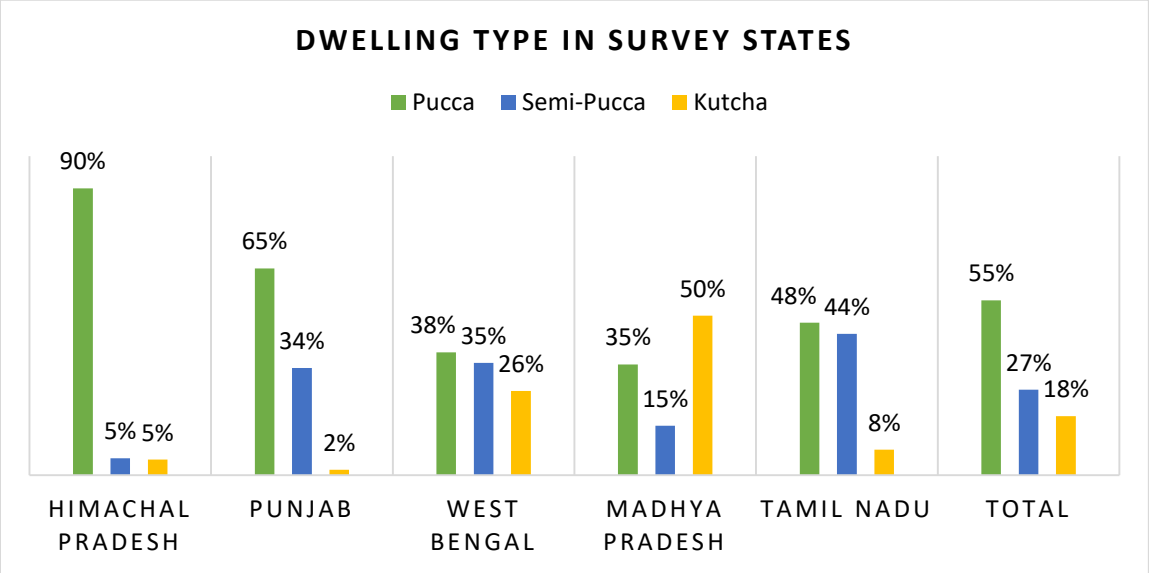
Toilet Usage

In all states, 99 percent of the households said that everyone uses the toilet regularly. There are more chances of finding a male (of all age groups) who does not use a toilet than a female. Most of the kids of the sampled household have toilets in the school they attend. In most cases, there are separate toilets for girls in the school. Overall, most of the children have never complained about the school toilet. The main issue faced by the kids about the school toilet is cleanliness.

Dwelling Type

Around 55 percent of the respondents had pucca houses, with Himachal Pradesh reporting the highest (90 percent), followed by Punjab (65 percent). West Bengal and Tamil Nadu have an almost equal percentage of pucca and semi-pucca houses. Unlike other states, LDVs of Madhya Pradesh have a higher proportion of kutcha houses (50 percent) than pucca (35 percent) or semi-pucca (15 percent) ones.

Figure 10 Dwelling Type in the Survey States



This section has highlighted the basic results of the survey. The following sections would take the analysis further to give some meaningful insights.

Highlights of Key Informants' Interviews

Gram Panchayat (GP) Members:

A total of 39 GP members were interviewed by the survey supervisors in every state survey. Of all the GP members interviewed, 25 cited water access as being a problem and 17 categorically cited drinking water as one of the primary issues of their respective village. While 8 GP members proclaimed sanitation as one of the main issues of their village, 9 and 11 respondents cited sewage and drainage as major problems. Regarding garbage collection 4 GP members cited it as a concern while 9 GP members asserted that cleanliness in the village was a pressing matter. Among other infrastructure and service-related concerns, roads were mentioned as the biggest issue with 23 GP members citing it, followed by schools and education with 15 responses, health services with 7 responses, and finally electricity with 4 responses.

Of the total GP respondents, 23 cited the Panchayat as the primary provider of drinking water; of these 18 mentioned that provisions were through tap or piped water supply. While 10 respondents did not provide any response on the primary drinking water provider, 13 mentioned Public Health or State Water Department as the primary supplier, 4 GP members (1 from MP and 3 from WB) mentioned reliance on ground water sources, and 4 others said the villagers make their own arrangements. 11 GPs were reported to have less than 50 percent of households with water within premises (the majority of these are from West Bengal followed by Tamil Nadu).

Regarding toilets and on-site containment systems some interesting information was highlighted by GP members. Out of the 39 respondents, 21 mentioned more than 80 percent of the village households having in-house toilets out of which only 4 villages have public or community toilet facilities. Overall, 5 GP members mentioned the absence of any PT/CT in the village. An average of 490 toilets were reported being constructed under SBM by the respondents, with the highest number of constructions occurring in Thanjavur district, Tamil Nadu, and the least number of constructions in West Bengal. Only 15 villages reported masons from the same village. For on-site containment systems, the majority of the respondents highlighted septic tanks as the preferred and more prevalent type of on-site containment system. The majority of the GP member respondents mentioned construction of single-chambered septic tanks (16 responses) and twin pits (12 responses). A staggering 15 respondents reported more than 30 percent incidence of OD in their village. A majority of these villages are from West Bengal and Madhya Pradesh.

Among other information provided by the GP members, the key highlights are as follows. Less than 100 percent drainage coverage in their village was reported by 22 respondents, while the majority of the drains are uncovered pucca or kutcha. Only 3 GP members reported having some village-level facility to desludge on-site systems; they primarily rely on hand-carts. Though the GP members have not directly mentioned the practice of manual scavenging, 8 of them (mostly from Madhya Pradesh) have mentioned the presence of some households with manual scavengers in the village.

Masons:

The interview of 13 masons is equally telling about the state of the water and sanitation sectors in the survey states. Only 3 of those interviewed have had any formal training and 6 were formally contracted by the Panchayat to build toilets under SBM. They have an average of 15 years of experience and almost all of them have engaged in masonry in nearby villages and cities. The masons report constructing approximately 70 toilets on average; 9 of them have first-hand experience constructing on-site systems. The masons report single-chambered septic tanks and single pits to be the predominant OSS constructed in the villages. Though they categorically cited either septic tank or pit as the predominant OSS in any village, 8 of the 13 masons interviewed mentioned constructing different kinds of substructures in the same village. The masons reported an average cost of Rs 23,000, Rs 13,300 and Rs 8300 for constructing septic tanks, twin pits and single pits respectively.

Only two of the masons interviewed said soil quality and ground water levels were given priority while constructing on-site systems, most of which were already reported to be unlined at the bottom. On the other hand 6 masons

reported making the budget mentioned by the household the major deciding factor for the type and dimensions of the OSS system. Only 4 of the 13 masons interviewed mentioned taking households inputs into consideration while building OSS. Regarding construction of OSS, only 3 of the interviewed masons reported their awareness of CPHEEO design standards and only 1 mason reported receiving training on the construction of OSS by a District Level Office. Also, interestingly, while 9 masons reported that people from the village desludge their OSS, only 6 reported receiving inputs from the household on their desludging requirements before the OSS construction.

Manual Scavengers:

There were 11 manual scavengers interviewed under the KII process. No manual scavengers were interviewed in Himachal Pradesh. Only 1 of the interviewed manual scavengers was a female. Out of the interviewed manual scavengers, 7 reported this being their full-time occupation and just 1 reported being engaged by the Panchayat as a street sweeper. Of the total, 4 manual scavengers mentioned that other people from their house are also engaged in this work. All of them reported taking up such work in nearby cities and villages. While most of them reported a range of INR 1000-15,000 charged for desludging, they stated it really depended on the size of the OSS. Corroborating the varying charges for desludging is the fact that lower amounts are charged in the states of Tamil Nadu and West Bengal where the OSS volumes are reportedly not too high.

While none of the manual scavengers said anything about the regularity of this practice, all of them mentioned travelling around 5-10 km and sometimes more to provide desludging services in nearby villages and towns. All of the interviewed manual scavengers reported being contacted directly by households when the need for manual cleaning has arisen but some also mentioned being contacted by the Panchayat and the desludging truck operators. Only 4 of the manual scavengers reported using safety equipment – primarily gloves and sometimes cloth to cover their face. They also reported using oil on their body before getting down into the OSS. Out of the 11, 9 mentioned that OD was still practised in their villages and nearby areas. Finally, regarding the question on the caste or community they belong to, most of the manual scavengers mentioned belonging to SC groups. While 2 of the respondents from Madhya Pradesh were Domars and 1 just said he was a Harijan, there was 1 belonging to the Christian community and the other from the Mazhabi Sikh community in Punjab. All 3 respondents from Tamil Nadu were Thotis. From West Bengal, however, barring 1 respondent who said he was a Harijan, the remaining 2 refrained from mentioning their caste other than just saying they were Hindus.

Desludging Truck Operators:

A total of 12 desludging truck operators were interviewed under the KIIs: 1 from Himachal Pradesh, 3 from Madhya Pradesh, 3 from Tamil Nadu, 3 from Punjab and 2 from West Bengal. Except for the operators from Madhya Pradesh and West Bengal who were hired by the Panchayat, the operators from the other states were private businesses. On an average the operators have been in this business for 9 years. Of the interviewed operators, 8 use tractors and only 3 use septic tank trucks. Barring the operators from West Bengal none of the other operators have a license to operate from the Panchayat. However, 9 out of the 12 operators have availed a commercial vehicle license. The capacities of their tanks vary quite a bit, with the biggest tank reported to be of 6000 litres. On an average they desludge 31 OSS in a month with the highest desludging reported in West Bengal followed by Punjab, Tamil Nadu and Himachal Pradesh. The operators charge from Rs 800 in West Bengal to Rs 2000 in Tamil Nadu and Punjab to Rs 2500 in Himachal Pradesh per trip. They also report charging extra from households outside their villages; most transactions happen in cash. None of them report taking the sludge to any treatment plant and very few mention dumping in designated areas, which like most undesignated areas are open land. On an average they hire 2 people for the truck – one driver and another helper; however, some operators from Himachal Pradesh and West Bengal mentioned hiring as many as 4 labourers per truck. The remuneration of workers ranges from Rs 9000 to Rs 20,000 per month. However, operators in Tamil Nadu report receiving Rs 600 per trip while in West Bengal they get abysmally low rates of Rs 268 per day.

Kaleidoscopic View of Sanitation in Survey Areas:

The data collected from the household survey and the KIIs is a cornucopia of information that can be pertinently analysed to explore key issues surrounding sanitation in rural India. While the previous chapter provided a broad outline of the water and sanitation data compiled from the survey, there are bigger lessons to be inferred from the dataset through a deeper analysis. The canvassed data provides ample opportunities for a cross-sectional analysis to comprehend the socioeconomic, infrastructural, technical and behavioural attributes behind the continued paucity of water and sanitation infrastructure and services in rural India. For this purpose a definitive framework of analyses has been adopted in this section to categorically and meticulously understand the various trends across the survey states and districts for every aspect of the sanitation value chain: toilets, containment, collection, transportation, treatment and disposal/reuse.

In-house toilets status across survey states:

As described in the previous section, the survey states exhibit a higher access to in-house toilets compared to Census data (2011) and NARSS Survey data (2018-19). Some variations were observed while juxtaposing and comparing the state-level data compiled under all these datasets. While the Census data is slightly outdated, it has proven beneficial for the selection of the survey areas as mentioned earlier. The NARSS data, however, is fairly recent and makes for insightful comparison with the LDV survey.

Table 24 Toilet Access in Survey States based on CPR's LDV Survey 2018-29, NARSS 2017-18 and Census 2011

States	NARSS			CPR Survey			Census 2011		
	IHL %	Public and Shared %	OD%	IHL %	Public and Shared %	OD%	IHL %	Public and Shared %	OD%
Himachal Pradesh	93.5%	6.2%	1.1%	90.5%	2.9%	6.5%	80.3%	0.8%	19.0%
Punjab	84.2%	15.8%	2.8%	89.0%	0.7%	10.3%	77.2%	1.0%	21.8%
West Bengal	87.8%	11.9%	5.0%	93.7%	0.8%	5.6%	80.3%	1.5%	18.1%
Madhya Pradesh	76.6%	23.1%	5.9%	60.6%	0.3%	39.1%	41.7%	2.4%	55.9%
Tamil Nadu	74.9%	10.5%	0.5%	95.1%	3.3%	1.6%	63.3%	5.0%	31.7%
Total	**81.8%**	**14.5%**	**3.7%**	**85.7%**	**1.6%**	**12.7%**	**66.7%**	**2.6%**	**30.8%**

Table 24 juxtaposes and compares the data for all the LDV survey states with NARSS and Census 2011. It should be noted that the Census data provided is for the large and dense villages considered for the LDV survey conducted by CPR. On the other hand, the NARSS data presented is an aggregation of state information calculated from the larger database; hence it includes villages which may or may not coincide with the survey states of CPR. Compared to Census data the IHL percentages have improved for all the states, with the highest improvement seen in Tamil Nadu (where the IHL percentage has improved by 22 percent) and the lowest improvement seen in Himachal Pradesh (10.1 percent) but the latter's improvement is less on account of its previously high percentage of IHL. The NARSS data, however, paints a different picture. Two of the five survey states – Himachal Pradesh and Madhya Pradesh – exhibit higher percentages of IHLs compared to the survey findings, while all the states show a higher percentage of public, community and shared toilets access. The variations in IHL percentages in the aforementioned states based LDV survey and NARSS could possibly be because of the nature of the villages surveyed in the LDV survey which as already has been mentioned are large, dense and proximity to cities.

Toilet Access based on Water Supply:

Table 25 Access to Toilets based on Supplementary Water Sources

Survey States	Tap-water*		Ground Water Sources**		Other Surface Sources***	
	IHL	No IHL	IHL	No IHL	IHL	No IHL
Himachal Pradesh	91.1%	8.9%	79.5%	20.5%	100.0%	0.0%
Punjab	84.9%	15.1%	93.7%	6.3%	.	.
West Bengal	93.8%	6.2%	95.3%	4.7%	91.9%	8.1%
Madhya Pradesh	64.6%	35.4%	59.4%	40.6%	40.0%	60.0%
Tamil Nadu	93.7%	6.3%	99.3%	0.7%	.	.
Total	88.2%	11.8%	81.0%	19.0%	91.3%	8.7%

* Tap-water comprises treated and untreated tap-water and public stand posts/taps
** Ground Water Sources include wells, boreholes, handpumps and springs
*** Surface water sources include rivers, ponds, reservoirs and rain water

Some trends were also noticed when toilet access was compared vis-à-vis different kinds of access to water for supplementary use, as shown in Table 25. While Himachal Pradesh and Tamil Nadu have the highest percentage of households with tap water as their main supplementary water source, they also exhibit high percentages of IHL. This trend is different, however, for Punjab and West Bengal which on account of their substantial reliance on ground water sources exhibit higher percentages of IHL. Also households in West Bengal are highly reliant on surface water sources (38 percent) but a high percentage of such households report having IHLs. In Madhya Pradesh provision of tap water is available to a low percentage of households (26 percent) where IHL percent too is seen to be low compared to other states. Access to toilets worsens still (59 percent) for households relying on ground water sources, which at 74 percent forms the dominant supplementary water source. This could be because 67 percent of the supplementary water sources are near or away from the premises in Madhya Pradesh. Without examining more nuances it can be inferred from the information provided that access to supplementary water sources – the nature and the distance of the source – act as important incentives for households to own toilets.

Toilet Access Based on Socio-Economic Indicators:

Socioeconomic indicators also reveal fascinating aspects in access to toilets in the survey states. Looking at access to toilets across religion and caste groups, interesting trends were observed across different survey states. Table 26 shows access to toilets across caste-religious groups for all the survey states. While at the aggregate level a decreasing trend is observed across Hindu caste groups in access to IHL, the severity of the disparity varies across states. Caste-based disparity in access to toilets is most severe in Madhya Pradesh followed by Punjab. Disparities across religions is also observed across the survey states. It is seen to be acute across Hindu and Muslim groups in Madhya Pradesh and Himachal Pradesh but less acute in Tamil Nadu and West Bengal.

Table 26 Access to Toilets across different Caste and Religious Groups

States	Toilet Access	Caste and Religion Categories								Total
		Gen Hindu	OBC Hindu	SC/ST Hindu	Muslim	Christian	Sikh	Other Minorities	Refused to say	
Himachal Pradesh	No IHL	23	9	21	5	.	.	0	0	58
		6.7%	15.8%	10.7%	45.5%	.	.	0.0%	0.0%	94.6%
	IHL	322	48	176	6	.	.	1	2	555
		93.3%	84.2%	89.3%	54.6%	.	.	100.0%	100.0%	90.5%
Punjab	No IHL	1	2	21	1	13	25	0	4	67
		2.9%	7.1%	12.8%	11.1%	16.1%	9.2%	0.0%	22.2%	11.0%
	IHL	34	26	143	8	68	247	3	14	543
		97.1%	92.9%	87.2%	88.9%	84.0%	90.8%	100.0%	77.8%	89.0%
West Bengal	No IHL	11	3	17	10	.	.	.	0	41
		4.5%	7.3%	6.2%	11.8%	.	.	.	0.0%	6.3%
	IHL	235	38	257	75	.	.	.	2	607
		95.5%	92.7%	93.8%	88.2%	.	.	.	100.0%	93.7%
Madhya Pradesh	No IHL	20	87	122	18	.	.	0	1	248
		25.6%	33.1%	49.4%	51.4%	.	.	0.0%	33.3%	39.4%
	IHL	58	176	125	17	.	.	3	2	381
		74.4%	66.9%	50.6%	48.6%	.	.	100.0%	66.7%	60.6%
Tamil Nadu	No IHL	.	15	11	4	0	.	.	0	30
		.	4.5%	7.1%	5.7%	0.0%	.	.	0.0%	4.9%
	IHL	.	316	143	66	16	.	.	41	582
		.	95.5%	92.9%	94.3%	100.0%	.	.	100.0%	95.1%
All Survey States	No IHL	55	116	192	38	13	25	0	5	444
		7.8%	16.1%	18.5%	18.1%	13.4%	9.2%	0.0%	7.6%	14.3%
	IHL	649	604	844	172	84	247	7	61	2668
		92.2%	83.9%	81.5%	81.9%	86.6%	90.8%	100.0%	92.4%	85.7%
	Total	704	720	1036	210	97	272	7	66	3112

Toilet Construction over the Years:

Of the households with access to toilets, 23 percent the toilets were constructed within the last 4 years, implying their construction since the inception of SBM (see Table 27). Further exploration of the number of years since the construction of toilets yields insightful information. Notwithstanding the 7 percent of the respondents with access to toilets who couldn't recollect the year in which their toilet was constructed, it was seen that 34 percent of the toilets were constructed in the last 5-10 years followed by 23 percent in the last 10-20 years; finally, 23 percent of reported toilets were constructed in the last four years as mentioned above. The interesting trend here is that most of the toilets were built during a time of a centralized programme for building toilets. Also, the data very intriguingly suggests that the highest number of toilets constructed within 10-20 years were in West Bengal, within 5-10 years in Tamil Nadu and finally within 5 years in Madhya Pradesh.

Table 27 Variations in Toilet Construction over the years

State	Within last 4 yrs	5-10 yrs	10-20 yrs	More than 20 yrs	Don't know	Total
Himachal Pradesh	60	161	134	143	75	573
	10%	28%	23%	25%	13%	100%
Punjab	131	189	136	43	48	547
	24%	35%	25%	8%	9%	100%
West Bengal	107	130	259	104	12	612
	17%	21%	42%	17%	2%	100%
Madhya Pradesh	197	103	51	28	4	383
	51%	27%	13%	7%	1%	100%

Tamil Nadu	131	352	52	12	55	602
	22%	58%	9%	2%	9%	100%
Total	626	935	632	330	194	2,717
	23%	34%	23%	12%	7%	100%

Reasons provided for not constructing Toilets:

Attempts have been made in this study to elicit reasons for households not building toilets in their house. The household survey questionnaire asked households their reasons for not constructing IHLs. More specifically, households were posed a multiple response question for not building IHLs, with the following options: (i) insufficient water in premises, (ii) unavailability of land, (iii) costly to build and to maintain, (iv) did not receive subsidy from government, (v) difficult to build due to soil conditions, (vi) prefer to defecate in open, (vii) religious reasons. Interestingly, very few, an almost negligible number of households cited water, land and soil conditions or behavioural reasons based on preference for OD or religious reasons as primary reasons for not building IHLs. In fact, 53 percent of households with no IHL cited 'costly to build and maintain' and 51 percent cited 'did not receive subsidy from government' as the primary reason for not building toilets. When both these pecuniary reasons were cross-tabbed it was seen that (see Table 28) 12 percent of households with no IHL have cited both cost and lack of subsidy as deterrents in building IHLs and almost 80 percent in total have cited either of the economic reasons as the primary deterrent.

Table 28 Economic Reasons for not building IHL

Costly to build & maintain	**No Subsidy received from government**		**Total**
	No	Yes	
No	32	175	207
Yes	184	53	237
Total	216	228	444

It would also be interesting to examine to what degree economic reasons have been provided by households for not building IHLs across the consumption categories of the surveyed households. Here consumption expenditure is used as a proxy for the households' economic wellbeing and it has been done so for all subsequent analyses pertaining to assessing impact of economic factors on water and sanitation infrastructure and services. Table 29 gives a cross-tabulation of the two economic reasons provided by households for not building toilets across five consumption quintiles – poorest, second, middle, fourth and richest, and even the category of households that have not declared their consumption expenditure. It is seen that only 7 percent of the households without toilets have not cited either of the two economic reasons for not constructing toilets. Around 53 percent of the households without IHL are from the poorer quintiles (poorest and second quintiles) and 96 percent of the households which have cited such economic reasons belong to these quintiles. While these numbers are revealing about the priority given to economic reasons as a deciding factor among the poorer households, they are also equally telling about the relevance of these factors for households which are relatively economically well-off. Around 36 percent of the households without IHL are from the middle and richer quintiles, and 90 percent of these households have cited economic reasons of cost and lack of subsidy as important deciding factors.

Table 29 Economic Reasons for not building IHL across consumption quintiles

Consumption Quintiles	Economic Reasons for not constructing an in-house toilet					
	Not Costly to Build and Maintain			Costly to Build and Maintain		
	Didn't receive subsidy is not a reason	Didn't receive subsidy is a reason	Total	Didn't receive subsidy is not a reason	Didn't receive subsidy is a reason	Total
Poorest	3	88	91	57	18	75
Second	8	21	29	32	8	40
Middle	4	16	20	40	8	48
Fourth	7	21	28	26	6	32
Richest	5	9	14	15	3	18
Not Declared	5	20	25	14	10	24
Total	32	175	207	184	53	237

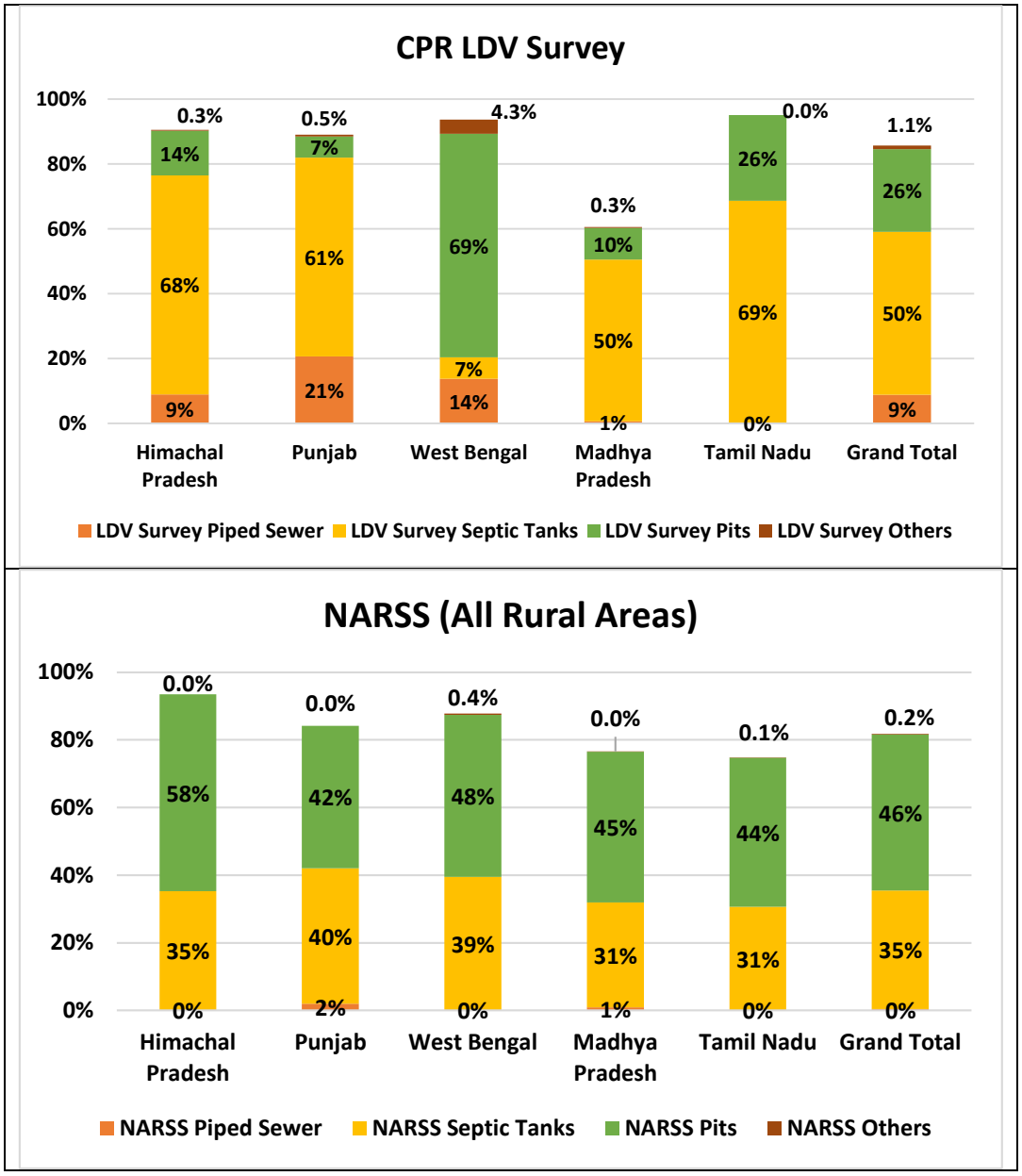
Type of Toilets found in LDVs

Following the analysis of access to in-house toilets in LDVs in the survey states, it is only pertinent to explore the types of toilets found in the surveyed households. Keeping in mind the sanitation value chain, it is imperative to not only explore the variations in toilet substructures across survey units (states and districts) but also to understand the explicit and implicit reasons for their preference. This section explores the prevalence of different OSS structures in the survey states. This assessment is imperative to understand the types of substructures used for wastewater containment in rural areas to develop a greater comprehension and establish policies for better wastewater management services. Towards this end the first puzzle that needs to be deciphered is: what fraction of the population residing in LDVs relies on on-site containment structures?

Revelations from CPR's LDV Survey compared to findings of NARSS and SQUAT Survey:

Following from the earlier comparative assessment of CPR's survey on LDVs with the NARSS data, it is imperative to understand the distribution of types of toilets across the survey states and their overall distribution which is fairly representative of India's aggregate figures. Fortunately, the NARSS survey has compiled information on the types of toilets found in rural areas. The classification of the types of toilets in both the surveys is more detailed than the Census 2011 classification. They both furnish particulars of the kind of on-site systems found in the survey cohort. But for a preliminary understanding, the types of toilets are classified under four broad categories: toilets connected to piped sewers, to septic tanks, to pits and to other facilities (including drains, open land and water bodies). Figure 11 juxtaposes the percentage figures of types of exclusive toilets (IHLs only) from the two aforementioned surveys which are roughly separated by a few months, unlike Census 2011 which is slightly outdated for the assessment. It is interesting to note that for India aggregates the percentage of septic tanks is much higher in the LDV survey than the corresponding figure in the NARSS survey. The percentage of IHLs connected to piped sewers is also higher in the LDV survey than that assessed from NARSS. Conversely, the percentage of IHLs connected to pits is lower in the LDV survey compared to NARSS. A similar trend is observed in all of the CPR survey states with the exception of West Bengal. West Bengal is the only state for which the LDV survey reveals a much higher percentage of reliance on pits and conversely a lower reliance on septic tanks than that revealed by NARSS. It is to be noted that the LDV survey was conducted in only 3 districts and 12 villages from every state, and the villages considered were large and dense as defined for the purpose of the study and proximate to statutory towns. This may be the reason for the large variation in the percentages of IHLs connected to septic tanks and pits in the LDV survey and NARSS data.

Figure 11 Type of Toilets (IHLs for exclusive use of household only) based on CPR LDV Survey and NARSS findings



Also comparable to the LDV survey findings are the findings from the longitudinal SQUAT Survey conducted in 2014 and 2018, as mentioned in the previous section comparing access to toilets. But for a quick comparison of the two surveys findings from 2018 round of SQUAT survey has been considered here. For the rural areas of states of Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh, SQUAT survey in 2018 covered 1224 households which were covered in their previous round in 2014. In addition to these households 334 new households were covered in the 2018 round of the survey. The terminology for toilet substructure used in SQUAT survey is slightly different from the LDV survey. While the LDV survey essentially puts them under the larger bracket of OSS comprising septic tanks and pits (of all makes), the SQUAT survey classifies them under twin-pits, single pits and containment chamber (septic tanks). SQUAT survey finds that 31 percent of the weighted households which have toilets in their house from its focus states have containment chambers or septic tanks and 65 percent have pits (twin pits and single pits). When these numbers are worked out from the number of households with toilets the percentage share of containment chambers (septic tanks) stands

at 22 percent and that of pits at 46 percent. For the only overlapping state in both the surveys Madhya Pradesh the results are also strikingly contrasting. While LDV survey reports only 61 percent of IHL for Madhya Pradesh, SQUAT survey reports 90 percent IHL in the state. SQUAT survey also reports 23 percent of septic tanks and 65 percent pits in Madhya Pradesh and both these figures are quite contrasting compared to LDV survey which reports percent septic tanks and 10 percent pits. These variations can be attributed to the distinct selection of survey villages in both the surveys.

Preference for different types of toilets over the years:

Based on the survey data the most preferred substructures are septic tanks (with and without soak pits), which are followed by pits (single and twin leach-pits) and then toilets connected to piped sewers. However, there are two interesting trends, evident from Table 30, that need to be underscored here. One, in every reported year of construction the septic tank category exhibits the highest percentage, including construction within the last four years when the centralized programme has been promoting twin leach-pits. Two, pit construction has shown an increasing trend for the toilets constructed within the last 4 years compared to the toilets constructed in the last 5-10 years. Delving deeper to unravel state-specific trends it is observed that Himachal Pradesh, Punjab and Madhya Pradesh have consistently shown a higher preference for septic tanks with a slight shift in preference for pits for toilets constructed within the last 4 years. However, interestingly, a sharp shift towards pits is noticed in the recently constructed toilets in Tamil Nadu, with the percentage share jumping from 21 percent for toilets constructed 5-10 years ago to 60 percent for toilets constructed within the last 4 years. In West Bengal there has been a consistently high preference for both single and twin-leach pits over the years.

Table 30 Type of Toilets Constructed across Different Periods of Construction

Toilet Facility	Number of years since the toilet has been constructed					Total
	Within last 4 yrs	5-10 yrs	10-20 yrs	More than 20 yrs	Don't know	
Piped Sewer	57	84	50	50	35	276
	9.1%	9.0%	7.9%	15.2%	18.0%	10.2%
Septic Tanks	346	620	304	190	139	1,599
	55.3%	66.3%	48.1%	57.6%	71.6%	58.9%
Pits (Combined)	219	222	264	83	19	807
	35.0%	23.7%	41.8%	25.2%	9.8%	29.7%
Others	4	9	14	7	1	35
	0.6%	1.0%	2.2%	2.1%	0.5%	1.3%
Total	626	935	632	330	194	2,717

Type of Toilets built within the last 4 years:

While empirical evidences substantiate the preference for septic tanks in LDVs, it remains unclear whether septic tanks were still the preferred choice of containment system for households when the government was promoting the construction of twin-leach pits in rural areas under SBM. Towards this end Table 31 sheds some light on the kind of containment structures constructed in the last 4 years across the survey sites. While we have seen that the maximum number of new toilet constructions occurred in Madhya Pradesh, it is also interesting to note that 80 percent of those toilets were constructed with septic tanks as the preferred OSS. Madhya Pradesh was followed by Himachal Pradesh and Punjab in terms of high preference for septic tanks as the OSS. The two states where pits were the preferred OSS were West Bengal and Tamil Nadu, with West Bengal having a larger percentage share from its respective total of new toilet constructions. It is also very interesting to note that new toilet constructions occurred across all consumption quintiles (from poorest to richest) with septic tanks being a preferred choice in all of the categories. Madhya Pradesh records the highest number of constructions from the poorer quintiles (poorest and second) with a high preference for septic tanks, while for the middle to the richest quintiles Himachal and Tamil Nadu record a higher number

of toilet constructions. Out of the total 626 new toilets, 32 percent (198 toilets) were constructed in households which had Below Poverty Line (BPL) cards and 66 percent of these had septic tanks.

Table 31 Toilets Constructed within the Last Four Years across States and across Consumption Quintiles

Consumption Quintiles	Toilet Type	Survey States					Total
		HP	Punjab	WB	MP	TN	
Poorest	Piped Sewer	.	13	10	.	.	23
	Septic Tanks	2	12	1	74	1	90
	Pits (Combined)	.	4	14	14	17	49
	Others	.	.	.	.	.	.
	Total	2	29	25	88	18	162
Second	Piped Sewer	.	3	4	.	.	7
	Septic Tanks	2	17	1	28	6	54
	Pits (Combined)	3	2	9	5	7	26
	Others	.	1	.	.	.	1
	Total	5	23	14	33	13	88
Middle	Piped Sewer	.	4	2	1	.	7
	Septic Tanks	8	21	1	23	9	62
	Pits (Combined)	2	1	26	2	11	42
	Others	.	1	.	.	.	1
	Total	10	27	29	26	20	112
Fourth	Piped Sewer	.	3	4	.	.	7
	Septic Tanks	12	16	3	16	16	63
	Pits (Combined)	5	.	21	4	7	37
	Others	.	.	1	.	.	1
	Total	17	19	29	20	23	108
Richest	Piped Sewer	1	1	1	.	.	3
	Septic Tanks	12	3	1	9	1	26
	Pits (Combined)	4	.	8	3	3	18
	Others	.	.	.	.	.	.
	Total	17	4	10	12	4	47
Total MPCE declared		51	102	107	179	78	517
MPCE not declared	Piped Sewer	0	10	.	0	0	10
	Septic Tanks	8	16	.	8	19	51
	Pits (Combined)	1	3	.	9	34	47
	Others	0	0	.	1	0	1
Total MPCE not declared		9	29	.	18	53	109
Total New Toilets Built		60	131	107	197	131	626

Cross-checking whether a toilet was constructed using some scheme or programme, interesting information can be unravelled regarding toilets constructed in recent years. Table 32 provides information on the different schemes or programmes or agencies that funded the construction of toilets across different states and the kind of toilets constructed within the last 4 years. It is noticed that 21.6 percent of the new toilet constructions are said to have been constructed under SBM-G. Out of these toilets 61.5 percent toilets are connected to pits and 59 percent are connected to single pits (lined, unlined and leach). Around 14 percent of the new toilets are claimed to have been constructed by Panchayats. Now, these toilets may or may not have been constructed under SBM. However, the most interesting finding here is that the majority of the new toilets constructed (63 percent) were reportedly private constructions. For these private constructions, septic tanks are clearly the most preferred choice of containment structures, with a 64 percent share. It is unclear, though, whether these households availed subsidies. Table 33 provides some insight on this matter. It is seen that for the new toilets with septic tanks and pits that were reportedly built under SBM or by Panchayats, the construction of the septic tanks purportedly cost an average of INR 12,026 and INR 14,600 respectively, while the average amount reported for private construction is around INR 17,300.

Table 32 Scheme-led and Private Toilet Constructions within the last 4 years

State	SBM				Panchayat				Private Construction				Other Programmes and Schemes	Total New Toilets
	Piped Sewer	Septic Tanks	Pits	Total	Piped Sewer	Septic Tanks	Pits	Total	Piped Sewer	Septic Tanks	Pits	Total		
Himachal Pradesh	.	.	2	2	.	4	5	9	1	39	8	48	1	60
Punjab	3	2	.	5	.	11	1	12	30	70	9	109	4	131
West Bengal	7	.	25	32	1	.	12	13	13	7	41	61	0	107
Madhya Pradesh	.	40	3	43	.	27	17	44	.	90	17	107	2	197
Tamil Nadu	.	.	53	53	.	6	3	9	.	46	22	68	1	131
Total	10	42	83	135	1	48	38	87	44	252	97	393	8	626
Percentages	(7.4%)	(31%)	(61%)	[21.6%]	(1.1%)	(55.2%)	(43.7%)	[13.9%]	(11.2%)	(64.1%)	(24.7%)	[62.8%]		

Note: The figures in parenthesis () give percentage share of toilets within the categories - SBM, Panchayat and Private construction. The figures in square brackets [] give percentage share of the aggregate number of toilets from every category from the total number of new toilets constructed (626)

Table 33 Cost of Construction of Scheme-led and Private Constructions

Programme or Institution	Parameters	Toilets constructed within the last 4 years			
		Piped Sewer	Septic Tanks	Pits	Others
SBM	frequency	10	42	83	1
	mean OSS cost	NA	12026	6736	NA
Panchayat	frequency	1	48	38	1
	mean OSS cost	NA	14600	7470	NA
Private Construction	frequency	44	252	97	1
	mean OSS cost	12200	17302	7157	NA
Others	frequency	2	4	1	1
	mean OSS cost	NA	14500	NA	8000

Type of Toilet Preference based on Type of Water Supply for Supplementary Use:

The preference for different kinds of toilet types (which varies across states) exhibits specific trends when it is assessed through access to other infrastructure. In the following two tables, Table 34 and Table 35, we assess specific trends in different toilet types based on households' access to water for supplementary use and distance from the main supplementary source. It is interesting to note that for the two main LDV types – CTs and other villages, water consumption is much lower than corresponding figures in urban areas, but water for supplementary usage clearly shows a decreasing trend, in terms of litres per capita per day, from tap water to ground water sources to surface water sources. This decreasing trend is also seen categorically across households with similar toilet types. This indicates that different technical options like toilets to piped sewers, septic tanks and pits are being relied on or are used given varying levels of water for supplementary uses. This could potentially impact the functionality and sustainability of these technical options. It could also affect the desludging behaviour of the households and thus overall sanitation of any given area.

Septic tanks are clearly the preferred on-site system when households have access to tap water but their prevalence declines in households with access to ground water sources. Nevertheless, septic tanks in households relying on ground water sources exist and function at lower water consumption levels. Conversely, the preference for pits as the on-site system increases when households have access to non-networked water supply or ground and other surface water sources, steadily declining from tap water sources to ground water to surface water sources. It is to be noted that all the toilet types, based on their design, are supposed to be doing the same kind of containment or treatment of human waste, but considering the variations in water usage for different water supply categories they may be under-functioning. This may be offset or aggravated by variations in sizes of the containment system in the case of septic tanks and pits, or the flow capacity of sewer lines wherever they exist. The behavioural impact may also be gauged from the variations seen in the median Monthly Per Capita Expenditure (MPCE) of the households for various combinations. Evidently, the median MPCE decreases from households with tap water to households relying on surface sources, or from households with water within premises to households with supplementary water sources at a distance. Given the visibly declining reliance on water for

the OSS systems, this could be a concern for adequate liquid waste management in rural areas already lacking proper infrastructure and services. This may manifest in various forms: irregularity of desludging, discharge of waste to open or closed drains and, most abominably, sustaining the practice of manual scavenging.

Table 34 Distribution of Different Toilet types across Different Sources of Water for Supplementary Use

Toilet Facility	Indicators	Tap Water		Ground Water Sources		Other Surface Sources	
		CTs	Other Villages	CTs	Other Villages	CTs	Other Villages
Piped Sewer	freq	116(14.8%)	55(7.7%)	69(15.7%)	33(6.2%)	1(0.5%)	2(6.1%)
	mean lpcd	64.4	58.8	44.2	50.9	250.0	20.5
	median MPCE	2000.0	1333.3	2000.0	1428.6	5000.0	1216.7
Septic Tanks	freq	546(69.7%)	523(73.1%)	201(45.7%)	308(57.8%)	10(4.8%)	10(30.3%)
	mean lpcd	79.3	97.0	52.4	62.6	22.8	59.1
	median MPCE	2400.0	2500.0	1800.0	1750.0	2000.0	3333.3
Pits	freq	113(14.4%)	135(18.9%)	165(37.5%)	190(35.6%)	184(87.6%)	18(54.5%)
	mean lpcd	48.0	73.4	40.9	53.3	28.6	23.3
	median MPCE	2000.0	2000.0	2000.0	2000.0	1800.0	1333.3
Others	freq	8(1.0%)	2(0.3%)	5(1.1%)	2(0.4%)	15(7.1%)	3(9.1%)
	mean lpcd	29.5	118.8	49.0	17.1	22.0	45.0
	median MPCE	1750.0	2500.0	3000.0	2000.0	1775.0	1500.0
Total	freq	783	715	440	533	210	33
	mean lpcd	72.1	89.7	46.7	58.4	28.9	36.0
	median MPCE	2250.0	2333.3	2000.0	1800.0	1800.0	1500.0

Note: The figures within the parenthesis give column percentages of toilets of different types for the combinations of the categories of type of water source (Tap water, GWS and Other Surface Sources) and settlement type (CT or other villages)

Table 35 Distribution of Toilet types across Supplementary Water Sources and Distance form Water Source (With median water consumption and mean monthly consumption expenditure of every household)

Toilet Facility	Parameters	Water Within Premises				Near Water Sources				Away Water Sources			
		Tap Water	GWS	Surface Water Sources	Total	Tap Water	GWS	Surface Water Sources	Total	Tap Water	GWS	Surface Water Sources	Total
Piped Sewer	Freq	159(11.8%)	101(13.9%)	.	260(12.5%)	11(11.0%)	1(0.5%)	1(0.8%)	13(3.1%)	1(2.0%)	(0.0%)	2(1.8%)	3(1.3%)
	Median lpcd	42.9	30.0	.	37.5	35.0	37.5	250.0	36.7	7.7		20.5	16.0
	Mean MPCE	2248.8	2060.8	.	2177.6	1581.2	1750.0	5000.0	1857.1	1538.5		1216.7	1323.9
Septic Tanks	Freq	988(73.3%)	329(45.3%)	.	1317(63.5%)	54(54.0%)	138(75.8%)	17(13.0%)	209(50.5%)	27(52.9%)	42(65.6%)	3(2.7%)	73(32.0%)
	Median lpcd	62.5	41.7	.	55.0	50.0	40.0	25.0	40.0	50.0	50.0	26.7	50.0
	Mean MPCE	2771.4	2136.4	.	2607.6	2401.1	1674.3	2612.0	1910.6	2644.7	1740.5	2333.3	2105.7
Pits	Freq	191(14.2%)	291(40.0%)	.	483(23.3%)	34(34.0%)	42(23.1%)	102(77.9%)	179(43.2%)	23(45.1%)	22(34.4%)	100(89.3%)	145(63.6%)
	Median lpcd	50.0	30.0	.	33.3	40.0	52.8	25.0	30.0	18.8	95.0	25.0	25.0
	Mean MPCE	2301.8	2158.3	.	2217.0	1643.2	1762.8	2024.9	1910.1	1498.4	1405.1	1890.0	1780.1
Others	Freq	9(0.7%)	6(0.8%)	.	15(0.7%)	1(1.0%)	1(0.5%)	11(8.4%)	13(3.1%)	(0.0%)	(0.0%)	7(6.3%)	7(3.1%)
	Median lpcd	25	35	.	35	50	75	25	25			20	20
	Mean MPCE	1850.0	2437.5	.	2170.5	3000.0	1500.0	2085.0	2112.5			1771.4	1771.4
Total	freq	1,347	727	.	2,075	100	182	131	414	51	64	112	228
	Median lpcd	53.3	34.0	.	50.0	44.2	40.8	25.0	37.5	33.3	71.4	25.0	26.7
	Mean MPCE	2627.5	2139.0	.	2451.0	2072.6	1690.9	2124.8	1915.0	2146.1	1624.1	1882.4	1867.4

Note: The figures within the parenthesis give column percentages of toilets of different types for the combinations of the categories of type of water source (Tap water, GWS and Other Surface Sources) and distance from water source (Within premise, Near and Away)

Septic Tanks versus Pits as predominant OSS

After analysing trends in OSS system preferences in the survey states based on economic, social and infrastructural parameters, it is pertinent to develop a better understanding of the peculiarities of these preferences. Some of this understanding could come indirectly, from inferences from the data, and some directly, from questions pertaining to reasons for constructing particular kinds of containment structures. Based on our research objective, the questionnaire was so designed to elicit direct information on the economic, technical and behavioural reasons for constructing septic tanks or pits. These questions were posed directly to households which had OSS systems: septic tanks and pits. The responses to these questions are analysed in this section to understand the explicit reasons cited by the respondents of the survey households for constructing pits or septic tanks. But before discussing these explicit reasons, it is worthwhile to explore some of the interesting trends in socioeconomic characteristics of households and how they may affect a household's decision to build septic tanks or pits.

Preference for Septic Tanks and Pits across Consumption Categories:

The analysis undertaken in the previous section corroborates the correlation between kinds of supplementary water sources and types of toilet facilities. It was seen that households with access to tap water had a higher likelihood of building septic tanks; this reduced for households relying on ground water source and then further declined for surface water source-reliant households. Similar trends were also seen for distance from the main supplementary water source. One of the distinctive findings from the state statistics on OSS systems was that most of the states had a majority of households with toilets connected to septic tanks, with the highest percentage of preference seen in Punjab (72 percent) followed by Himachal Pradesh (69 percent). However, the exceptional case was West Bengal which had a majority of households relying on pit systems (70 percent) followed by Tamil Nadu (27 percent). What is more interesting is that a very clear trend is noticed for both kinds of on-site systems when gauged across the consumption quintiles. Table 36 shows that the percentage share of septic tanks improves from the poorest to the richest quintile; conversely, there is a decline in the percentage share of pits from the richest to the poorest quintiles.

Table 36 Preference for Septic tanks vs. Pits across Consumption Quintiles

Type of OSS	Poorest	Second	Middle	Fourth	Richest	Not Declared	Total
Septic Tanks	210(60.0%)	196(58.0%)	248(59.0%)	331(65.7%)	252(78.0%)	362(76.9%)	1599(66.5%)
Pits	140(40.0%)	142(42.0%)	172(41.0%)	173(34.3%)	71(22.0%)	109(23.1%)	807(33.5%)

Preference for Septic Tanks and Pits across Social Groups:

While Table 36 above reveals a very simple trend – the preference for septic tanks or pits by households across consumption quintiles – exploring the nuances of the socioeconomic characteristics of households can unfurl more significant behaviour patterns. For instance, Table 37 gives an interesting insight on the effects of caste and class intersections on access to the two broad on-site systems. The table shows an fascinating trend for the General Hindu category in terms of access to septic tanks, based on the class (consumption class). It is only in this category that we notice a steep rise in the number of households with septic tanks as we move from the poorest to the richest category. It is also seen that there is an increasing trend in the cost incurred to build the septic tanks and their capacities. Contrastingly, while such trends are also observed for other caste and religion categories, the degree of increase isn't too high. This is probably because of the concentration of lower caste groups (OBC and SC/ST) in the poorer and middle quintiles. It is also noticed that for the other caste and religion groups there is little variation in the sizes of the septic tanks or the cost of constructing them. This sort of evidence, though revealing, is not very strange. Rather, it corroborates the notion of purity that exists amongst the Hindu upper castes. For pits, however, the practice is quite standardised. There is little variation regarding the volume of pits and cost of construction across the

consumption quintiles for different consumption groups. However, there may be a pattern in desludging behaviour across these cross-sections, which is explored in the next section.

Table 37 Preference pattern for Septic Tanks and Pits across all Caste and Religion Groups (includes distribution, median cost of construction and median volume of the substructure)

Caste/Religion Categories	Parameters	Septic Tanks						Pits					
		Economic Categories Based on MPCE						Economic Categories Based on MPCE					
		Poorest	Second	Middle	Fourth	Richest	Not Declared	Poorest	Second	Middle	Fourth	Richest	Not Declared
General Hindu	Freq	22	30	49	60	106	63	32	43	60	61	31	22
	Median OSS Cost	18000	20000	20000	20000	25000	25000	8000	7000	7000	7000	7000	6000
	Median OSS Vol	11000	8500	14000	18000	23000	18000	2900	3000	2800	3500	3600	5150
OBC Hindu	Freq	71	53	61	105	48	125	21	15	32	30	7	33
	Median OSS Cost	15000	15000	15000	15000	20000	15000	6000	6500	6000	6000	6000	6000
	Median OSS Vol	4000	7000	5000	6000	7000	5000	2600	2800	2500	2500	1800	2000
SC/ST Hindu	freq	76	64	71	95	62	73	67	71	59	64	28	34
	Median OSS Cost	12000	15000	18000	18000	20000	20000	6000	7000	6000	7000	8000	7000
	Median OSS Vol	5000	6500	7000	8000	14000	7000	2800	2800	2400	2800	3750	2400
Muslim	freq	9	9	15	12	7	34	18	11	14	15	4	9
	Median OSS Cost	16500	12000	16500	15000	15000	15000	8000	7000	7000	7000	12000	6000
	Median OSS Vol	7000	5000	7000	7000	7000	7000	3900	3600	3300	2800	3450	2600
Christian	freq	10	12	9	13	4	13	.	1	2	.		2
	Median OSS Cost	12500	10000	9500	12000	15000	12500	.	10000	4000	.		.
	Median OSS Vol	4000	4000	5000	4000	5000	4000	.	2200	1300	.		2000
Sikh	freq	18	27	33	37	19	39	1	.	4	1	.	4
	Median OSS Cost	10000	15000	15000	15000	15000	15000	.	.	7000	5000	.	.
	Median OSS Vol	4500	5000	5000	5000	5000	7000	3900	.	2900	2800	.	3000
Other Minorities	freq	2	.	2	1	.	.	.	.	.	.	.	.
	Median OSS Cost	19000	.	16500	15000	.	.	.	.	.	.	.	.
	Median OSS Vol	14000	.	9500	7000	.	.	.	.	.	.	.	.
Refused to Say	freq	2	1	8	8	6	15	1	1	1	2	1	5
	Median OSS Cost	12000	.	18000	15000	15000	15000	10000	.	6000	12000	3000	10000
	Median OSS Vol	4000	4000	6000	7000	4500	7000	8300	1800	1800	4700	3400	2400

Explicit Reasons provided for Preference of Septic Tanks and Pits:

Having discussed some of the implicit reasons, it is imperative to analyse the direct responses regarding the reasons for constructing on-site systems. While it is intuitively understood that the majority of households build OSS systems due to the unavailability of sewerage networks, the exact economic, technical and behavioural reasons for constructing septic tanks or pits is a seldom researched topic. These on-site substructures have become even more significant in recent times with burgeoning access to toilets and the pressing need to address faecal sludge management. Taking cognizance of the undeniable over-reliance on such systems, the survey has sought to elicit information on the economic, behavioural and technical reasons for building them. This information has been analysed at the state level for septic tanks and pits.

Each of the three broad reasons include specific reasons. For example, the larger set of behavioural reasons includes behaviour-specific reasons such as general awareness of the benefits of septic tanks or advised by masons, etc. Table 38 provides key insights on how respondents ranked or prioritized their economic, behavioural and technical reasons for building septic tanks. It is noticed that 45 percent of the households have cited economic reasons as the primary basis for constructing septic tanks. This is followed by behavioural reasons, prioritized by 42 percent of the respondents with septic tanks. Only 12 percent of the households have cited technical reasons as most vital for their decision to build septic tanks. Interestingly, the patterns in the reasoning for building septic tanks are different for the different survey states. West Bengal very few septic tanks so it can be left out of this analysis. It is seen that a majority of households in Himachal Pradesh have cited behavioural reasons as the primary deciding factor for construction of septic tanks. While in Punjab, Madhya Pradesh and Tamil Nadu, households have largely cited economic reasons as deciding factors. When we look at the exact preference patterns we notice that a major share of households in Punjab and Tamil Nadu give the highest preference to economic reasons followed by behavioural and, finally, technical reasons. Contrastingly, in Himachal Pradesh and Madhya Pradesh a larger share of households report prioritizing of behavioural reasons followed by technical and, finally, economic reasons.

Table 38 Explicit Economic, Behavioural and Technical Reasons Preference Pattern for Building Septic Tanks

State	Econ>Tech>Beh	Econ>Beh>Tech	Tech>Econ>Beh	Beh>Econ>Tech	Beh>Tech>Econ	Total
Himachal Pradesh	39	71	37	126	146	419
	9.31	16.95	8.83	30.07	34.84	100
Punjab	48	152	49	49	71	369
	13.01	41.19	13.28	13.28	19.24	100
West Bengal	10	14	7	3	9	43
	23.26	32.56	16.28	6.98	20.93	100
Madhya Pradesh	75	71	32	38	100	316
	23.73	22.47	10.13	12.03	31.65	100
Tamil Nadu	75	154	60	83	67	439
	17.08	35.08	13.67	18.91	15.26	100
Total	247	**462**	185	299	393	1,586
	15.57	**29.13**	11.66	18.85	24.78	100

Table 39 is similar to Table 38 above but shows households which have pits. It is seen that 45 percent of total households with pits have prioritized economic reasons, 40 percent have cited behavioural reasons as primary, and only 15 percent of the households have cited technical reasons. Perhaps the most interesting statistics of the pit latrine data is that 27 percent of such toilets were constructed within the last 4 years and 55 percent of the new constructions were reportedly subsidised under SBM or by the Panchayats; the rest were private constructions. While a majority of pits are found in West Bengal (more than 50 percent of the total respondents here have pits), Tamil Nadu too has a fairly large number of households with pits. For both West Bengal and Tamil Nadu economic reasons are prioritized.

Table 39 Explicit Economic, Behavioural and Technical Reasons Preference Pattern for Building Pits

State	Econ>Tech>Beh	Econ>Beh>Tech	Tech>Econ>Beh	Beh>Econ>Tech	Beh>Tech>Econ	Total
Himachal Pradesh	5	7	7	36	34	89
	5.62	7.87	7.87	40.45	38.2	100
Punjab	9	9	8	8	7	41
	21.95	21.95	19.51	19.51	17.07	100
West Bengal	76	157	67	78	74	452
	16.81	34.73	14.82	17.26	16.37	100
Madhya Pradesh	6	11	12	3	28	60
	10	18.33	20	5	46.67	100

Tamil Nadu	24	60	24	30	25	163
	14.72	36.81	14.72	18.4	15.34	100
Total	120	244	118	155	168	805
	14.91	30.31	14.66	19.25	20.87	100

Desludging Behaviour and Practices in LDVs:

Particulars of Desludging Reported for different types of Septic tanks and Pits:

The analysis so far corroborates the higher prevalence of on-site systems in LDVs which have also been found to have better access to tap water. Besides this, correlations have also been explored with socioeconomic characteristics of households: consumption expenditure of households considered as proxy for income, as well as caste and religion categories for social stratification of the sample households. However, access to on-site systems is far from the end of the sanitation puzzle. Without proper desludging, these structures act as mere containment units. While the design and construct of these structures, as prescribed by BIS or CPHEEO or even the latest SBM-G technical guidelines, are paramount to the proper functioning of these structures for treatment of wastewater, large aberrations are noticed across geographies. Table 40 shows the septic tank makes and wastewater outlets of households that have reported desludging and Table 41 shows the same for pits.

Table 40 Desludging reported for Septic tanks of Different Structures and Waste Water Outlets

Septic Tank Structure	Waste Water Outlet				Total
	To Soak Pits	To Drains	To Open Land	No Outlet	
Three Chambered	9	2	2	4	17
	52.9%	11.8%	11.8%	23.5%	100%
Two Chambered	20	33	8	20	81
	24.7%	40.7%	9.9%	24.7%	100%
Single Chambered	13	16	12	246	287
	4.5%	5.6%	4.2%	85.7%	100%
Total	42	51	22	270	385
	10.9%	13.2%	5.7%	70.1%	100%

Table 41 Desludging reported for Pits of Different Structures and Waste Water Outlets

Pit Design	To Drains	To Open Land	No Outlet	Total
Twin-pits	3	1	15	19
	15.79%	5.26%	78.95%	100%
Single Pits	5	17	81	103
	4.85%	16.5%	78.64%	100%
Others	0	0	1	1
	0%	0%	100%	100%
Total	8	18	97	123
	6.5%	14.63%	78.86%	100%

It has also been noted that 70 percent of the septic tanks that reported being desludged are from Census Towns while the rest are from other LDVs. Similarly, for pits that have reportedly been desludged, 61 percent are from Census Towns and the rest are from other villages.

Among households with septic tanks, only 25 percent of them have reported desludging their tanks. Again, only 15 percent of the total sample households with pits have reported availing desludging services. While the abysmally low numbers of desludging speaks volumes of the existing gaps in sanitation services and/or household level negligence, it is pertinent to understand which households, with what kind of OSS designs, are actually availing desludging services. From the above tables we again notice interesting trends. It is observed that households with single-chambered septic tanks, the simplest design and arguably inadequate for serving the purpose of providing primary treatment of waste, report the highest levels of

desludging (75 percent). Also very interestingly, 86 percent of the households with single-chambered septic tanks that have reported availing desludging have no wastewater outlet. Though at an aggregate level 70 percent of the septic tanks with no outlet have reportedly been desludged, 19 percent of septic tanks with wastewater outlets to open drains and open land have reported desludging. Similarly, 84 percent of pits that reported being desludged are single pits and, at an aggregate level (for both single and twin pits), the majority of pits getting desludged have no outlets.

Periodicity of Desludging of OSS based on Types of Non-potable Water Source:

Notwithstanding the importance of design and make of the on-site systems towards incentivising households to avail desludging services, it is pertinent to comprehend what other factors may be influential for regular or irregular desludging of on-site systems. Table 42 provides the frequency of households which report desludging their septic tanks and pits given their supplementary water source and distance from the source. As seen in the previous sections regarding water supply, the sample households report large variations in access to water for supplementary uses. For instance, 53 percent of households have access to tap water, of which 89 percent have these taps within premises. Similarly, for ground water sources it is observed that of the 38 percent of households relying on such sources, 36 percent of them are either near the premises or away.

Considering these variations in access to water for supplementary use, the desludging behaviour of households was examined across these categories. It was observed that larger numbers and percentage of desludging of septic tanks were reported from households with access to tap water (30 percent); of this category 88 percent of the desludging was reported from households with tap water within the premises. On the other hand, lower levels of desludging of septic tanks were reported from households which relied on ground water sources. The converse was observed for pits, where 17 percent of households relying on ground water sources reported desludging their pits compared to 10 percent of desludging reported from households with tap water. But there is also a state aspect when it comes to pits since most of the pit desludging has been reported by sample households from West Bengal.

Table 42 Periodicity of Desludging of Septic tanks and Pits across different Supplementary Water Sources

OSS Type	Time Reported	Tap-water				Ground Water Sources				Surface Water Sources			
		Within Premise	Near	Away	Total	Within Premise	Near	Away	Total	Within Premise	Near	Away	Total
Septic Tanks	Within 6 months	29	6	.	35	10	.	.	10	.	1	.	1
	Within a year	136	19	7	162	26	2	1	29	.	1	1	2
	Within 2 years	89	2	3	94	15	2	.	17	.	.	.	
	Within 3 years	13	.	.	13	10	.	.	10	.	2	.	2
	Can't Remember	21	.	1	22	1	.	.	1	.	.	.	
	Total	288	27	11	326	62	4	1	67	.	4	1	5
Pits	Within 6 months	1	1	1	3	6	.	.	6	.	.	3	3
	Within a year	6	2	2	10	6	.	.	6	.	3	3	6
	Within 2 years	4	1	.	5	17	.	1	18	.	7	2	9
	Within 3 years	6	.	.	6	29	1	1	31	.	9	4	13
	Can't Remember	1	1	.	2	.	1	.	1	.	.	.	
	Total	18	5	3	26	58	2	2	62	.	19	12	31

Desludging Behaviour and Cost across Social Groups and Type of Waste Water Outlets:

Besides infrastructural factors such as water supply described above, social factors too contribute to the decision to build pits or septic tanks. It was observed in Table 37 in the previous section how for the General Hindu category household there is a very strong relation between septic tank size and monthly per capita expenditure. Now looking at desludging of on-site systems – septic tanks and pits separately – we notice interesting patterns across caste and religion groups (see Table 43). First, there is the clear variation in cost reported for desludging septic tanks and the corresponding figure for pits. This variation can be directly attributed to the capacity variations of these substructures: pits are clearly smaller than septic tanks. Second, from the caste and religion categories it is understood that highest levels of desludging have been reported by the OBC Hindu households (almost 40 percent of them have reported desludging) followed by Muslim households (36 percent) and then SC/ST households (23 percent). However, General Hindu households and Sikh households have reported only 10 and 6 percent.

This desludging behaviour can be partly explained by infrastructure variations and partly by caste- and religion-specific practices and trends (see Figure 12, 13 and 14). The reason why a large section of OBC Hindu, SC/ST Hindu and Muslim households have reported desludging is because a larger section of these groups have no outlets from their septic tanks which are already of a smaller size. On the other hand, while a sizeable section of General Hindu Households have septic tanks, only 10 percent have desludged their tanks for two probable reasons: one, they generally have much larger septic tanks (18,000 litres median volume compared to 5000 litres for OBC and 7000 litres for SC/ST hindu categories); and two, almost 70 percent of General Hindu households have their large septic tanks connected to soak pits, thus reducing the need for frequent desludging. The latter reason has been induced by the larger plot sizes of General Hindu households. For Sikh households too, which is a sizeable cohort in the sample survey where households have reported high percentage of on-site systems, we see very few households reporting desludging.

Table 43 Desludging Services Availed for Septic tanks and Pits across Caste and Religious Groups

Caste Religion Groups	Septic Tanks				Pits			
	Freq	Median OSS Vol	Median OSS Cost	Median Amount for Desludging	Freq	Median OSS Vol	Median OSS Cost	Median Amount for Desludging
Gen Hindu	33	14000	20000	2000	38	2800	7000	1200
OBC Hindu	186	4000	13500	2500	12	2500	7000	1500
SC/ST Hindu	103	6000	15000	2000	49	2600	7000	1200
Muslim	29	7000	15000	2500	18	2900	7000	2000
Christian	13	5000	15000	2000	1	1300	3000	1500
Sikh	7	5000	15000	1500	.	.	.	.
Other Minorities	1	23000	30000	5000	.	.	.	.
Refused to Say	26	5500	15000	2500	2	2700	3000	1500

Figure 12 Box-plots of OSS Volumes across Caste and Religion Groups

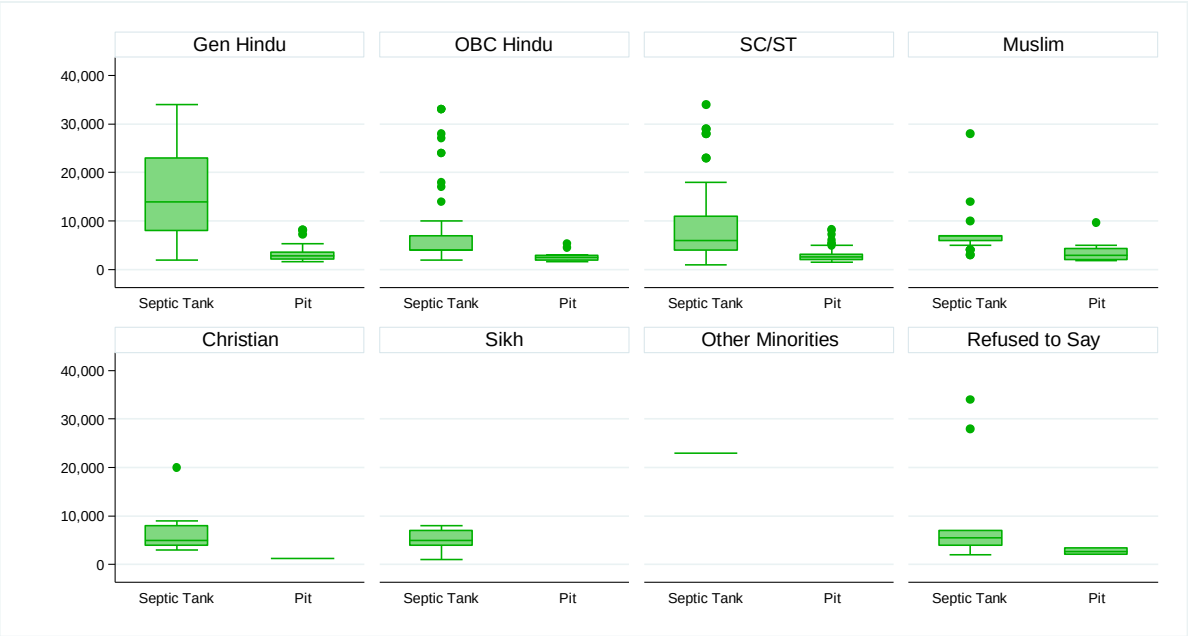


Figure 13 Distribution of Septic Tank volumes across caste and Religion Groups for Households that report desludging and those that don't

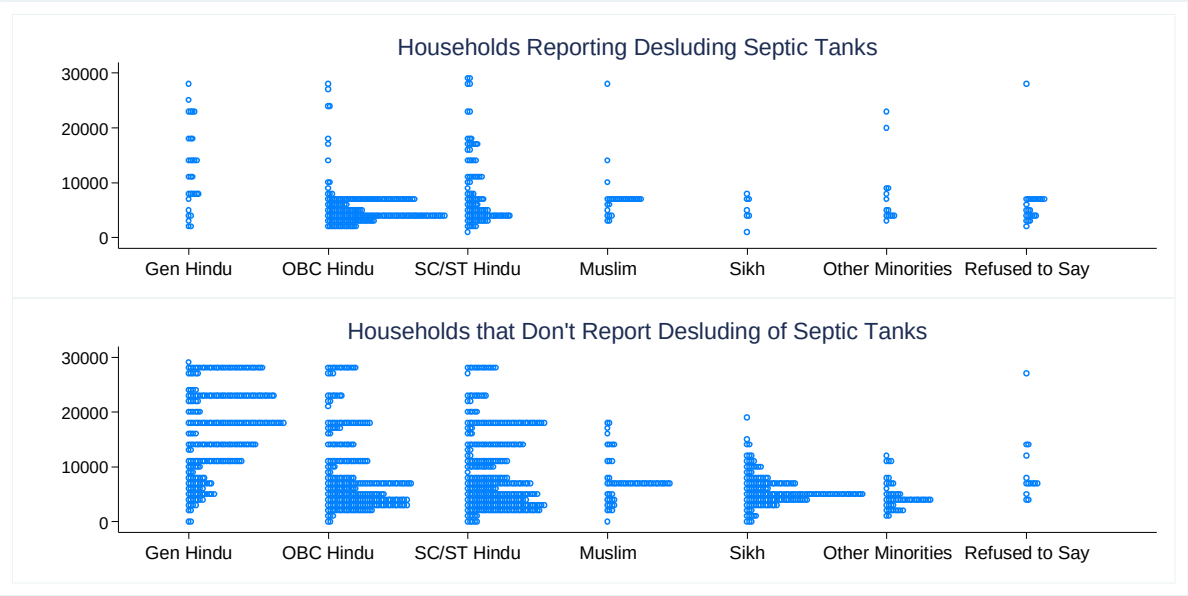
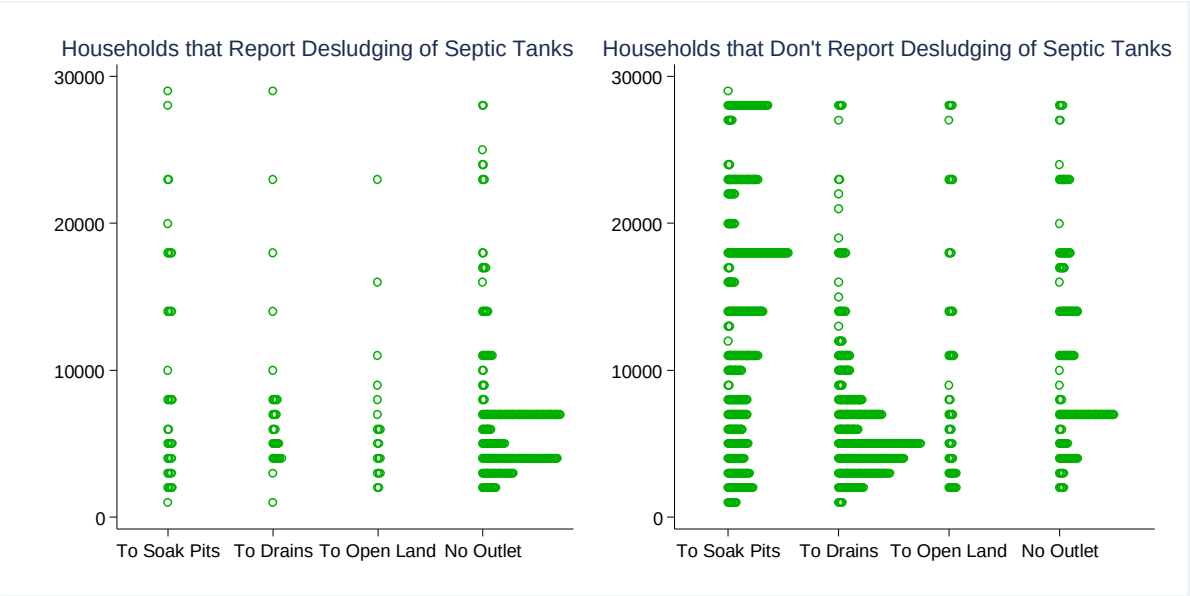


Figure 14 Distribution of Septic Tanks volumes across Reported Waste Water Outlets for Households that report desludging and those that don't



Emerging Trends:

The survey of the LDVs has yielded interesting revelations. Both the household survey and the KIIs have provided a plethora of information which lays bare intriguing trends upon careful scrutiny. While some revelations – such as the predominance of on-site systems – were earlier intuitively understood as normal given the absence of larger sewerage infrastructure, these aspects can now be studied in detail with the available information. The findings not only corroborate some of the earlier studies, which had tried to find correlations between the prevalence of on-site systems and economic and geographical conditions, but also provide evidence of the peculiarities in practices around the construction and maintenance of specific OSS systems. It has also been found that some of these peculiarities and practices are influenced by personal, social and institutional factors. The broader takeaways from this research are the preference patterns for the construction and upkeep of these on-site containment structures which, given their individual and yet quasi-public nature, have significant environmental ramifications. Hence, this research attempts to highlight some of the idiosyncrasies pertaining to OSS systems in LDVs.

Undercurrents of Socio-Economic effects on on-site sanitation systems:

The household survey data makes it feasible to undertake cross-sectional analysis to comprehend some nuances of the prevailing preference for on-site systems. As discussed in the previous section, there are clear evidences of socioeconomic undercurrents affecting the preference patterns. While much of the variations can be attributed to access to water and other public services, patterns do emerge when looking at variations in the consumption expenditure of households (used as a proxy for their economic wellbeing) and caste and religion as social identity markers (and hence proxies for their social stature).

There is a clear indication of higher preference for septic tanks in the wealthier households with a higher monthly per capita expenditure. As seen in the previous section, there is an increase in preference for septic tanks as we move from the poorest to the richest consumption quintile, and conversely a decline in preference for pits. However, exploring variations in capacities of on-site containment structures across economic indicators, interesting trends are observed. Figure 15 shows the capacities of OSS systems (shown in terms of volume in litres) for different consumption grades (colour coded), separately for septic tanks and pits, given their water usage in litres per capita per day. For septic tanks, there is a clear and evident increase in the capacities of the structures as we move from the poorer to the richer consumption categories of survey households. For pits, however, there is little variation in capacities across different consumption quintiles. This could be attributed to the standardized design and make of pits in most of the survey districts, with most of them relying on concrete cylindrical rings. Figure 16 gives a clearer representation of the distribution of different households across the consumption categories based on monthly per capita consumption expenditure (MPCE).

Figure 15 Nature of Correlation between OSS Volume (in litres) and Water for Supplementary use (in lpcd) for varying levels of Monthly Per Capita Expenditure (in rupees)

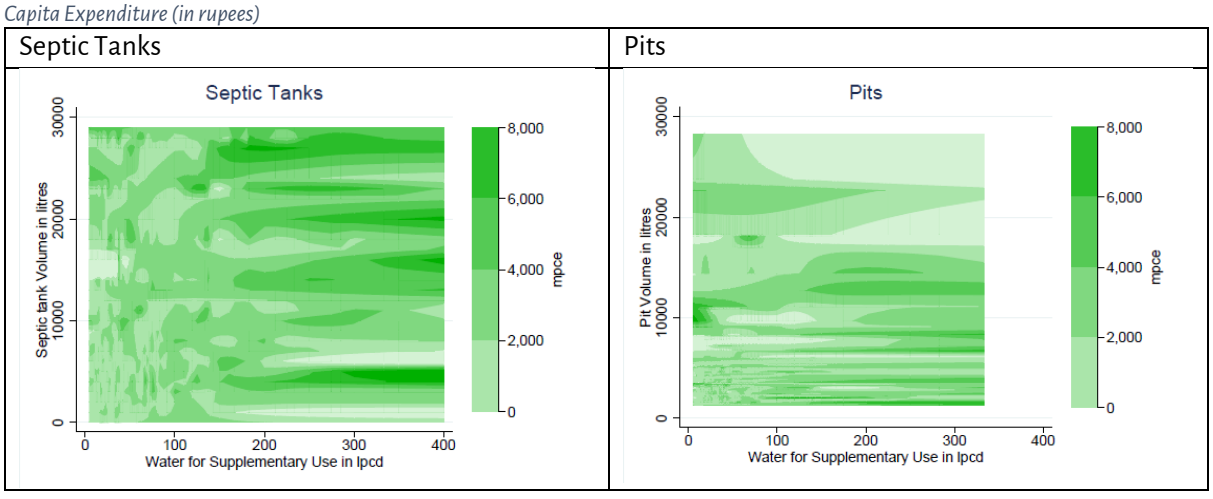
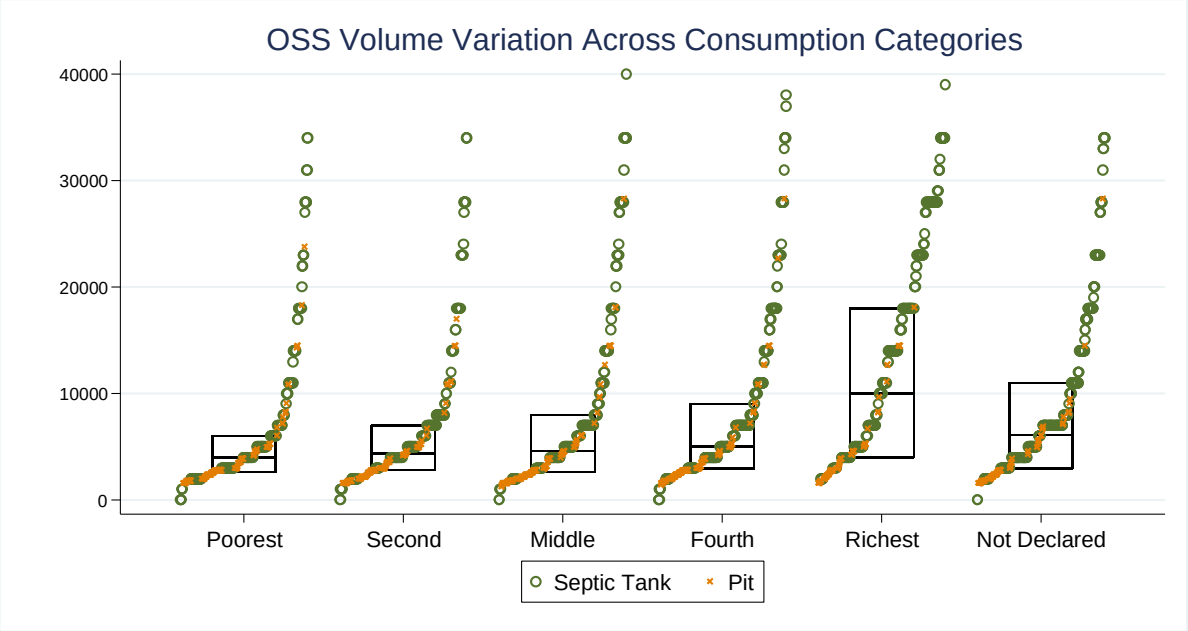
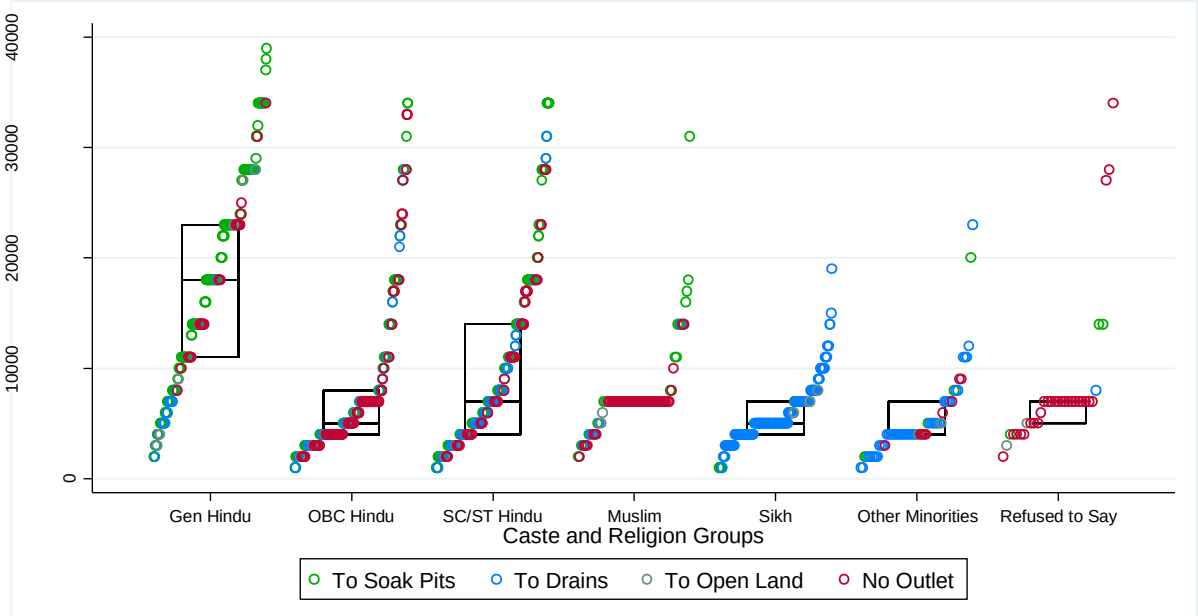


Figure 16 Variation in Volume of OSS across Consumption Categories



Septic tanks, which are clearly the most preferred on-site systems, exhibit interesting trends across caste and religion groups as well. In Figure 17 the septic volume of households have been plotted across different castes and religions, and are separated by wastewater outlets (shown in different coloured circles in the legend of the plot). This plotting corroborates the fact that General Hindu households are very risk-averse when it comes to constructing septic tanks. This is evident in the concentration of the green circles which represent septic tanks with soak pits. Also, there is a very large variation in sizes which is correlated to the economic wellbeing of the household. This presumably relates to the purity practices which is a noticeable trait of the Hindu upper castes. On the contrary, lower Hindu caste groups and Muslim households have smaller tanks which are often without any outlets. These correlations have been found to have a substantial impact on the desludging behaviour of households. As discussed in earlier sections, upper caste Hindu households report much lower desludging compared to other caste and religion groups, and this can be attributed to their reliance on larger tanks with soak pits.

Figure 17 Box-plots and Cumulative Frequencies of Septic tank Volume across different Caste and Religion Categories Separated by Waste-water Outlets



Access to Water and its implications on the functionality of OSS:

What emerges as a striking finding is the variation in reliance on water supply for supplementary use and the implications this may have on the functioning and sustainability of OSS systems. The implications of adequate water supply are far-reaching for two particular reasons. One, given the sluggish levels of development of sanitation infrastructure, primarily tap water supply and sewerage systems, in rural areas there is a heightened reliance on on-site systems which are built with an intent to provide primary treatment of liquid waste. Two, the durability and functionality of these on-site systems, which are clearly contingent on the adequacy of the aforementioned infrastructures, necessitates periodic desludging. Both these implications are instrumental to the effective management of blackwater from households, which is also informed by the seldom discussed reliance on mechanized or manual cleaning of on-site systems.

As seen in Table 34 and Table 35, the litres per capita/day water consumption/usage for supplementary uses (other than drinking) varied across the sources of water and the distance of households from the sources. Across these variations the investigation on prevalence of different types of on-site systems also revealed variations. Septic tanks were preferred in households with networked water supply and when these sources were within the premises. However, deviations from tap water to ground water and surface water, and from sources within premises to those near and away result in a decline in the preference for septic tanks and commensurate increase in preference for pits. Nonetheless, this change in preference does not discount the existence of similar on-site systems which operate with less supplementary water, and this has a vital implication for the desludging practices of households. Table 44 distributes households which have reported desludging their on-site systems across different sources of water supply. It should be reiterated here that only 22 percent of households with on-site systems have reported availing desludging services. The nature of desludging has been broadly classified into mechanized desludging done using cess-pool vacuum trucks and manual cleaning. It is strikingly evident that mechanised desludging is availed largely when households have access to tap water supply and the sources are within the premises. There are still a large number of households who report availing manual scavenging in this combination of water supply where most number of desludging had been reported (83 percent of total reported desludging). However, deviations from this combination of water supply result in increasing reliance on manual scavenging.

Table 44 Mechanised and Manual Desludging reported for all OSS across different combinations of Supplementary Water Sources and Distance from Source

Supplementary Water Sources	Within Premises			Near Sources			Away Sources		
	Mechanised	Manual	Total	Mechanised	Manual	Total	Mechanised	Manual	Total
Tap Water	290	28	318	30	2	32	11	3	14
Ground Water Source	78	52	130	1	5	6	.	3	3
Other Surface Water Sources	.	.	.	.	23	23	3	10	13
Tanker or Cart Drums	1	.	1	.	.	.	.	.	
Total	369	80	449	31	30	61	14	16	30

It is to be noted that 77 percent of desludging reported is mechanised. Studies and field anecdotes underscore the reliance on manual scavenging despite households availing mechanised desludging (Xess and Zerah, 2017). While households do get their toilet substructures desludged mechanically through trucks, oftentimes further manual cleaning is required. This is partly due to the irregularity of desludging practices and partly due to inadequacy of water; in most cases, it is because of a combination of these two reasons. The scale of dependence of households on this inhumane and hence, legally prohibited practice is high and is often underreported. Unfortunately, the practice of manual scavenging is significantly sustained by the inadequacy of water supply and desludging services (apart from the hierarchical caste system).

Clusters of High Sanitation Service Areas:

As discussed earlier, the household survey provides interesting insights on the kind of desludging services availed. It is pertinent to understand the areas where most of these services are being availed. Table 45 gives a distribution of mechanized and manual desludging reported across the survey districts. Two states emerge on top with highest levels of desludging reported: Tamil Nadu and West Bengal. The trends, however, in these two states are remarkably different. Tamil Nadu reports the highest number of mechanized desludging but West Bengal reports the highest number of manual cleaning of on-site systems. The marked variations obviously are the higher percentages of septic tanks in Tamil Nadu contrasting with the higher percentages of pits in West Bengal. But, interestingly, both states have significantly high percentages of on-site systems with no wastewater outlets. Contrastingly, Himachal Pradesh, where septic tank predominance is the highest, does not report high numbers of desludging for two reasons: one, large capacities of septic tanks and, two, most septic tanks being connected to soak pits. But in Punjab, where septic tanks are quite common, desludging has not been reported because most of these have outlets to drains.

Tamil Nadu and West Bengal provide interesting case studies. In Coimbatore district, Pollachi, Coimbatore and Peelamedu cities are seen to cater to the high demand for desludging in surveyed villages. The desludging reported from these areas is done through desludging trucks and the KIIs also corroborate this. There definitely seems to be a network of private service proividers in this area catering to the desludging needs of households in the peri-urban areas and nearby villages. In West Bengal, as discussed earlier, most of the desludging services availed are manual. Interestingly, the LDVs from Nadia district report that most of the manual scavengers are from the same village with some coming from nearby villages. This has been reported despite the availability of desludging trucks from Chakdah town providing some services in these villages.

Table 45 District wise Reporting of Mechanised and Manual Desludging Separately for Septic Tanks and Pits

State	District	Septic Tanks		Pits	
		Mechanised	Manual	Mechanised	Manual
Himachal Pradesh	Kangra	10	.	.	.
	Mandi	9	1	2	.
	Shimla	5	5	.	.
Punjab	Gurdaspur	1	4	.	.
	Jalandhar	12	4	4	.
	Amritsar	5	7	.	.
West Bengal	Nadia	9	4	6	43
	Hugli	3	.	4	4
	South Twenty-four Parganas	.	7	7	33
Madhya Pradesh	Satna	.	3	.	.
	Rewa	.	.	.	2
	Jabalpur	6	5	.	1
Tamil Nadu	Cuddalore	81	1	14	.
	Coimbatore	126	.	.	.
	Thanjavur	90	.	.	.

Conclusion:

OSS systems have always had considerable relevance in the context of toilets by virtue of being their substructures and receptacles for waste collection. Reliance on them has definitely burgeoned in recent times under the flagship toilet construction programme, primarily, because the development of sanitation infrastructures, such as drainage and sewerage networks and treatment plants, has been highly inadequate in the rural areas of India. The capital intensive nature of such large infrastructure also posits a higher improbability of their development in rural areas than in their neighbouring urban settlements. Thus, it's only fair to presume that in rural areas the government's impetus on OSS has been with an intent to make them viable and durable for black water management. Toilets and OSS, however, at the end of the day are private goods which constitute a vital component of collection in the sanitation value chain (which also includes transportation of waste and treatment).Notwithstanding their larger role in environmental sanitation, OSS are subjected to a fair amount of customisation in their design and construct guided by the economic, behavioural and technical factors pervading the households' decision making. Hence, there are many noticeable deviations from the prescribed technical norms.

The results of the LDV survey have been canvassed in this study to comprehend some of these deviations and variations in OSS across the survey states. The analysis reveals some of the correlations between economic, social and technical factors and the prevalence of particular types of OSS. Further, there has been an attempt to understand the access to sanitation services pertaining to desludging of these OSS, specifically on the periodicity of desludging based on volume and kind of outlet of the OSS. There is clear evidence on the predominance of OSS and mainly septic tanks in survey LDVs which were proximate to cities and this corroborates the previously inferred rural-urban continuum in sanitation infrastructure based on secondary data. This has been further substantiated by the revelation of households having availed desludging services from private truck operators from nearby cities.

This study has revealed some trends in the form of idiosyncratic preferences for sanitation infrastructure and services and has attempted to expound on gaps, concerns and potential hazards related to water and sanitation services in rural areas. However, this is a pilot survey and there is ample scope for further research on this subject which could and should be conceived and undertaken with broader framework which gives due consideration to following research areas:

a) **Impact of current sanitation programmes on OSS:**
   The exploration of the impact of government programmes on OSS undertaken in this study has yielded some cursory insights on the matter. The study has revealed some of the trends in state-wise preferences for septic tanks and pits in the recent years during the implementation of the Swachh Bharat Mission (SBM) in rural areas. For example, out of the 23 percent toilets reported of being constructed within the last 4 years, 22 percent directly reported availing SBM subsidy. Of these SBM toilets, 61 percent have pits and 31 percent have septic tanks. However, for a detailed impact assessment of the toilet construction programme of such a scale it is imperative to adopt a broader framework of analysis. This could help us scrutinise: (i) to what extent the programme has impacted the design and make of OSS? (ii) And whether the impact has been substantial enough to complement the development of sustainable FSM methods for rural areas?
b) **Households' preferences and decision making around OSS:**
   The LDV survey has found that 86 percent of the IHL reported are privately constructed of which 61 percent had septic tanks and 26 percent had pits. From amongst the households who constructed their toilets within the last 4 years, 63 percent were privately constructed. Out of these new private toilet constructions, 64 percent had septic tanks and only 25 percent had pits despite the government promoting the latter. Presumably, the largely privately built toilets are subjected to a fair share of customisation on account of the economic, social and technical factors influencing the households'

decision making. Some state-specific trends have been discussed in this report. Further detailed analysis of the same is necessary which could help us analyse: (i) whether subsidies and IEC programmes were sufficient to streamline OSS construction? and/or (ii) whether social, economic and infrastructural factors were more influential in this regard?

c) Correlations between the quality of desludging services and nature of OSS:

The survey results also hint at strong correlations between desludging behaviour of households and the kind of OSS that serve as containment units for their toilets. It was seen that largely households which have single chambered septic tanks and single pits have reported desludging. Also, for both types of OSS, the ones which have no waste water outlets, were reported to have desludged. This paints the demand side of desludging services. This analysis is complemented by the supply side assessment of availability of desludging service. It is observed that only 22 percent of the households with IHLs have reported desludging and out of this, 5 percent have reported availing services by government service provider while 71 percent by private operators and 24 percent had availed manual cleaning services. State-specific trends have also been discussed in the analysis sections of this report. Given the large homogeneity of OSS infrastructure across LDVs and urban areas, the surveyed sites prove to be ideal sites for a research on the understanding of the network of desludging services. To engender a more holistic understanding of the supply and demand for desludging services in rural areas and their impact on the design and make of OSS, a larger survey may be required. The key research questions in this regard would be: (i) which are the factors that constitute the demand and supply side of the OSS desludging services and (ii) how do these factors interact with each other towards collectively burgeoning quality of sanitation behaviour and services?

d) Case studies on high sanitation service areas:

Last but not least, the study has exhibited the existence of high sanitation service areas. The higher degree of desludging can be attributed partly to the kind of OSS and partly to the availability of service providers and their accessibility i.e. where they come from. Cost of desludging and socio-economic factor also play important roles. A demand and supply analysis of desludging services in the emerging areas with higher OSS density can be studied as case studies and the learnings can be invaluable to the discourse of FSM. Such studies will help understand the informal service networks and help streamline service delivery mechanisms to ensure proper treatment and disposal of waste. They can also help understand: (i) why there is a continued reliance on manual cleaning practices, as has been found in the survey (ii) how much of it is sustained by social, economic and technical factors that shape households' behaviour and (iii) how this practice is affected by the informality and inadequacy of mechanised desludging services available in rural areas?

e) Potential health hazards of poor sanitation:

In a quick analysis of the health information recorded during the survey, it is seen that diarrhoeal incidences are higher in households which depends primarily on ground water for potable usage and had septic tanks or pits as their preferred OSS. The percentage share of households reporting diarrhoeal incidences with septic tanks and ground water sources for drinking is 33 percent while the same for pits is 16 percent. This gives us a quick insight on the health hazards imposed by the proximity between ground water sources and on-site sanitation systems. In the last few years, several organisations e.g. IIHS, ATREE, NEERI etc. have been trying to investigate the linkages between typology of on-site sanitation systems and its potential role in ground water contamination. At the same time, there is merit in a larger survey to appropriately assess: how much impact this may have on the health of people in rural areas where there is a predominance of OSS and high reliance on ground water sources?

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Annexure:

Table A1 Final List of Large and Dense Villages Surveyed

State	District Name	Village No.	Village Name	LDV Type	Census Population	Household Sample Size planned	Actual Household Sample Surveyed
Himachal Pradesh	Shimla	1	Jhakhri	CT	4655	100	101
		2	Kumharsain	Vill	1545	35	35
		3	Meheli	Vill	1523	35	35
		4	Shogi	Vill	1256	30	30
	Mandi	5	Dehar	Vill	1738	35	37
		6	Jarol	Vill	2136	45	47
		7	Karsog	Vill	1907	50	50
		8	Salaper	Vill	2850	70	72
	Kangra	9	Bhapoo	Vill	2400	35	37
		10	Gangath	Vill	4194	63	66
		11	Indora	CT	4534	70	70
		12	Kandrori	Vill	1959	32	33
Madhya Pradesh	Jabalpur	13	Baghraji	Vill	5375	50	57
		14	Bargi	CT	6916	50	53
		15	Gandhigram	Vill	6817	50	50
		16	Kundam	CT	4856	50	53
	Satna	17	Majhgawan	CT	8290	50	55
		18	Rahikawara	Vill	7845	50	50
		19	Singhpur	Vill	5965	45	48
		20	Sonwari	Vill	8105	55	57
	Rewa	21	Garh	Vill	5229	45	47
		22	Nowbasata	CT	4358	45	47
		23	Raipur	Vill	6415	55	57
		24	Tiwani	Vill	6779	55	55
Punjab	Jalandhar	25	Apra	CT	6258	55	55
		26	Birk	Vill	5264	55	55
		27	Chomon	CT	3704	35	36
		28	Dhin	CT	5961	55	55
	Amritsar	29	Baba Bakala	CT	8946	53	55
		30	Chogawan	CT	5416	32	33
		31	Nag	Vill	9352	64	64
		32	Sathiala	Vill	9358	52	53
	Gurdaspur	33	Behrampur	CT	5432	45	47
		34	Fateh Nangal	CT	7721	65	65
		35	Harchowal	Vill	5291	45	46
		36	Kala Afgana	Vill	4944	45	46
Tamil Nadu	Cuddalore	37	Manjakuzhi	Vill	5949	46	46
		38	Pallippadai	CT	6369	46	49
		39	Periyakurichi	CT	7599	62	64
		40	Silambimangalam	Vill	5695	46	49
	Coimbatore	41	Arasur	CT	11510	70	70
		42	Chinnathadagam	CT	8407	50	50

		43	Chinniam palayam	CT	8232	45	45
		44	Kattampatti	Vill	5859	35	35
	Thanjavur	45	Chakkarapalli	CT	6227	43	43
		46	Kabisthalam	Vill	6630	51	52
		47	Natchiarkoil	CT	7505	57	59
		48	Thirunariyur	Vill	6786	50	50
West Bengal	**South Twenty-four Parganas**	49	Ghatak Pukur	Vill	5048	40	44
		50	Kanganbaria	CT	6657	60	65
		51	Ramkrishnapur	CT	5971	50	51
		52	Uttarparanij	CT	6810	50	53
	Nadia	53	Belgharia	CT	5858	45	50
		54	Gangni	CT	5532	40	43
		55	Punglia	CT	6857	50	54
		56	Silinda	Vill	7741	65	68
	Hugli	57	Baksa	CT	6432	60	74
		58	Bargachhia	CT	4566	40	41
		59	Kalachhara	Vill	4225	40	41
		60	Ramanathpur	CT	6811	60	64

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Sanitation programme at the Centre for Policy Research (CPR) is a multi-disciplinary research, outreach and policy support initiative. The programme seeks to improve the understanding of the reasons for poor sanitation, and to examine how these might be related to technology and service delivery models, institutions, governance and financial issues, and socio-economic dimensions. Based on research findings, it seeks to support national, state and city authorities develop policies and programmes for intervention with the goal of increasing access to inclusive, safe and sustainable sanitation. Initiated in 2013, the programme is primarily funded by the Bill and Melinda Gates Foundation (BMGF).

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