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What Ails Rural Sanitation and Hygiene? Economic and Institutional Aspects of Sustainable Services in AP, India

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ABSTRACT

This paper, based on the extensive data collected from more than 5000 households and 400 focus group discussion in 107 sample villages of Andhra Pradesh (AP), India, estimates the costs of providing sanitation and hygiene services. These costs include public as well as household costs. The paper also analyses factors influencing sanitation costs and service levels at the village level. The per capita costs estimated here pertain to 45 % of the rural households so far covered. The key findings include:

i) Allocations towards sanitation needs to be more than doubled to provide basic infrastructure (ISL) and achieve full coverage.

ii) Sanitation expenditure is biased in favour of infrastructure to the neglect of demand generation and awareness building resulting in low use of infrastructure.

iii) Households contribute to about 50% or (ranging between US$ 7 and 31 per capita) of the infrastructure costs and 70% or (ranging between US$ 0 and 6 per capita) of the total costs of sanitation.

iv) Sanitation expenditure seem to be closely associated with the service levels though investment in infrastructure influence usage of ISL at the household level to a limited extent.

v) Households investing in sanitation are likely to have higher usage, as the demand for sanitation seems to prompt investments.

vi) Literacy, governance and economic development are critical for improving access as well use of sanitation.

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It is argued, based on the analysis in the paper, that sanitation at the household level needs to be treated as a private responsibility, while public support should be limited to creating the infrastructure required for safe disposal of waste, institutions for governance, awareness building, etc. And better targeting of subsidies towards most needy should be the policy priority. The gap between access and use needs to be explored and explained in a systematic manner. Given the magnitude of investments required, mainstreaming sanitation with separate allocations and planning should be taken up on priority at the policy level. Creating and promoting professional institutional arrangement rather than the actual participatory institutions at village level would be more effective, due to the changing socioeconomic dynamics in the rural areas. As far as Andhra Pradesh is concerned reviving the dormant village water and sanitation committees (VWSC) ought to taken up on priority. A focused approach using professional marketing methods to din the ears of communities on the importance of sanitation and hygiene should be central to the WASH policies.

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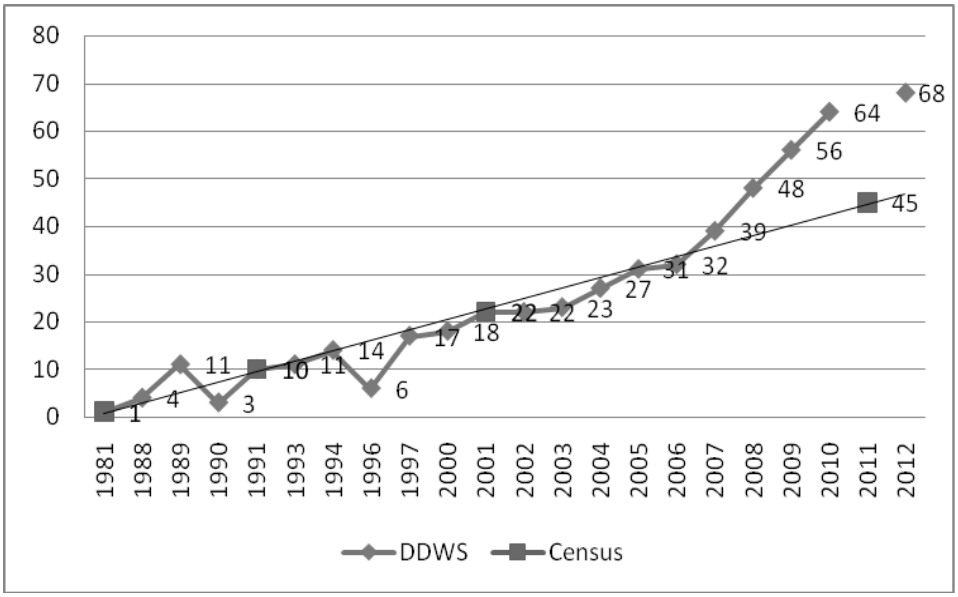
I. Introduction

Sanitation and Hygiene continue to be a nagging policy issue in India even after a decade of implementing Total Sanitation Campaign (TSC). The sanitation coverage (households having access to toilet) in rural areas is about 45 %, which has moved from 22 % in 2001 (GoI, 2011). As per the latest population census 31 % of the rural households have access to toilets and 67 % of them still defecate in open. And there are wide variations across the states. Access to toilets in rural areas is as low as 8 % in Jharkhand and as high as 93 % in Kerala. While official estimates show that MGD targets are met in terms of access to sanitation (infrastructure), the actual use of the infrastructure is not part of the MGD indicators. The plan target of achieving open defecation free (ODF) status by 2012 is far behind. According to a recent assessment of Total Sanitation campaign (TSC) it was reported that Sikkim has achieved 100 % ODF status by 2008 itself (WSP, 2010). Contradicting this figure, the 2011 census shows that none of the states have achieved ODF status. As per the census 2011, in fact, 11 % (Rural 15% and urban 2 %) of the households in Sikkim still practice open defecation. Kerala has reported the lowest percentage of households (4 % overall; Rural 6 % and Urban 2%) practicing open defecation. Thus there is wide gap between census and department estimates on sanitation (Fig. 1).

Mindful of such gap, the department of drinking water and sanitation has reset its goals in its Vision - A Nirmal Bharat strategy (GoI, 2011). The timeline for achieving the goals:

- Creation of Totally Sanitized Environments - By 2017: The end of open defecation and achievement of a clean environment where human faecal waste is safely contained and disposed.
- Adoption of Improved Hygiene Practices - By 2020: All people in the rural areas, especially children and caregivers, adopt safe hygiene practices during all times.

Figure 1: Trends in Access to ISL in India



- Solid and Liquid Waste Management - By 2022: Effective management of solid and liquid waste such that the village environment is kept clean at all times.

The departments strategy to achieve these goals include: i) completely eliminating open defecation, ii) safe management of solid and liquid waste at scale, iii) promoting the adoption of improved hygiene behaviour, iv) addressing inequalities in access with special attention to vulnerable groups such as women, children, aged and disabled, v)ensuring that providers have the capacity and resources to deliver services at scale, vi) stimulating and enabling cooperation across public sector agencies concerned with rural development, health, environment, and vulnerable sections and vii) working with business, academic and voluntary partners to achieve the goals of the strategy.

It is also known that lack of adequate sanitation leads to significant losses for the country. As per a recent study carried out by Water and Sanitation Program (WSP), the adverse economic impacts of inadequate sanitation in India (child mortality, loss of productivity, etc) as of the year 2006 is about Rs. 2.4 lakh crore (US$ 53.8 billion[1]), or Rs. 2,180 (US$ 48) per person. This works out to 6.4 % of Gross Domestic Product (WSP, 2010). While the country has come a long way since then and all these indices stands improved to a great extent, the linkage between inadequate sanitation coverage and economic loss is of extreme significance.

[1] Conversion rate of US$ = 45.72 for year 2010 is used throughout the paper

The WSP study also suggested that only in 109 out of 162 GPs surveyed toilet usage was higher than 60 %, i.e. the balance slipped back to the open defecation status (WSP, 2010). This is further corroborated by the top line results coming from a recent study with bigger samples undertaken by the Government of India in 12 states, 56 districts and 664 in 12 states, 56 districts and 664 GPs, which found that toilet usage was 80 % in the NGP villages at the aggregate level and as low as 45 % in states like Bihar. AP and UP are the other two states reporting above 20 % slippage among NGP villages (GoI, 2011).

The gap between access and use needs to be explored and explained in a systematic manner. While the performance of Total Sanitation Campaign (TSC) is measured in terms of ODF status, monitoring the use of latrines at the household level is quite poor. Both financial and institutional arrangements are observed to be closely linked to the TSC performance , though based on a small sample (WSP, 2010). Differentiating between access to infrastructure and use appears to be the key to understand and assess the performance for explaining the status of sanitation in rural areas.

This paper attempts to assess and explain the existing expenditure and service levels achieved of sanitation and hygiene at the village level across 107 sample villages in Andhra Pradesh (AP). The status of AP in terms of access is slightly above all India with 32 % of the rural households having ISL while 65 % of the rural households practice open defecation. The specific objectives include:

i) Estimate the actual expenditure per person and its composition in providing sanitation and hygiene at the village level

ii) Assess the service levels at the village level resulting from the expenditure

iii) Explain the variations in costs and service levels across the sample villages.

II Approach

Life cycle cost (LCC) approach[2] is adopted to estimate the actual cost components of service provision. The costs assessed here cover the construction and maintenance of systems in the short and long term, taking into account the need for hardware and software, operation and maintenance, cost of capital, source protection, and the need for direct and indirect support costs, including training, planning and institutional pro-poor support (Fonseca, et. al., 2011). In the case of sanitation it is difficult to differentiate financial and economic costs, as sanitation provision is not purely a public

[2] For details see Fonseca, et. al., (2010) and other WASHCost publications at (www.washcost.info)

service. In fact, the public and private territories could be demarcated but for the promotional activities as part of public policy. While sanitation in terms of constructing a toilet and management of solid and liquid waste management at the household level is purely a private affair, in developing countries like India, subsidies are provided to the households to construct toilets. On the other hand, sanitation management, and keeping environmental hygiene such as provision for solid and liquid waste disposal and management is beyond household level and is a public affair. In the case of rural areas the pure public investment in the later is on a limited scale. As a result, the contribution of households to the overall sanitation expenditure is substantial in most cases, especially in villages where sewer facilities are not provided. Therefore, the cost analysis includes both public and household expenditure.

The cost analysis is based on the data collected from 187 habitations spread over nine agro-climatic zones of Andhra Pradesh. The sample villages were selected on the basis of a stratified sampling design in each of the agro-climatic zones[3]. A village (habitation) is considered as a sampling unit for the survey. Cost data were obtained from the official records of the Rural Water Supply and Sanitation (RWSS) department at district level. These data were triangulated or crosschecked with the help of data generated from the village panchayat (local government). The data on Operation and Maintenance were obtained from the village panchayat records. The household cost and service levels data was gathered from 107 sample villages spread across the nine agro climatic zones. A sample of 50 households from each sample village were selected and a structured questionnaire was canvassed to elicit information on costs and service levels along with the demographic and socio-economic attributes of the households. On the whole household cost and service level data are based on a sample of 5350 households. The quantitative information is complemented with qualitative information collected using qualitative information system (QIS) approach involving focus group discussions, etc.

Cost components and calculations[4]

Capital expenditure has two components, namely hardware (CapExHrd) and software (CapExSft). Establishment of sanitation infrastructure such as ISL construction (household as well as public), sewer systems, waste treatment plants, etc., are part of capital expenditure on hardware. Capital expenditure on software includes the costs of planning and designing the sanitation schemes at village level, especially the location of public toilets, sewerage systems, waste disposal, etc. The capital costs, hardware as well as software, are one-time costs.

[3] Scientific sampling procedure was followed while selecting the sample habitations (See for details Reddy, et.al., 2010).

[4] For details see WASHCost (India), 2010.

All the capital investments are cumulated over the years. Capital maintenance expenditure (CapManEx) is another major expenditure item that is made for renewal and rehabilitation of the systems, i.e., replacement of major components like septic tanks / pits (including emptying), sewerage lines, waste treatment plants, etc. Capital management expenditure is also summed over the years. Operational expenditure (OpEx) made on regular maintenance of the ISLs, disposal systems, etc., is incurred annually, and hence we have taken the average of the years for which data are available after bringing them to the current year. Expenditure on direct support costs (ExDS) are in the form of salaries of the staff, IEC activities, demand management initiatives, etc. Expenditure on indirect support costs (ExIDS) are the costs associated with macro planning and policy making at the national and state level. These costs are estimated based on the data from the planning and budgetary documents with the help of some assumptions and expert opinion[5].

Table 1: Framework of Sanitation Service Ladder

Service level	ISL Access	ISL use	Reliability*	Environmental protection
Improved	sufficient number of toilets proportio-nate to family members (or more than one toilet)	All Family members use and infant feaces is also disposed into the toilet	Rs 1000+ spent on O&M Wastewater reused.	Solid waste is composted and reused
Basic	One ISL	All the members of family using	Rs 500+ spend on O&M	Drains are well maintained. Dumps used for solid waste disposal
Limited/ Sub Standard	Shared	Some family members using the toilet	1-500 spent on O&M	Drains are there but poorly designed and maintained. Dumping area for solid waste exists but not used
No service	No ISL	All Open Defecation	Households did not spend any amount	No Solid or liquid waste management

Note: There are no difference between technologies.

[5] For details see WASHCost India (2011).

Since capital and capital maintenance expenditure are one time investments in the past they are converted to current values (2010) using the National GDP inflator for the specific years and converted to US dollars using the average 2010 exchange rate (US$ 1=INR 45.72). These costs are annualised using the normative life span of the systems. The data on normative life are provided by the department, which is nothing but the expected life of a specific component. The official cost estimates do not include salary component of direct support costs (ExDS) and the indirect support costs (ExIDS). These two components, which are estimated using budget data, are added to the official norms in order to make them comparable with the actual costs based on our estimates.

Service levels are assessed using four indicators of access, use, reliability and environmental protection following the service ladder approach (Table 1)[6]. The levels of service for each indicator are categorised under four levels, viz., no service, sub-standard, basic and improved. Each parameter is defined in terms of service received. These parameters are assessed using the household level data. Households are then grouped under different service levels based on the service they receive. For the ease of analysis and clarity, we have presented the proportion of households receiving basic and above service level, as the below basic service could be termed as poor service in the Indian context[7]. For, basic and above service level is defined as: access: households having one ISL and more; use: all family members using and disposing the infant faeces in the toilet; reliability: household spending Rs. 500 and above per year on maintenance of the toilet; and environmental protection: drains are well maintained, dumps used for solid waste disposal, waste water reused, solid waste is composted and reused (Table 1).

III Cost of Provision: Public and Private

The main cost components of rural sanitation that are available and considered in the sample habitations include household level and community level investments. At the household level, the main public investment is in the form of subsidies towards individual sanitary latrines (ISLs). Besides, private households also spend on sanitation and hygiene practices like water filtering, boiling, hand wash, etc. In majority of the cases the household investments are part of or due to the promotional activities of the department like subsidies, incentives, etc. In the case of ISLs, subsidies are provided for below poverty line households and the contribution of households is 10 percent of the total costs. There is no subsidy for above poverty households and the entire cost is borne by the household. However, it is observed most of the households get subsidy. For, ISLs are usually constructed by the households when there is subsidy.

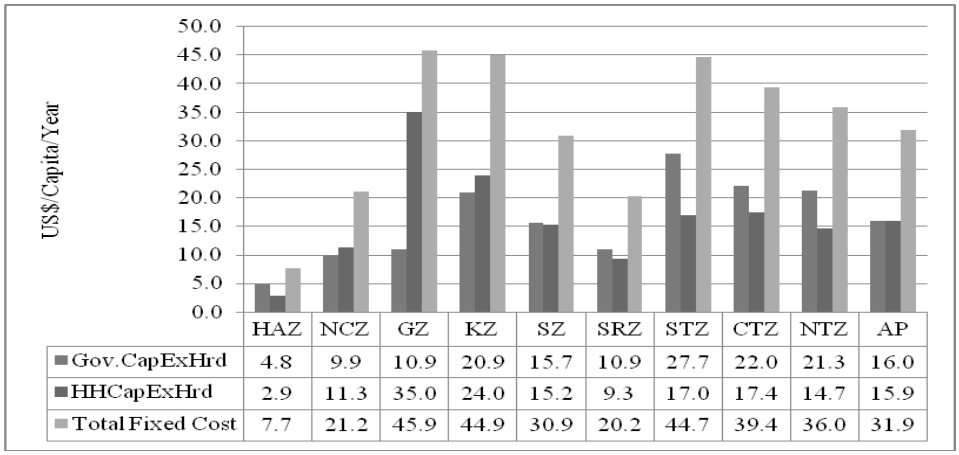
[6] WASHCost research follows a service ladder approach (for details see Potter, et. al., 2011).
[7] The detailed service levels are presented in the appendix (Figs. A3 to A6)

Household costs are integral to total sanitation costs, as the public expenditure on household sanitation is only partial (limited to subsidy). The cost estimates thus include public expenditure including subsidies and household investments over and above subsidy or excluding subsidy. At the community level, the major investment includes public or common toilets at schools[8], public places, *anganwadis*, drainage systems, solid and liquid waste disposal systems, training and awareness programmes, etc. All these components are grouped under life-cycle cost components and come under public expenditure. In the case of sanitation mostly single pit toilets are used though double pit toilets and septic tanks are also in use in a limited way. Technology is not found to be influencing the service performance (WSP, 2010). Therefore, we do not differentiate between the technologies in the case of sanitation.

Fixed Costs (CapExHrd)

Total fixed costs are about US$ 32 per capita at the state level. Fixed costs range between US$ 7.7 in High Altitude Zone (HAZ) to US$ 46 in Godavari Zone (GZ) (Fig. 2). These variations are mainly due to the differences in coverage across the zones i.e., high expenditure (government) due to higher coverage. They also reflect the differences in household expenditure. While the share of household expenditure in fixed costs is 50 % at the state level, it is lower (about 38 %) in the HAZ and STZ. In GZ households spend as much as 78 % of the total fixed costs. In fact, this is the only zone where households spend substantially more than the public expenditure on sanitation. Wide variations are observed across the villages within the zones (Table 2). Apart from the coverage there could be other factors responsible for these variations, which is taken up separately later in the paper. The annualised fixed costs reveal similar picture (Fig. 3) as the normative life of the systems does not vary much across the zones.

Figure 2: Total Fixed Cost of Provision (all HH)



	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	AP
Gov.CapExHrd	4.8	9.9	10.9	20.9	15.7	10.9	27.7	22.0	21.3	16.0
HHCapExHrd	2.9	11.3	35.0	24.0	15.2	9.3	17.0	17.4	14.7	15.9
Total Fixed Cost	7.7	21.2	45.9	44.9	30.9	20.2	44.7	39.4	36.0	31.9

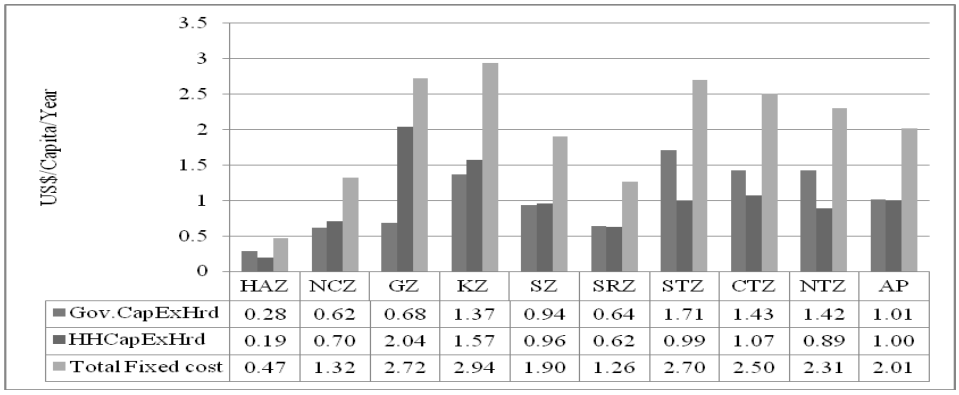
[8] School toilets are constructed by the education department.

Table 2: Fixed Capital Costs of Sanitation across Agroclimatic Zones (US$ / Capita)

	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	AP
Gov.CapExHrd (Cum)-Avg	4.8	9.8	11	21	15.7	10.9	28	22	21	16
Median	5.0	4.9	8.7	17	12.1	7.3	19	14.5	23	11
Min	0	0	0.5	0	0	1	0	2	0	0
Max	13	49	28	122	67	33	144	73	50	144
CV	94	125	77	124	98	94	123	89	62	119
Gov. CapExHrd (Nor)-Avg	0.3	0.6	0.7	1.4	0.9	0.6	1.7	1.4	1.4	1
Median	0.3	0.4	0.6	1.1	0.6	0.4	1.1	1.1	1.5	0.6
Min	0	0	0.04	0	0	0	0	0.1	0	0
Max	0.8	3	1.9	8.2	4.6	2	9	5	3.9	9.1
CV	95	121	78	126	110	94	126	90	71	123
HHCapExHrd (Cum)-avg	2.6	11.4	24.7	20.8	16.1	9.0	22.1	18.6	14.1	22.1
Median	0.8	7.7	30.3	22.9	13.1	8.3	23.4	13.2	13.2	23.4
Min	0	0	0	0	3.1	1.5	7.2	4.8	3.9	7.2
Max	9.7	40.6	39	40.2	38.9	20.5	31.1	45.8	34	31.1
CV	138	100	61	45	67	69	38	67	64	38
HHCapExHrd (Nor)-avg	0.2	0.7	1.4	1.4	1	0.6	1.3	1.1	0.8	1.3
Median	0.1	0.5	1.8	1.5	0.8	0.6	1.4	0.8	0.8	1.4
Min	0	0	0	0	0.3	0.1	0.4	0.3	0.2	0.4
Max	4.4	2.5	2.3	2.6	2.4	1.4	1.8	2.8	2.1	1.8
CV	174	100	51	45	33	92	38	67	64	38

Note: CV= Coefficient of Variations; Cum= Cumulative per capita; Nor= Normative per capita / year.

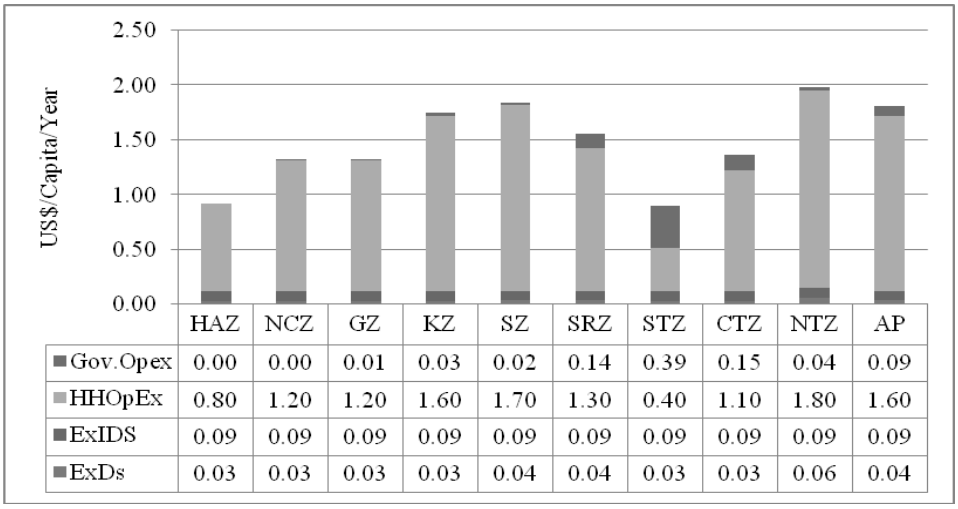
Figure 3: Annualized Fixed Costs



Recurring Costs (OpEx; CapManEx; ExDS&ExIDS)

In the case of sanitation recurring costs mostly born by the households, as very little is spent on OpEx from the public expenditure (Fig.4). Households spend as much as 90 % of the recurring costs. Inter and intra zonal variations are also high in the case of household expenditure (Table 3). In relative terms when fixed and recurring costs are annualised, household expenditure accounts for almost 70 % at the state level. Across the zones it is more than 50 % in all except South Telangana Zone (STZ) (Fig. 5). The share of household OpEx accounts for a major proportion, while CapEx is equally shared by the households and public expenditure at the state level. There are variations across the zones in the relative shares of household expenditure. This indicates the importance of household expenditure in the case sanitation investments though there appears to be some complimentarity between public and private (household) investments.

Figure 4: Recurring Costs



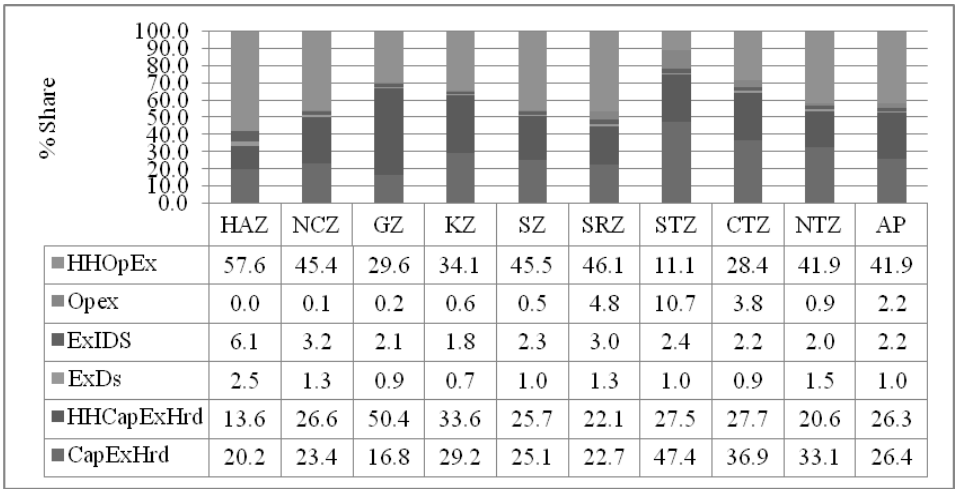
	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	AP
Gov.Opex	0.00	0.00	0.01	0.03	0.02	0.14	0.39	0.15	0.04	0.09
HHOpEx	0.80	1.20	1.20	1.60	1.70	1.30	0.40	1.10	1.80	1.60
ExIDS	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
ExDs	0.03	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.06	0.04

Sanitation expenditure seem to be closely associated with the service levels (Fig. 6). The positive association seems to hold good especially in the case of access and use. While public capital costs and household costs complement each other they also influence ISL usage (Fig. 7). This is a good indication of the impact of public investment in sanitation as well. However, the consistency and robustness of this impact needs to be assessed at the disaggregated level (village). Interestingly, the use levels are only marginally high among the NGP villages when compared with non-NGP villages (Fig. 8). This calls for a disaggregate analysis of factors influencing sanitation service levels across the sample villages, which is taken up in the next section.

Table 3: Recurring Costs of Sanitation by Agroclimatic Zones (US$ / Capita / Year)

	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	AP
OpEx	0	0	0.01	0.03	0.02	0.1	0.4	0.2	0.04	0.09
Median	0	0	0	0	0	0	0.1	0.1	0	0
Min	0	0	0	0	0	0	0	0	0	0
Max	0	0	0.2	0.3	0.3	0.6	2	0.7	0.4	2
CV	0	0	357	250	336	147	145	130	247	281
HHOpEx	0.8	1.2	1.2	1.6	1.7	1.3	0.4	1.1	1.8	1.6
Median	0	1.1	1.2	1.6	1.8	1.1	0	1	1.7	1.2
Min	0	0	0	0	0.3	1	0	1	1	0
Max	4.5	6	2	2.3	2.4	3	3.5	2	3	6
CV	174	116	51	37	33	68	251	32	37	64

Figure 5: Relative Cost Shares



	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	AP
HHOpEx	57.6	45.4	29.6	34.1	45.5	46.1	11.1	28.4	41.9	41.9
Opex	0.0	0.1	0.2	0.6	0.5	4.8	10.7	3.8	0.9	2.2
ExIDS	6.1	3.2	2.1	1.8	2.3	3.0	2.4	2.2	2.0	2.2
ExDs	2.5	1.3	0.9	0.7	1.0	1.3	1.0	0.9	1.5	1.0
HHCapExHrd	13.6	26.6	50.4	33.6	25.7	22.1	27.5	27.7	20.6	26.3
CapExHrd	20.2	23.4	16.8	29.2	25.1	22.7	47.4	36.9	33.1	26.4

Hygiene Costs

Apart from sanitation, households spend regularly on hygiene. Household expenditure on hygiene practices include material for hand wash (soap, etc), boiling and filtering of water, etc. On an average households spend US$ 4.6 per capita per year at the state level (Table 4). These costs range between US$ 2.8 in HAZ and US$ 5.9 in CTZ across the zones and between US$ 0.9 and US$ 10.8 between the villages. The low expenditure on hygiene practices in HAZ reflects the poor service levels of sanitation. The low expenditure in this zone is mainly due to poverty and poor awareness levels associated with remote and inaccessible areas. Besides the low investments from government in sanitation as well as water could be the reason for low private investments and awareness.

That is the present public investment is not enough to pull in private investment. That is poor regions may need higher public investments to attract private investments in sanitation and hygiene.

Figure 6: Service Levels (>Basic) and Total Expenditure

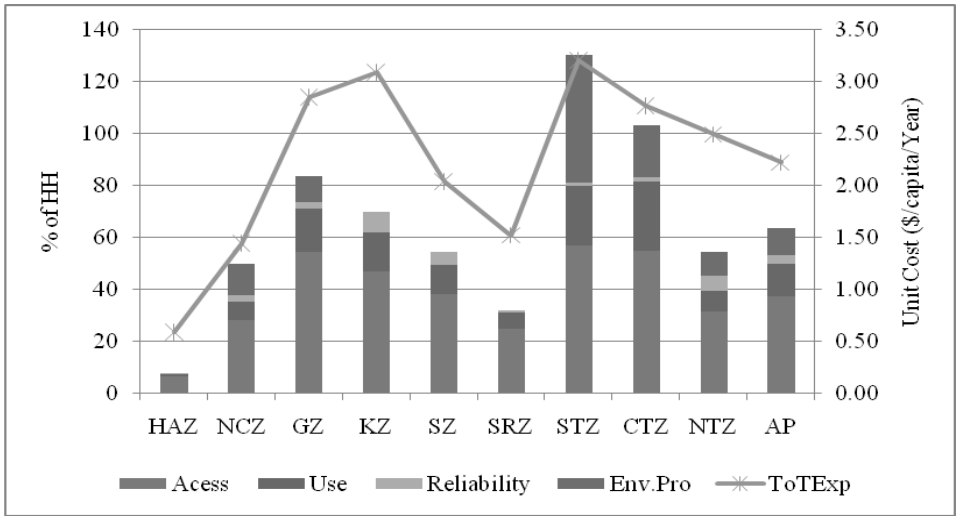


Figure 7: Investments in Capital Expenditure and ISL Use across Zones

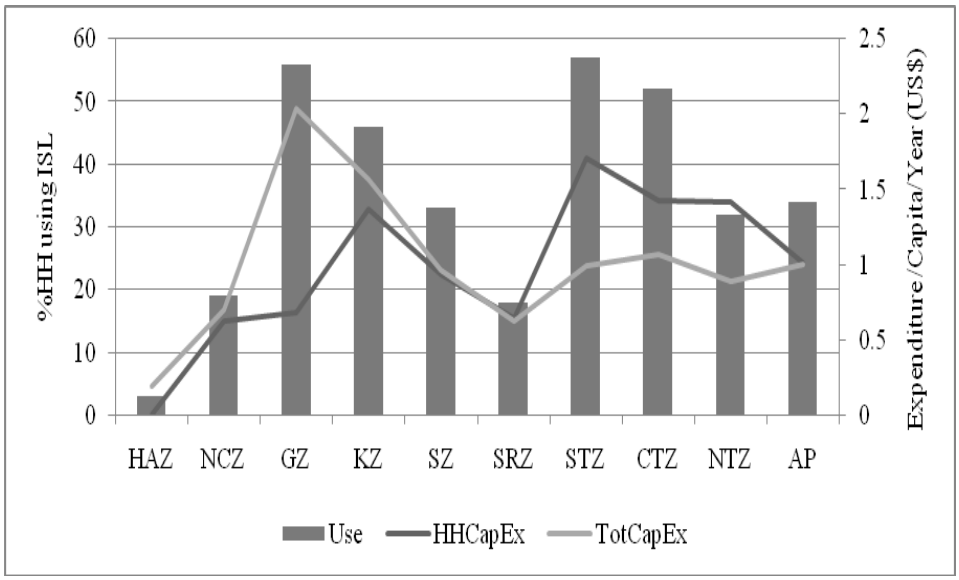
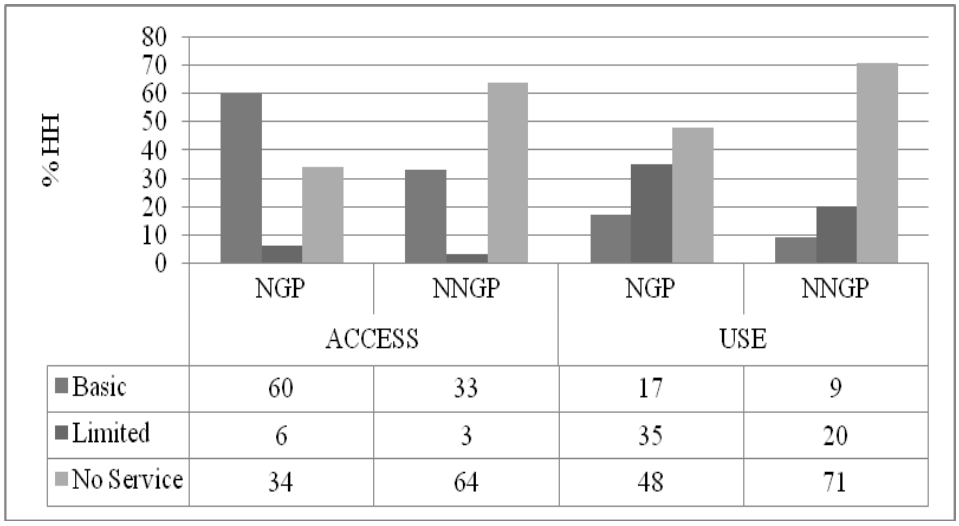


Figure 8: Access and Use of ISL between NGP and Non-NGP Villages



	ACCESS		USE	
	NGP	NNGP	NGP	NNGP
Basic	60	33	17	9
Limited	6	3	35	20
No Service	34	64	48	71

Table 4: Household Expenditure on Hygiene Practices across Zones in AP (US$ /capita/ year).

Zone	Mean	Median	Range	CV
HAZ	2.8	2.9	1.5-4.1	33
NCZ	3.6	3.7	0.8-7.8	51
KZ	4.4	4.3	0.9-9.4	55
GZ	5.2	5.3	3.8-6.3	15
SZ	4.6	4.5	3.5-6.2	18
SRZ	5.7	6.7	2.7-8.2	41
NTZ	5.8	5	3.8-10.8	38
CTZ	5.9	5.8	4.4-7.9	21
STZ	0	0	0	0
AP	4.6	4.6	0.9-10.8	42

Note: Hygiene costs are not available for the South Telangana Zone.

IV Factors influencing Costs and Services

Multiple regression analysis is used to identify the factors influencing sanitation costs and service levels. Different indicators of cost and service levels are used as dependent variables. And a set of independent variables is identified from the village and household data using the correlation matrix. All the variables are standardised in per capita terms.

The data set is based on 107 villages spread over 9 agro-climatic zones, which have cost as well as service level data.

i) Cost Drivers:

In the case of sanitation combination of public and private expenditure is critical for providing the appropriate infrastructure as well as maintaining them and hence cost of sanitation includes public as well as household expenditure. Besides, public investment is limited to basic minimum as far as household infrastructure is concerned and investments in waste management and community infrastructure is also limited. In fact, the coverage of household sanitation infrastructure is partial i.e., about 65 %. Due to the complimentarity between public and private investments, it may be appropriate to term cost of sanitation as investments in sanitation as it captures the demand side (household costs) as well. Therefore, the terms costs and investments are used interchangeably as far as sanitation is concerned. The basic specification for cost variations is as follows:

$SNCOST_{vt}$ = f (Demographic; Social;Eonomic;Source; Institutional)+ U_vt--1

Where;

SNCOSTvt= Sanitation Provision Cost in village 'v' and time 't'.

Uvt= Error Term

The independent variables are selected based on the theoretical considerations. These were selected from an exhaustive list of indicators generated from the village and household surveys, which are primarily used to identify the important variables with the help of simple correlation matrix. These indicators are broadly grouped under five groups viz., social; economic; demographic; source related and institutional factors. Details of variable measurement and their theoretical / expected impact on unit costs are presented in table 1. Five dependent variables are included viz. fixed per capita capital expenditure on hardware by the government (CapExHrd (Govt.)); households (CapExHrd (HH)); combined (CapExHrd (Govt+HH); total costs (fixed + recurring) by the government (TExp (Govt.) and combined (TExp (Govt.+HH) (Table 5).

Independent variables under demographic factors include size of the village in terms of number of households and household size. Size of the village is expected to have a positive impact on sanitation provision costs as the big villages are likely to get better support for sanitation provision. On the other hand, due to size of population the per capita costs could be lower due to the scale economies. Household size also may have negative impact though it is not clear how effective the scale economies would be at this

level. Social indicators include proportion of scheduled castes and Tribes (SC / ST) households (percent SC/ST); Social Diversity Index[9] (SDI) and Level of Education (LEdu.).

In the absence of a priori evidence on the impact of proportion of SC/ST households and SDI indicators on unit costs, we hypothesise a positive or a negative impact which will be tested here. For, the lower economic status of SC/ST households would influence the household investments in sanitation adversely. On the contrary, as the subsidy on ISL is targeted to these groups, there is a possibility of higher investments. Whereas level of education measured in terms of average years of schooling per household is expected to have a positive impact on sanitation investments. For, educated communities are expected to demand sanitation facilities and also likely to invest more on sanitation.

Economic indicators include; household income (HHINC); farm size (FRMSIZE); household expenditure on buying water (HHExp-B) and payment to water tariff (HHExp-T). All these reflect the economic status of the households at the village level and hence expected to invest in sanitation as well as avail the public sanitation incentives. For economically well off villages are expected to mobilise better funding for the sanitation when compared to low income villages. However, in the case of farm size, larger farm size is often associated with rainfed or poor regions. In this case, the impact of farm size need not be positive.

Governance is measured using 19 indicators. For the present analysis nineteen indicators are categorised under five groups (Table 5) and also an aggregate Indicator of Governance (GI). These are: Institutional Space (IS) including functioning of village water and sanitation committee; and women / SC / ST participation in decision making and meeting of *grama sabha* (village meeting) on WASH issues. Community involvement in planning (IP) includes the following indicators: feasibility study; technical survey; system integration and extension. Capacity building inputs (CBI) including effectiveness of training and IEC activities. Involvement in the O&M systems (IO&MS) includes O&M of PSPs and HPs; water quality testing; solid waste management; waste water management and hygiene and sanitation. Involvement in financial management (FM) includes maintaining water and sanitation records; tariff collection and proactive disclosure. All the 6 indicators (including over all governance - GI) are used in the analysis in order to assess their relative importance in influencing the unit costs. All the governance indicators are expected to have a positive influence on sanitation investments or costs. For governance is expected to increase awareness, efficiency due to transparency and better management practices (Reddy, et. al., 2009). A dummy variable for the 9 agro-climatic zones is also included to assess any zonal differences in costs.

[9] Social development Index used in Verghese and Ostrom (2001).

Table 5: Measurement and Expected Signs of the Selected Variables Pertaining to Unit Costs.

Variable	Measurement	Theoretical / Expected Impacts
SNCOST1-5	1) CapExHrd (Govt) = Per Capita per year Government Expenditure on Capital Expenditure-hardware in Rs. 2) CapExHrd (HH) = Per Capita per year household Expenditure on Capital Expenditure-hardware in Rs. 3) CapExHrd (Govt.+HH)= Per Capita per year total (govt. and household) capital expenditure on hardware in Rs. 4) TotExp (Govt)= Per Capita per year total Government Expenditure (fixed+recurring) per year (observed) in Rs.. 5) TExp (Govt+HH) = Per capita Total per year Govt. Expenditure (fixed + recurring) per year (observed) in Rs.	Dependent Variables
VS	Village size (number of households in the village)	Negative /positive
AFS	Average Family Size	Negative /Positive
Percent SC/ST	Proportion of Scheduled Castes / Scheduled Tribe (lowest social category) households	Negative?
SDI	Social Diversity index ranging from '0 to 1", where '0' is no diversity and '1' is high diversity. Index of social heterogeneity = $1-\sum_{i}^{n} P^2$ Where Pi is the proportion of total population in the ith caste group.	Positive /Negative?
LEdu	Level of education (average number of years of schooling)	Positive
HHINC	Household Income (Rs. Per year)	Positive
FRMSIZE	Farm Size (net sown area per household)	Positive
HHExp-B	Household expenditure on buying water (bottled)	Positive
HHExp-T	Household Expenditure on water (tariff) (Rs./Capita)	Positive
TIME	Time spent in Fetching water (Minutes/Capita/day)	Negative
ZONE	Agroclimatic zones measured as dummy variable [(dummy 1= High Altitude Zone (HAZ), 2= North Coastal Zone (NCZ), 3= Godavari Zone (GZ), 4= Krishna Zone (KZ), 5= Southern Zone (SZ),	

	6= Scarce Rainfall Zone (SRZ), 7= Southern Telangana Zone (STZ), 8= Central Telangana Zone (CTZ), and 9= North Telangana Zone (NTZ)]	Positive / Negative?
GI	Governance indicator (average score) i) Institutional Space (IS) i.e., functioning of village water and sanitation committee; women / SC / ST participation in decision making and meeting of grama sabha (village gathering)on WASH issues ii) Involvement in Planning (IP) iii) Involvement in financial Management (IFM) iv) Involvement in Operation and Management of systems (IO&M) v) Capacity Building Inputs (CBI)	Positive
Ut	Error term	

Ordinary Least Squares (OLS) estimates were used to regress the different dependent variables (SNCOST1-5) against the selected independent variables. Descriptive statistics of the selected variables are presented in the appendix. Regressions were run on cross sectional data at the village level using the data from 107 villages (n=107). Various permutations and combinations of independent variables were used to arrive at the best fit. Multicolinearity between the independent variables was checked using the Variance Inflation Factor (VIF) statistic. Multicolinearity is not a serious problem as long as 'VIF' value is below 2. The best fit specifications were selected for the purpose of final analysis. Though we have also tried log linear estimates, only linear specifications are retained for the purpose of analysis as the log linear specification have poor explanatory power.

The estimates indicate that all the specifications (six) explain about 50 to 70 percent of the variations in existing unit costs across sample villages (Tables 6 and 7). Two each of the dependent variables pertain to Government and household costs per capita and the other two are combined for government and household costs. The costs are measured in terms of fixed hardware (CapExHrd) and total costs (fixed+recurring). It may be noted that specifications of government costs have relatively less explanatory power with fewer variables turning significant (Tables 6 & 7). All the selected variables have the theoretically expected signs and the signs are consistent across specifications (see table 5). Number of variables turned out significant in the selected specifications.

Table 6: Regression Estimates of selected Specifications: Hardware Costs per capita per year

Variables	Dependent Variables					
Independent	CapExHrd (Govt.)		CapExHrd (HH.)		CapExHrd (Govt.+HH)	
Variables	Coefficient	VIF	Coefficient	VIF	Coefficient	VIF
(Constant)	-172.2 (-0.51)		719.75** (2.22)		245.10 (0.43)	
VS	-0.3 (-1.19)	1.3	---	--	---	---
AFS	---	---	-252.25* (-3.47)	1.7	-214.46 (-1.46)	1.4
PCI	---	---	0.02* (3.42)	1.5	---	--
FARMSIZE	-48.6 (-1.1)	1.1	---	---	---	---
LEdu.	26.61*** (1.68)	1.2	29.93* (3.59)	1.6	54.38* (3.24)	1.3
Acc.Wat	17.35* (3.99)	1.4	---	---	20.21* (4.34)	1.6
TIME	---	---	-0.04* (-2.69)	1.3	---	---
HHExp-B	11.33* (4.89)	1.5	2.25** (2.32)	1.4	11.39* (5.64)	1.1
NGP/NNGP	395.97** (2.17)	1.4	212.7** (2.14)	1.9	502.61* (2.54)	1.6
GI-FM	---	---	---	---	13.65* (2.85)	1.7
GI-CBI	---	---	4.93** (2.18)	1.8	---	---
Zone (NCZ)	---	---	473.94* (4.4)	1.3	---	---
Zone (GZ)	----	---	-193.64*** (-1.89)	1.2	---	---
Zone (KZ)	-429.74*** (-1.91)	1.4	---	---	---	---
Zone (SRZ)	383.17*** (1.77)	1.1	---	---	---	---
R^2	0.50	0.69	0.69			
Adjusted R^2	0.46	0.66	0.67			
N	107	107	107			

Note: Figures in brackets are 't' values. *; ** and *** indicate level of significance at 1, 5 and 10 percent level respectively.

In the case of demographic factors the average family or household size in the village has turned significant with a negative impact on the household capital expenditure (CapExhrd-HH) and combined (CapExHrd-Govt.+HH) investments. This indicates that larger families are less likely to invest in sanitation, though government investments are not influenced by the family size. This could be due to the reason that maintenance of toilets becomes easier in the small households because of too many people. Given the increasing trend in nucleus families (GoI, 2011), household investments in sanitation are likely to increase in the coming years.

Level of education (LEdu.) has turned out significant with a positive sign in four out of six specifications. Higher education levels in the village could result in demand for sanitation facilities and investments in sanitation. Education can also help enhancing the activities and functioning of the institutions, formal as well as informal. Informed discussions and decisions could lead to efficient allocation of resources. Thus improving the literacy and education levels in the rural areas is critical for cost effective sanitation services. However, level of literacy appears to have greater impact on fixed (hardware) investments when compared to total (fixed+recurring) investments.

Table 7: Regression Estimates of Selected Specifications: Unit Costs per Capita per Year

Variables	**Dependent Variables (Annualised)**					
Independent Variables	TExp (Govt.) (Fixed+recurring)		TExp (HH.) (Fixed+recurring)		TExp (Govt.+HH.) (Fixed+recurring)	
	Coefficient	VIF	Coefficient	VIF		VIF
(Constant)	149.76 (1.57)		979.64* (2.69)		462.39 (0.76)	
AFS	----	---	-281.96* (-3.45)	1.7	-255.5*** (-1.65)	1.4
% SC&ST	----	---	-1.75 (1.41)	1.1	----	---
Acc.Water	15.25* (3.21)	1.6	---	---	21.44* (4.35)	1.6
PCI	---	---	0.01** (2.08)	1.7	---	---
HHExp-B	8.92* (4.41)	1.1	2.65* (2.45)	1.3	12.17* (5.7)	1.1
HHExp-T	---	---	0.19** (2.15)	1.7	---	---
TIME	----	---	-0.04* (2.65)	1.3	---	---
Ledu.	---	---	29.31* (3.18)	1.6	---	---
NGP/NNGP	302.86 (1.55)	1.5	229.78** (2.08)	2.0	539.57* (2.58)	1.6
GI (CBI)	9.23*** (1.92)	1.7	4.59*** (1.79)	1.9	---	---
GI (FM)	----	---	---	----	12.99* (2.56)	1.7
Zone (NCZ)	---	---	425.39* (3.56)	1.3	---	---
R^2	0.46	0.68	0.68			
Adjusted R^2	0.44	0.65	0.66			
N	107	107	107			

Note: Figures in brackets are 't' values. *; ** and *** indicate level of significance at 1, 5 and 10 percent level respectively.

Among the economic factors, per capita income (PCI); expenditure on buying water (Exp-B) and tariffs (Exp-T) turned out significant with expected positive sign. This indicates that economically better off villages are likely to have better sanitation

infrastructure. One reason could be that economically better off villages are likely to garner more funds. Another important variable that turned out significant is access to water, which is measured in terms of people's perceptions on access (Acc. Water) and also time spent on fetching water (TIME). Better access to water is expected to increase the demand for sanitation investments. The positive impact of access to water on government as well as combined investments indicate the close relation between water and sanitation. In the case of household investments, TIME turned out have a negative impact. That is household investments are likely to be less in the villages where time spent on fetching water is high. This reemphasises the importance of access to water in promoting sanitation investments in both public and private sectors. Two of the governance indicators i.e., capacity building inputs (GI-CBI) and Involvement in financial management (GI-FM) turned out be positively influencing sanitation investments, especially in the case of household investments. Better governance is linked to higher awareness and hence sanitation demand and investments. This is also reflected in the positive impact of NGP on sanitation investments in five out of six cases. NGP villages are expected have better governance, awareness, etc. Sanitation investments are substantially higher in the NGP villages when compared to non-NGP villages.

The analysis indicates that North Coastal Zone (NCZ) has a positive impact on household investments. On the other hand, Krishna Zone (KZ) has a negative impact on government expenditure, where as Scarce Rainfall Zone (SRZ) has a positive impact. This could be due to the relatively poor economic status of SRZ. This only indicates that that zonal differences in government spending on sanitation are significant in some cases.

ii) Factors Influencing Variations in Service Levels

Given the status of sanitation services in terms of infrastructure understanding and explaining the factors that determine service levels becomes important. How far costs or investments in the sector influence the service levels needs to be assessed. For this purpose, two indicators of service levels in quantity terms as well as qualitative perceptions of the households are used. Though there are four indicators of sanitation service levels (access, use, reliability and environmental protection), we restrict our analysis to access and use, as the data on the other two indicators is scanty[10]. Access is defined in two ways viz., i) percent of households having a toilet which is a quantitative variable, and ii) households perception of having access to sanitation at basic and above level (at least one ISL per household). These two access variables along with the use variable are used as dependent variables. Use is also defined and measured as proportion of households using a toilet.

[10] Fewer observations are available in the case of reliability and environmental protection.

The basic specification for the analysis of service levels is as follows:

$$SNSL_{vt} = f(Demographic;\ Social;Eonomic;Source;\ Institutional) + U\_vt\text{---}2$$

Where;

$SNSL_{vt}$ = Sanitation Service Level in village 'v' and time 't'.

Uvt= Error Term

Here also the independent variables are selected based on the theoretical considerations. Variables are also identified with the help of simple correlation matrix (Table 8). Both quantitative and qualitative indicators are generated. Most of the independent variables are expected to have positive impact on service levels (Table 8). Under demographic factors, size of the village is expected to have a positive impact on the service level, especially access, as the bigger villagers are expected to garner the public support for sanitation and hence the more people will have access to ISL. Household / Average Family Size (AFS) is expected to have negative impact. As observed from the cost analysis larger households are less likely to invest in sanitation. Similarly larger households are expected to have lower use due to higher water requirements and also crowding. Social indicators such as SC / ST households (percent SC/ST) and social diversity index (SDI) may influence service levels negatively. However, higher SDI may have positive impact if the concentration is in favour of SC/ST, which is rare. Whereas level of education (LEdu.) is expected to increase the demand for sanitation in terms of access and use, as educated people tend to prefer improved sanitation and hygiene conditions.

Economic indicators include; household income (HHINC); farm size (FRMSIZE); Capital expenditure of government (CapExhrd (Govt.)); household capital expenditure (CapExHard (HH)); households buying water (% HHBUY); household expenditure on water tariff (HHExp-T); and household expenditure on buying water (HHExp-B)). All these variables are expected to have positive influence on service levels though some of them (% HHBUY and HHExp-B) could have negative impact as buying water may be a consequence of poor water service. Higher expenditure of government as well as households is expected to improve the access and use levels. Household expenditure on tariffs and buying water reflects the economic status of the household and hence it will have a positive influence on access and use of sanitation.

Access to water or lack of it is often assumed to be the critical factor influencing sanitation service levels. Here we have tried to capture the access to water in terms of quantity (WATERqnt.); % of household having house connections (%HC); source of water (SOURCE) and age of the system (AGEsyt.). While water quantity is a direct measure, %HC indicate better and more availability of water and are expected to have a positive

Table 8: Measurement and Expected Signs of the Selected Variables Pertaining to Service Levels.

Variable	Measurement	Theoretical / Expected Impacts
SNSL1-3	1) SNSLacc-o.= Sanitation Service level in terms of Accessibility measured as % of Households owning a toilet.	
	2) SNSLacc-p= Sanitation Service level in terms of Accessibility measured as perception of the household.	
	3) SNSLuse= Sanitation Service level in accessibility (percent households receiving above basic accessibility).	Dependent Variables
AFS	Average Family Size	Negative
VS	Village size (number of households in the village	Positive
percent SC/ST	Proportion of SC / ST households	Negative
SDI	Social Diversity index (see table 5)	Positive / Negative?
LEdu	Level of education (average number of years of schooling	Positive
% HC	Proportion of house connections	Positive
HHINC	Household Income (Rs. Per year)	Positive
FRMSIZE	Farm Size (net sown area per household)	Positive
Govt. CapExHrd	Government Capital Expenditure per capita / per (Rs)	Positive
HHCapExHrd	Household Capital expenditure per capita/yera (Rs.)	Positive
HHExp-T	Household Expenditure on water (tariff) (Rs. / Capita)	Positive
HHExp-B	Household expenditure on buying water (bottled) (Rs. /capita)	Positive
% HHBUY	percent of households buying water	Positive
SOURCE	Source of Water Dummy (Goundwater=0; Surface water=1)	Positive
AGESyt	Age of the System (number years since established)	Negative
NNGP / NGP	Dummy variable representing NGP/NonNGP status of the village (NGP=1 and NNGP=0)	Positive
GI	Governance indicator (average score) i) Institutional space (IS) ii) Involvement in Planning (IP) iii) Involvement in financial Management (IFM) iv) Involvement in Operation and Management of systems (IO&MS) v) Capacity building inputs (CBI)	 Positive
ZONE	Agro-climatic zones 9 (dummy 1, 2, 3, 4, 5, 6, 7, 8and 9) (see table 5)	Positive / Negative?
Ut	Error term	

impact. Source of water is measured as dummy variable where surface (canal) sources are more reliable and provide greater quantities when compared to groundwater sources and we anticipate a positive impact of this variable on sanitation service level. Water service levels decline with the age of the system (Reddy, 2012). Based on this AGEsyt. is expected to have a negative impact on sanitation service levels, access as well as use.

The dummy variable for the 9 agro-climatic zones is used to test the hypothesis whether natural factors influence service levels or not. And we do not have any a *priory* expectation on the sign of this variable. And all the governance variables are expected to have positive impact on service levels due to better management practices. Another institutional related variable pertaining to the Nirmal Gram Puraskar (NGP) status of the village is also included. As this status is directly related to sanitation, it is expected that NGP villages are expected to have a positive impact on service levels.

Ordinary Least Squares (OLS) estimates were used to regress the different dependent variables ($SNSL_{1-3}$) against the selected independent variables. Descriptive statistics of the selected variables are presented in the appendix. The regression estimates of factors influencing service levels were carried out on three different service variables and six specifications (Table 8). Explanatory power of the specification is quite high i.e., above 80 % in the case of access and above 90% in the case of use. Most of the selected variables have the expected signs (Tables 9 and 10).

Access

Two indicators viz., proportion of households having ISL and proportion of households perceiving of having basic and above service levels. Majority of the explanatory variables turned out to be positively significant. From the policy point of view hardware investment or cost variables, government as well as household, have strong influence on access (table 8). The investment variables accounted for 20 percent of the explanatory power, as the adjusted R2 has gone up from 0.61 to 0.84 when these variables are included. It may be observed that household investments have stronger (four times) influence on access.

Among the social variables education has a positive impact on accessibility. Despite the targeted approach of government providing subsidies to socioeconomically weaker sections % of SC/ ST households have a negative impact on accessibility. That is the subsidy programme for constructing ISLs for these communities has not really penetrated in terms of improving the access. This could be due to the reasons: i) allocations are not good enough to improve the access to these sections or / and ii) subsidies are not targeted properly or they are being corned by other sections, as is the case with most subsidy programmes. This indicates that proper targeting and focused coverage of SC/ ST sections is a policy imperative as far as improving the access is concerned.

Table 8: Regression Estimates of Selected Specifications of Service Levels (Accessibility)

Variables	Dependent Variables (Accessibility)					
Independent Variables	SNSLqt (Access-%HH with ISL) -S1		SNSLqt (Access-%HH with ISL) -S2		SNSLqt (Access-%HH having above basic service)	
	Coefficient	VIF	Coefficient	VIF	Coefficient	VIF
(Constant)	5.87* (2.33)		16.28 (0.95)		-1.78 (-0.44)	
AFS	---	---	-6.31 (-1.49)	1.6	---	---
LEdu.	---	---	1.58* (3.44)	1.3	---	---
%SC/ST	-0.08*** (-1.92)	1.1	-0.16* (-2.44)	1.1	-0.09*** (-1.92)	1.2
Govt. CapExHrd	0.01* (3.95)	1.2	---	---	0.01* (4.61)	1.2
HHCap ExHrd	0.04* (16.39)	1.4	---	---	0.04* (16.07)	1.7
WATERqnt	---	---	---	---	0.09 (1.57)	1.5
% HC	---	---	0.17* (2.73)	1.4	---	---
AGEsyt	---	---	-0.59 (-1.51)	1.1	---	---
NGP/NNGP	---	---	22.28* (3.75)	2.0	---	---
GI-CBI	0.25* (3.30)	1.5	0.41* (2.94)	2.0	---	---
GI-IS	---	---	---	---	0.19** (2.18)	1.5
Zone (NCZ)	---	----	18.75* (2.84)	1.3	4.71 (1.17)	1.2
ZONE (KZ)	---	---	20.96* (3.76)	1.2	---	
ZONE (SRZ)	-7.41** (-2.21)	1.0	---	---	6.53*** (1.72)	1.2
R^2	0.85	0.64	0.87			
Adjusted R^2	0.84	0.61	0.86			
N	107	107	107			

Note: Figures in brackets are 't' values. *; ** and *** indicate level of significance at 1, 5 and 10 percent level respectively.

As far as access to water is concerned, house connections (%HC) are positively associated with access to sanitation. That is the households with house connections are more likely to have access to sanitation, i.e., construction of ISL. House connection indicates better access and availability of water, which is a necessary condition for maintaining the sanitation infrastructure. Of the institutional or governance indicators, capacity building activities have a greater impact on access followed by institutional space (GI-IS). As expected, NGP villages have better access due to their targeted approach to achieve full coverage. Among the agro-climatic zones North Coastal and Krishna zones have a positive impact. In the case of Scarce rainfall zone the impact is not consistent as it revealed a

negative impact on measured access (%HH with ISL) and a positive impact with regard to household perception of access.

Use

Understanding the factors responsible for the usage of existing ISLs appears to the most critical for policy formulations towards improved and sustainable sanitation service delivery. The present usage levels need to be improved in order to improve the efficiency of future investments in sanitation infrastructure. Moreover, improving the access or availability may not result in real benefits as long as the usage of the infrastructure created is low. Here we analyse the factors influencing the usage of ISL at the household level i.e., % of households using the ISL across the sample villages using three different specifications. Here also both the cost variables have turned out positive and significant (Table 9). While costs or investments play an important role in increasing the use of toilets, it is the household investments that matter the most. It may be noted that the explanatory power of the equation changed little when government expenditure (CapExpHrd-Govt.) is dropped. This indicates that households use ISL when they themselves invest rather than with the support of the government. That is the subsidies provided by the government to households are not as effective as the demand driven investments from the households. However, the government subsidies may facilitate household investments and they both seem to complement each other. Either way, creating demand for sanitation is the key for improved sanitation services.

Among the other factors, bigger villages seem to have higher usage levels. On the contrary, larger families are less likely to use ISLs when compared to small families. Given the declining trends in family size usage levels also would go up along with access in the coming years. Usage levels are low in the villages with larger proportion of SC/ST households when compared to villages with more heterogeneous social composition (SDI). Literacy is an important factor in influencing usage, as it influences costs as well as access. All the economic factors like farm size (FARMSIZE); proportion of households buying water (%HHBUY); and household expenditure on water tariff (HHExp-T) have a positive impact on usage. Economic development in the rural areas is likely to improve sanitation services. However, the indications are that rural areas are lagging behind due to poor viability of agriculture.

Better water supplies in terms of quantities would help increase the use of ISLs. By increasing supplies at the household level either through pumping more water or reducing wastage (unaccounted water) would improve sanitation and hygiene conditions at the household as well as community level. The latter option would be more efficient given 40-50% wastage of water in the rural areas. Such improvements may not require huge investments and may only need better governance in most cases. Investments in terms of capital maintenance (CapManEx) would help in maintaining the efficiency of the

systems irrespective of their age. In the absence of CapManEx service levels decline as the systems age. This is reflected it the negative relation between age of the system (AGEsyt) and use of ISL. On the other hand, governance indicators like capacity building (GI-CBI) and institutional space (GI-IP) have a positive impact on use. These indicators, especially capacity building, are likely to increase awareness and demand for sanitation facilities and use as well.

Table 9: Regression Estimates of Selected Specifications of Service Levels (Use-percent HH using ISL)

Independent Variables	Specifications					
	ISL Use S1		ISL Use S2		ISL Use S3	
	Coefficient	VIF	Coefficient	VIF	Coefficient	VIF
(Constant)	-8.49* (3.11)		-6.60* (2.67)		45.03* (3.11)	
VS	---	---	0.001 (0.85)	1.3	---	---
AFS	---	---	---	---	-17.41* (-4.72)	1.5
% SC/ST	-0.08** (-2.26)	1.2	-0.07*** (1.89)	1.1	-0.15* (-2.48)	1.1
SDI	---	---	---	---	20.95* (2.41)	1.5
LEdu.	----	---	---	---	1.84* (4.10)	1.6
FARMSIZE	1.39** (2.24)	1.1	1.1*** (1.84)	1.1	1.88*** (1.71)	1.2
% HHBUY	0.15* (3.6)	1.4	0.12* (2.89)	1.6	0.27* (4.01)	1.4
HHExp-T	---	---	---	---	0.01*** (1.69)	1.5
Govt. CapExHrd	----	---	0.001*(2.40)	1.4	---	---
HHCapExHrd.	0.04* (16.06)	1.9	0.04* (18.01)	1.8	---	---
SOURCE	---	---	2.83 (1.33)	1.1	---	---
Water						
Quantity	0.09* (2.29)	1.5	---	---	---	---
AGESyst.	----	---	---	---	-0.94* (-2.78)	1.0
GI -CBI	----	---	0.23* (3.30)	1.9	0.56* (5.44)	1.4
GI -IP	0.48* (4.7)	1.7	0.13*** (1.82)	1.7	---	---
R^2	0.91	0.91	0.74			
Adjusted R^2	0.90	0.91	0.72			
N	107	107	107			

Note: S1= Specification 1; S2= Specification 2 and S3= Specification.
Figures in brackets are 't' values. *; ** and *** indicate level of significance at 1, 5 and 10 percent level respectively.

V Conclusions

Sanitation happens to be the most nagging developmental issue in the India growth story. Though the achievements so far may suffice meeting the millennium development goals, they do not reflect India's achievements in other sectors. Is this due to misplaced priorities in resource allocation or poor understanding of the sanitation sector? It appears that the present policy is faltering on both accounts. For, sanitation is often considered as a by product of drinking water for all policy purposes. And programmes designed for sanitation are mostly supply sided, as if sanitation is a pure public good. While the low policy priority and poor resource allocation have constrained sanitation coverage to 45 % at the national level, the supply sided policies have been ineffective in improving the use of the limited sanitation infrastructure created at the household level. Given the use levels at less than 60 % at best, effective sanitation service level is limited to a quarter of the population. In the case of Andhra Pradesh the usage is as low as 30 %. Given the fact that coverage is less than 50 %, effective sanitation coverage in terms of use is less than 15%.

The present analysis of real expenditures suggest that the entire allocations towards sanitation are going towards creating infrastructure (ISL) with little or no expenditure of IEC activities. Allocations towards various important components need to be assessed. The life-cycle cost approach would help in arriving at a balanced allocation. Households invest as much as the government in the construction of ISLs. Given the present coverage of 50 % investments need to be doubled to create even the infrastructure enough to provide 100 percent access. And maintenance (OpEx) is entirely carried out by the households. Public investments towards waste (solid and liquid) disposal is very limited in the rural areas. When these costs are included the allocations towards sanitation need to increased substantially. The analysis of factors influencing costs and services indicate that literacy, governance and economic development are critical for improving investments in sanitation and service levels. Household investments are critical for improving the use of ISLs. That is increasing the demand for sanitation at the household level is more effective than public investment in improving the use of infrastructure created. Public investment may be viewed as a facilitator to attract private investment as they complement each other. Proper targeting of public investments to benefit the backward regions and communities would improve the overall access.

It may be argued, based on the analysis, that creating and improving the demand for sanitation at the household level is the key for improved sanitation services. Sanitation at the household level needs to treated as a private responsibility, while public support should be limited to creating the infrastructure required for safe disposal of waste, institutions for governance, awareness building, etc., apart from supporting vulnerable sections. Given the magnitude of investments, mainstreaming sanitation with separate

allocations and planning should be taken up on priority. As far as Andhra Pradesh is concerned reviving the dormant village water and sanitation committees (VWSC) and making them professional institutions (Kurian and Reddy, 2012) ought to taken up on priority. A focused approach using professional marketing methods to din the ears of communities on the importance of sanitation and hygiene should be central to the WASH policies.

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Appendix Table 1: Descriptive Statistics

Variables	Mean	Minimum	Maximum	C.V
VS	327	17	1718	87
AFS	4	3	6	12
% SC & ST	31	0	100	84
SDI	0	0	1	46
FARMSIZE	2	0	8	75
PCI	17135	5551	43524	36
Ledu.	22	11	32	19
%HC	30	0	88	105
%HHBUY	14	0	100	185
Access (%HH with ISL)	37	0	100	74
CapExHrd (Govt)	47	0	388	117
CapExHrd (HH)	41	0	123	78
CapExHrd (G+H)	87	0	471	80
Texp (Govt.)	47	0	394	117
TExp (HH)	45	0	178	76
TExp (G+HH)	92	0	477	80
WATERqnt.	42	26	72	21
Access (%HH saying yes)	40	0	100	73
USE (%HH)	34	0	100	86
SOURCE	0	0	1	177
HHExp-B	39	0	368	192
HHExp-T	510	0	2478	89
TIMESPENT (min. per day)	14	6	53	42
AGEsyst.	6	1	22	81
NGP/NNGP	0	0	1	203
GI-IS	25	0	76	59
GI-IP	31	0	80	52
GI-CBI	17	0	75	101
GI-IO&M	22	1	57	52
GI-FM	17	0	79	99

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