

Applying the life-cycle costs approach to sanitation

Costs and service levels in Andhra Pradesh (India), Burkina Faso, Ghana and Mozambique

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This briefing note draws from detailed analysis done at country level. All country level reports, which explain the details and context of data collection and analysis are available within the country pages at www.washcost.info

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This briefing note draws from detailed analysis done at country level. All country level reports, which explain the details and context of data collection and analysis are available within the country pages at www.washcost.info. This briefing note aggregates and compares data which has been collected, validated and analysed between 2009 and 2011 by a large team of researchers:

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Front page photo

Photos (clockwise from left; all taken by Christine Sijbesma, unless otherwise indicated): child washing her hands (and playing) by a handpump in rural Karnataka, India (by Charles Batchelor); woman bathing child (by Kathy Shordt); training workshop showing solid waste ladder; community building blocks for toilet with the use of a machine; and woman selling toilet spare parts in Betul, Madhya Pradesh, India.



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WASHCost is a five-year action research project investigating the costs of providing water, sanitation and hygiene services to rural and peri-urban communities in Ghana, Burkina Faso, Mozambique and India (Andhra Pradesh). The objectives of collecting and disaggregating cost data over the full life-cycle of WASH services are to be able to analyse costs per infrastructure and by service level, and to better understand the cost drivers and through this understanding to enable more cost effective and equitable service delivery. WASHCost is focused on exploring and sharing an understanding of the costs of sustainable services (see www.washcost.info).

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Abbreviations

CapEx	Capital Expenditure
CoC	Cost of Capital
OpEx	Operational and minor maintenance expenditure
CapManEx	Capital Maintenance Expenditure
ExpDs/IDs	Direct and indirect support expenditure at district and national level
TIPL	Traditional Improved Pit Latrine
TPL	Traditional Pit Latrine
VIP	Ventilated Improved Pit Latrine
WASH	Water, Sanitation, and Hygiene

Summary

This briefing note presents an application of the life-cycle costs approach (LCCA) to sanitation in rural and peri-urban areas in four different countries – Andhra Pradesh (India), Burkina Faso, Ghana and Mozambique. It reports key findings on the comparison of the financial costs of a range of traditional and improved latrines and the quality of service delivered to users, as defined by Potter et al. (2011).

Findings in this briefing note are based on extensive surveys and data collection at household, district, regional and national level. All country level reports, which explain the details and context of data collection and analysis, are available in other briefing notes.

Limited information is available in any of the four countries surveyed on the current scale of expenditure made by governments and users on the construction and maintenance of different types of latrines. Even less is known about what it costs to deliver a desired level of service, e.g. cost to achieve the national norms. However, understanding the relationship between cost and quality of service contributes to improved planning and implementation of appropriate, cost-effective sanitation services.

This briefing note reports on how the costs and the quality of service delivery vary within and between Andhra Pradesh (India), Burkina Faso, Ghana and Mozambique, where existing data has been collected and analysed. Given the lack of sustainability and limited records on recurrent costs of many of the systems surveyed in these countries, the reported recurrent costs discussed here do *not represent the ideal spending* required to guarantee that services will last. Rather, they *represent the expenditure on the current level* of sanitation services achieved. Knowing the actual expenditure and improving existing accounting practices is the first step towards determining the ideal expenditure required to achieve sustainable services that meet national norms. This issue will be explored in future publications.

The first part of this briefing note details the methodology used to collect and analyse the costs and service levels. The remainder explores the comparison of this data for sanitation facilities and sanitation services found across the four countries.

Key findings

Disclaimer: This briefing note draws from the aggregation of data collected within specific regions of the four countries studied, but for the sake of simplicity we refer to the countries overall. Given the level of aggregation, many of the contextual details which explain the findings are too detailed for presentation here. The country level reports, which explain the context of data collection, present the analysis and link the findings with policy implications, are available from www.washcost.info

Costs of constructing and maintaining sanitation facilities

- Capital expenditure for equivalent latrines varies widely within and between countries, partly reflecting widespread differences in construction quality and standards.
- Ventilated improved pit (VIP) latrines are five times more expensive in Burkina Faso than in Ghana and Mozambique (even when analysis is done using purchasing power parities).
- Latrines in Mozambique and Burkina Faso cost up to two to three times more to construct in more densely populated, peri-urban areas than in rural areas. This is in contrast to VIP latrines in Ghana where construction costs are similar in both rural areas and small towns.
- Operational and minor maintenance expenditure is the most prevalent recurrent expenditure in each country. Typical household operational expenditure in rural areas ranges from US\$ 0 to US\$ 3 per person per year, although approximately 10% to 15% of households in Burkina Faso and Ghana spend more than US\$ 15 per person per year. This expenditure is higher in peri-urban areas and with more technologically advanced latrine facilities.
- Capital maintenance takes place very occasionally, with the majority of household, public sector and other providers not spending anything at all (or do not remember what they spent).
- Expenditure on direct and indirect support is also very low, ranging from US\$ 0.1 and US\$ 0.2 per person per year in rural Andhra Pradesh and Mozambique.
- Three-quarters of all latrines in Mozambique do not incur any financial costs, as construction and maintenance work is undertaken by unpaid family or community members using local materials.
- Sanitation expenditure in Ghana and Mozambique is almost entirely covered by households.
- In Andhra Pradesh, 17% of households received a financial incentive from the government to construct latrines. On average, this subsidy covers between 38% and 46% of latrine construction costs, with the shortfall being met by the household.

Analysis of sanitation services provided by the sanitation facilities

- In Africa, higher levels of service, by service ladder definitions, are achieved in peri-urban/small town areas in comparison with rural areas, due to improved environmental protection¹ and reliability.² This coincides with generally higher expenditure on construction and recurrent costs. It also coincides with the need for higher-quality sanitation, apparently recognised by households, for improved services in higher-density urban areas where alternatives are more restricted.
- In Andhra Pradesh, only 32% of household latrines are used³ by all family members. Some 17% are not used at all, with the remaining 51% only used by some family members.⁴

1 The environmental protection indicator is measured by: 1) the disposal and safe containment of faecal waste, including threats to groundwater supplies; 2) the environmental safety of sludge treatment and disposal.

2 The 'reliability of sanitation services' indicator is measured by: 1) the effort required for operation and maintenance of the latrine, e.g. pit desludging (mechanical) or emptying (manual); 2) the safety of operation and maintenance procedures for users and service providers; 3) longevity and robustness of top and 'underground' structures.

3 The 'use of sanitation facilities' indicator is measured by safe and hygienic use by all members of the household, day and night and in all seasons, and infant faeces disposed in the latrine.

4 Slippage of sanitation service levels over time in villages declared to be open defecation free is reported and discussed by Batchelor, Snehalatha and Batchelor (in press).

- Expenditure on operations and minor maintenance can vary greatly but is low for the vast majority of latrines sampled. Corresponding low service levels in some cases where sophisticated latrines exist may reflect a large gap in expenditure which is not sufficient to ensure the sustainability of sanitation services delivery.
- A third of VIP latrine users in rural Ghana receive 'no service' by service ladder definitions due to serious problems with the reliability and ongoing maintenance of these latrines.
- In Mozambique, the existence of an impermeable slab is an important indicator of a 'basic service' level. Over 85% of those with a slab achieve a 'basic service'. Of those latrines that fall below a basic service, 11% to 12% of these latrines in rural areas and 6% to 8% per cent in peri-urban areas fail because they provide insufficient environmental protection.

1 Costing sanitation facilities

1.1 Costing framework

To capture and understand the costs of a sanitation service, it is important to be aware that a number of different types of costs are associated with delivering a service. This goes beyond merely accounting for the capital investment. It encompasses maintenance, management and all financial costs incurred at the different stages of service delivery. The WASHCost research teams have categorised these different cost components as part of the life-cycle costs approach. This approach seeks to include all expenditure, as undertaken by the whole range of stakeholders. It offers a financial perspective on problems in the water and sanitation sector, which entail complex and unpredictable change processes, exacerbated by limited affordability and limited effective demand.

The cost components are summarised in Table 1. Further details can be found in Briefing Note 1a (Fonseca et al., 2011).

Table 1: Main cost components of the life-cycle costs approach

Cost components		Brief description
<i>Capital expenditure</i> The costs of providing a service where there was none before; or of substantially increasing the level of services.	Capital Expenditure Hardware	Capital investment in fixed assets, such as excavation, lining, slabs, superstructures and pipes.
	Capital Expenditure Software	Expenditure on work with stakeholders prior to construction or during implementation, such as community training, demand creation and hygiene promotion.
<i>Recurrent expenditure⁵</i> Service maintenance expenditure associated with sustaining an existing service at its intended level	Operational Expenditure	Operating and minor maintenance expenditure; typically regular expenditure, such as cleaning products.
	Capital Maintenance Expenditure	Asset renewal and replacement cost; occasional and lumpy costs that seek to restore the functionality of a system, such as replacing a slab or emptying a septic tank.
	Cost of Capital	Cost of interest payments on micro-finance and any other loans.
	Expenditure on Direct Support	Expenditure on support activities for service providers, users or user groups.
	Expenditure on Indirect Support	Expenditure on macro-level support, including planning and policy making, support to decentralised service authorities or local government.

1.2 Fieldwork sampling and research approach

The countries where the action research was conducted were selected due to the diversity of WASH services in each country. This allows for analysis and comparison of numerous technologies, the services they provide and their associated costs. Table 2 below displays, per country, the latrine facilities that have been costed as part of this study. Primarily, data collection focussed on the most common latrine types in each country. This meant that although certain latrines, such as traditional pit latrines, are found in some form in each of the four countries, information on costs was only collected in Mozambique where these latrines are widespread. In some cases, the entries in the table are blank because although latrines have been costed, there are not enough observations to draw significant conclusions.

⁵ In much of the WASH literature, costs associated with maintaining an existing service at its intended level are referred to as 'post-construction' costs. This usage reflects the historic tendency of the sector to focus on providing hardware where none had previously existed (hence 'construction costs'). Subsequent to this first time provision of hardware, it was realised that additional costs were required to make the system function (hence post-construction costs). Although we continue to use the term at times in our communication work, once a service has been provided for the first time, all costs become 'post-construction' costs.

Table 2: Definition of sanitation facilities and the countries where cost information was collected

Latrine	Definition	Status	Andhra Pradesh	Burkina Faso	Ghana	Mozambique
Traditional Pit Latrine (TPL)	A pit latrine without an impermeable slab	Present	•	•	•	•
		Sufficient data for cost analysis				•
Traditional Improved Pit Latrine (TIPL)	A pit latrine with an impermeable slab made from local materials	Present		•	•	•
		Sufficient data for cost analysis				•
Slab Latrine	A pit latrine with a concrete impermeable slab	Present		•	•	•
		Sufficient data for cost analysis		• ⁶		•
Ventilated Improved Pit Latrine (VIP)	A single or double pit with a safe (often concrete) super structure sitting below an impermeable slab. A ventilation pipe and screen are standard to reduce odours and flies.	Present		•	•	•
		Sufficient data for cost analysis		•	•	•
Pour Flush Latrine	A concrete or brick lined single or double pit, usually offset, with a safe super structure and a sealed impermeable slab including a flushable pan.	Present	•			•
		Sufficient data for cost analysis	•			
Latrine with Septic Tank	A pour or fully flushable latrine connected to an underground septic tank, with liquid outlet to a soakaway.	Present	•	•	•	•
		Sufficient data for cost analysis				•

Bringing all data to current value

The research was done using only financial analysis of past incurred real costs for providing the facilities and the services. All expenditure was brought to its current value in US\$ (2009) using Gross Domestic Product (GDP) deflators and the 2009 mid-year official exchange rate to account for the effect of inflation on historical expenditure. For comparison purposes findings are presented in US\$. In the African countries, data prior to 1995 was excluded as it was thought to be too contingent on fluctuations in exchange rates.

6 In Burkina Faso no distinction was drawn between pit latrines with a slab made from local material or latrines made from cinder block or concrete. For analysis purposes these have been classified as a slab latrine but a proportion may have characteristics more akin to Traditional Improved Pit Latrines.

7 In Andhra Pradesh no effective distinction was drawn between the commonly occurring single pit pour flush latrine and the rarer latrine with septic tank. Therefore for analysis purposes these have been all classified as single pit latrines, but a small proportion may have characteristics more akin to latrines with septic tanks.

Calculating and annualising recurrent costs

The recurrent costs of operational expenditure, expenditure on direct and indirect support and the cost of capital are typically accounted for on an annual basis. When data is available over a number of years, the average of these values can be taken. When the costs of a latrine are solely found at the household level, or if government subsidies are targeted at individual households, these can be calculated per person by dividing by the number of users of the latrine. Direct and indirect support expenditure has been calculated by dividing the support costs by the population of the target intervention area. For example, if an intervention is targeted at a district level, then this figure is divided by the district population. Each of the resulting figures can then be added to get the total per person expenditure.

Capital maintenance expenditure does not occur annually for individual sanitation facilities and for this, analysis has been annualised by dividing by the age of the latrine. Taken together, these costs represent total annual recurrent expenditure.

Calculating capital costs

Capital expenditure is a one-off sunk cost and does not occur annually in sanitation facilities (with very few exceptions). However, the life-cycle costs approach also recognises that it is important to take into account that the effectiveness and reliability of capital assets depreciates over time, and this varies between sanitation facilities. Consequently there is an expected cost in a given year set aside for the capital maintenance and eventual renewal of a latrine, referred to as depreciation.

In this briefing note only the analysis of expenditure found is presented. In future work, the analysis of the 'ideal' depreciation annual expenditure will be discussed, as well as more detail on the lifespan of infrastructure.

Comparison of expenditure using the purchasing power parity (PPP)

A complementary analysis has been made using the purchasing power parity approach – giving results in US\$ PPP 2009 (Annex 3). The PPP between two countries is the rate at which the currency of one country needs to be converted into that of a second country to represent the same volume of comparable goods and services in both countries. The difference in expenditure between the focus countries is partly explained by the 'undervaluation' of one currency in comparison with another which is made visible with the PPP analysis.

1.3 Determining and costing service levels

One option to compare like with like is to compare the costs of similar levels of service provided. The researchers involved in WASHCost have developed a framework for analysis which determines service levels for a specific area according to the following four main indicators explained further in *WASHCost Working Paper 3: Assessing Sanitation Service Levels* (Potter et al., 2011):

- The accessibility of the sanitation facilities to the household
- The use of sanitation facilities by members of the household
- The cleanliness, maintenance and pit emptying of the facilities
- The environmental safety of faecal waste

Table 3 details how each of these indicators is constructed and how it corresponds to the service level achieved. In each of the four study areas, different household surveys were carried out and results used to assign each household a specific service level. Occasionally direct answers on these indicators were unavailable and proxy answers were used.

Table 3: WASHCost sanitation service levels

Service level	Accessibility	Use	Reliability (operation and maintenance)	Environmental protection (pollution and density)
Improved service	Each family dwelling has one or more latrines in the compound	Facilities used by all members of household	Regular or routine O&M (incl. pit emptying) requiring minimal user effort	Non problematic environmental impact disposal and re-use of safe by-products (use of liquid or composted human waste)
Basic service	Latrine with impermeable slab (household or shared) at national norm distance from household	Facilities used by some members of household	Unreliable O&M (incl. pit emptying) and requiring high user effort	Non problematic environmental impact and safe disposal
Limited service	Platform without (impermeable) slab separated faeces from users	No or insufficient use	No O&M (pit emptying) taking place and any extremely dirty latrine	Significant environmental pollution, increasing with increased population density
No service	No separation between user and faeces, e.g. open defecation			

Taken together, these aspects are seen as the key characteristics of a service, therefore the final service level of each household and for the area of analysis is determined by the lowest service level scoring. The boundaries of each criterion have been adjusted in accordance with the national policy norms of each country involved in the research and the data collected. The service level analysis using this 'ladder' diagram aims to give to a more nuanced understanding of where underlying problems of coverage and slippage may lie.

1.4 Sample size

Despite the thousands of household surveys in each country, many households could not remember what they spent on sanitation facilities. This has led to some difficulties in gathering relevant data (Table 4).

Table 4: Number of households sampled per study area

Country	Detailed household surveys undertaken	Number of households with a latrine	Number of households with valid cost data ⁷
Andhra Pradesh (India)	5743	2156 (38%)	2156 (38%)
Burkina Faso	546	477 (87%)	316 (58%)
Ghana	1273	343 (27%)	65 (5%)
Mozambique	1710	1101 (64%)	1087 (64%)

8 Note that this figure refers to households providing any kind of latrine costs – whether this be capital, operational or maintenance expenditure and even if they are stated as zero.

Data limitations

Findings in this briefing note are based on extensive surveys and data collection at household, district, regional and national level, reflecting a range of hydro-geological and socio-economic contexts. Consequently even equivalent latrine types vary considerably in their construction quality, dimensions and specifications as a result of local geographical and socio-economic circumstance. The cross-country analysis undertaken in this briefing note therefore incorporates all these context specific variations and should not be considered representative of national contexts.

Through the processes of data cleaning and analysis, collected information has been cross-verified with the source documentation. However, as most of the data was found at household level, there are inherent risks that the recollection of past expenditure will be inconsistent across respondents, especially when it occurred many years previously. Although there is no way to completely eliminate this risk, the enumerators scored responses according to their perceived credibility and unreliable figures were excluded from the analysis. The findings also demonstrate the challenges encountered in collecting a large sample of valid life-cycle costs information.

The remainder of this briefing note explores the capital and recurrent costs found for different sanitation facilities and then examines how these relate to the services these facilities deliver.

2 Capital expenditure on latrines

2.1 Limited availability of financial costs

The number of latrines with capital expenditure (CapEx) collected across the four countries highlights how the availability of financial costs is limited at times (Table 5). In Mozambique, for example, traditional pit latrines dominate in both rural and peri-urban areas, yet the majority of these households (between 70% and 75%) have not incurred any financial costs, because labour and material without payment were sourced from within a family or community. These data points have therefore not been used in the analysis of capital expenditure. In a number of cases, when insufficient or unreliable data has been collected for analysis, 'not available' has been entered.

Table 5: Number of capital expenditure data points collected per study area

Country	Latrine type	Number of rural CapEx responses (number including CapEx = US\$ 0)	% with CapEx	Number of peri-urban CapEx responses (number including CapEx = US\$ 0)	% with CapEx
Andhra Pradesh (India)	Pour flush (single)	1749 (1749)	100	248 (248)	100
	Pour flush (double)	87 (87)	100	47 (47)	100
Burkina Faso	Slab	132 (134)	99	108 (108)	100
	VIP	Not available	-	32 (32)	100
Ghana	VIP	16 (16)	100	Not available	-
Mozambique	TPL	102 (497)	21	54 (211)	26
	TIPL	12 (30)	40	40 (68)	59
	Slab	18 (35)	51	97 (129)	75
	VIP	Not available	-	12 (12)	100
	Latrine with septic tank	Not available	-	24 (24)	100

CapEx – capital expenditure; TPL – traditional pit latrine; TIPL – traditional improved pit latrine; VIP – ventilated improved pit latrine

2.2 Capital expenditure on latrines in Burkina Faso, Mozambique and Ghana

The median capital costs of latrines sampled across rural, peri-urban and small town areas of Burkina Faso, Ghana and Mozambique is shown in Figure 1.

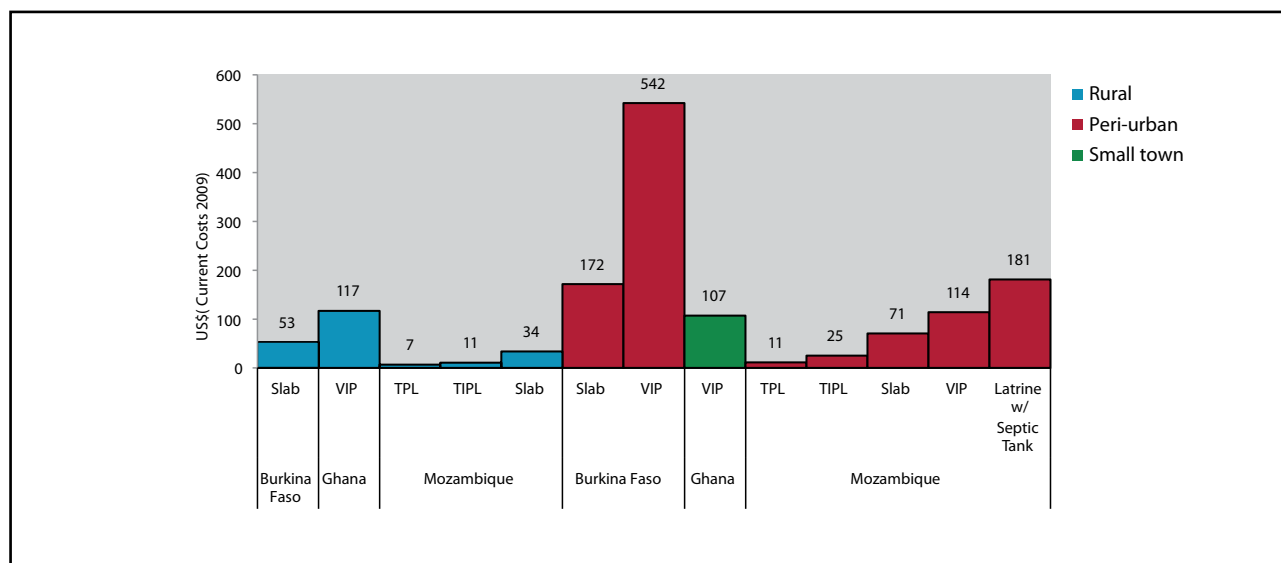
In Burkina Faso and Mozambique, the more technologically advanced latrines are, not surprisingly, more costly to construct. This is clearly illustrated in peri-urban and rural areas of Mozambique. In both areas, the two latrines types without an impermeable concrete slab – the traditional and traditional improved pit latrine – are typically between three to seven times cheaper to construct (at US\$ 7 and US\$ 11) than slab latrines (US\$ 34). The more advanced technologies costed in Mozambique were the VIP and latrines with septic tank in peri-urban areas. These were encountered in much fewer numbers. The median septic tank construction cost is US\$ 67 more than that of the VIPs.

Similar relationships can be seen in Burkina Faso where the construction costs of peri-urban VIP latrines are over three times the cost of peri-urban slab latrines and over ten times that of a slab latrine in rural areas.

In both Burkina Faso and Mozambique, higher levels of capital expenditure are found in the more densely populated peri-urban areas in comparison with rural areas. A slab latrine in Burkina Faso costs over three times as much in peri-urban areas than in rural areas. All latrines costed in rural Mozambique are two to three times cheaper than their peri-urban equivalents. In contrast, VIP latrines in Ghana are approximately 10% more expensive in rural areas than in small towns.

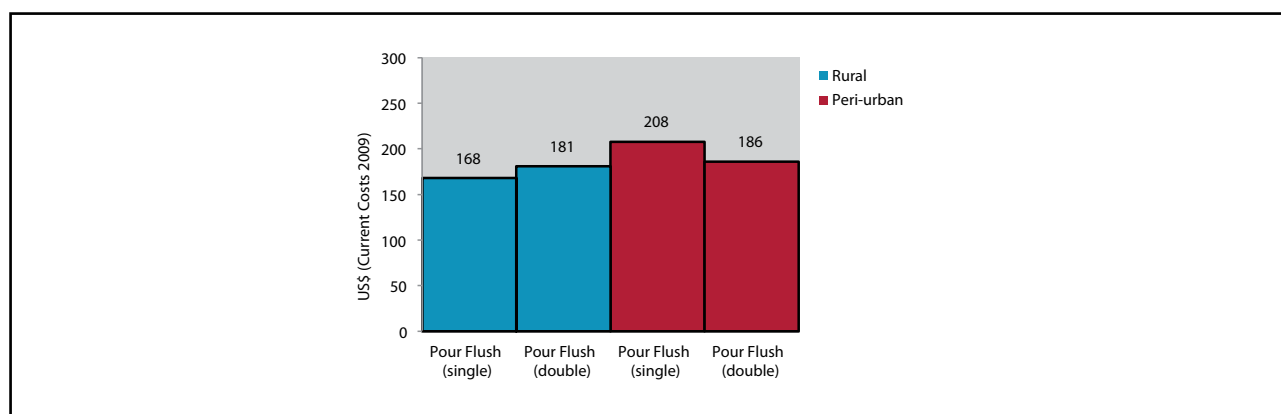
VIP costs in Burkina Faso are much higher than the found costs in neighbouring Ghana as well as in Mozambique. VIPs consistently cost between US\$ 300 and US\$ 600 to construct in Burkina, compared with average costs of between US\$ 100 and US\$ 250 in the other two countries.⁹ The occasional VIP in Ghana and Mozambique is of a comparable cost to those in Burkina Faso, but the majority cost three to four times less. The proportionally higher slab latrine costs in Burkina Faso reinforce the findings that the construction of latrines is generally more expensive here than in Mozambique.

Figure 1: Median capital expenditure in Burkina Faso, Mozambique and Ghana (current cost US\$ 2009)



2.3 Capital expenditure on latrines in Andhra Pradesh, India

Figure 2: Median capital expenditure in Andhra Pradesh, India (current Cost US\$ 2009)



The latrines sampled in Andhra Pradesh, India are pour flush, unlike the majority of the latrines sampled in the three African countries. As displayed in Figure 2, the typical peri-urban costs of latrines in Andhra Pradesh are only slightly higher than those in rural areas - this is in contrast to Burkina Faso and Mozambique where peri-urban construction costs were significantly higher. This might be explained by the fact that the villages and peri-urban areas in Andhra Pradesh tend to share many characteristics - such as similar levels of housing density, a blend of poor and rich households and expanding populations - meaning that latrines in both areas are subject to the similar cost drivers.

⁹ A detailed breakdown of the capital expenditure on all latrines can be found in Annex 2, Table 10.

Across Andhra Pradesh, construction costs varied greatly between latrines. Approximately five per cent of latrines costed over US\$ 500 to construct suggesting genuine differences in construction quality and materials used. However, it is surprising that the double pit toilets do not seem to be more expensive than the single pit toilets, given the added labour and materials needed to construct the second pit. This requires further research.

2.4 Comparison of capital expenditure using purchasing power parity

Results interpreted using purchasing power parity does allow for the re-evaluation of the relative expense of each latrine (Annex 3, Figures 9 and 10). Under a US\$ PPP analysis all latrine costs increase in terms of their US\$ equivalent value. This increase was most pronounced in Andhra Pradesh, India, and least pronounced in Ghana. Consequently the cost of a Burkina Faso VIP is still the highest of all sampled latrines but is comparable to the costs of pour flush latrines in Andhra Pradesh. Relative to Ghana, the PPP value of latrines in Mozambique rose sharply. The Mozambique slab latrine therefore has an equivalent US\$ PPP value to a VIP in Ghana.

2.5 Sources of capital expenditure on latrines

The majority of capital expenditure in Mozambique and Ghana is being incurred by households, with only very limited evidence of subsidy schemes either from government or non-governmental organisations (NGOs). In contrast, Andhra Pradesh, India, operates a widespread government subsidy scheme, extended to 'below poverty line' households. Seventeen per cent of sampled households had received this subsidy in Andhra Pradesh and it ranges between US\$ 52 and US\$ 89 across all latrine types, representing between 38% and 46% of total construction costs (See Annex 4, Figure 13 for more details).

In Burkina, 30% of latrines sampled in rural areas had received some form of subsidy from NGO activities and in peri-urban areas the utility provider, ONEA¹⁰, contributed cash and materials towards the construction of 67% of VIPs.

10 L'Office National de l'Eau et de l'Assainissement.

3 Recurrent expenditures for maintaining sanitation services

Recurrent expenditures represent the annual cost for maintaining or upgrading existing services. This expenditure takes a number of forms - operational and minor maintenance (OpEx); larger repairs or replacement (capital maintenance or CapManEx) ; expenditure on direct and indirect support occurring at district and national level (ExpDs/ ExplDs); and expenditure for financing any borrowing used to construct infrastructure, termed the cost of capital (CoC). Overall recurrent expenditure is low across all latrine types, ranging from a median of US\$ 0.2 - US\$ 2.8 per person per year in rural areas and US\$ 0 to US\$ 4.2 in peri-urban areas. Operational expenditure has the highest share of costs, accounting for 80% to 100% of annual expenditure per latrine.

Costs of capital expenditure exist across the four countries but for the most part this remains unquantified. Households are not borrowing for latrines in Mozambique or Burkina. There are some cases where households borrow for sanitation facilities in Andhra Pradesh and it remains uncertain whether they do so or not in Ghana.

3.1 Recurrent expenditure on latrines in Burkina Faso, Mozambique and Ghana

In Mozambique, the majority of households do not incur any financial, operational or capital maintenance expenditure and therefore the median for these costs is zero - in all areas, for all facilities. For the traditional latrine facilities, capital maintenance such as the emptying of the pit does not take place because once full, a new latrine is constructed somewhere else. As with capital expenditure, any re-siting or pit emptying that does take place is often undertaken by non-paid labour such as family or community members.

The only recurrent expenditure identified is the direct support expenditure made at district level which is broadly targeted at rural sanitation projects and represents a median value of US\$ 0.2 per person per year in rural areas. There are no support costs attributed to peri-urban areas.

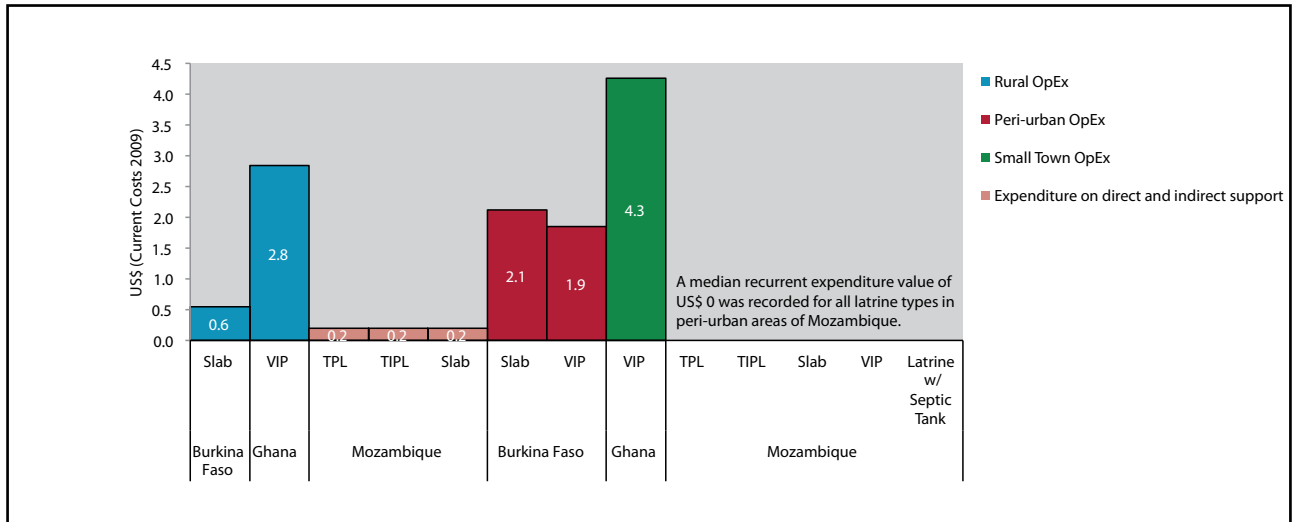
In Burkina Faso, operational expenditure was the only recurrent expenditure found with a median greater than US\$ 0. The majority of values, across all latrine types, fell between US\$ 0 and US\$ 2.5 per person per year. In peri-urban areas, however, a minority of households spend significantly more than this, presumably on occasional pit emptying, with 13% of those with slab latrines spending more than US\$ 16 per person per year and 12% of those with VIPs spending US\$ 15 or more. These high expenditure values are less common for rural slab latrines, where 78% spend less than US\$ 2 (30% spend zero), and just one per cent spend more than US\$ 16. Households in rural areas normally dig new pits rather than trying to empty full ones.

In Ghana, the median operational expenditure is the highest of all countries and is again the only found recurrent cost. For a rural VIP latrine, two thirds of all OpEx values fall between US\$ 0.1 and US\$ 4; with 14% of households incurring a much higher expenditure of more than US\$ 15. The seven data points collected for small town VIPs indicate a median OpEx of US\$ 4.2, with values ranging from US\$ 1 to US\$ 8 per person per year. Given the small sample size, this value cannot be considered representative of all small town VIPs, however it does broadly replicate the findings in rural Ghana, where more than a third of households spend more than US\$ 1 per person per year on operational and minor maintenance.

For each of the facilities studied, capital maintenance expenditure was only encountered very occasionally, giving median values of zero. Clearly, however the need for capital maintenance is intrinsically linked to the age of the latrine, with increasing maintenance needed over time. The majority of latrines sampled have been constructed in the last five years, which may contribute to lack of reported expenditure on capital maintenance. However, although results are varied, even in aged latrines, capital maintenance only takes place occasionally. It could be that in rural

areas households are undertaking capital maintenance through self-construction of a new pit, incurring zero financial cost, with the surveyors recording this activity as a new latrine.

Figure 3: Median recurrent costs of latrines in Burkina Faso, Mozambique and Ghana (current costs US\$ 2009)

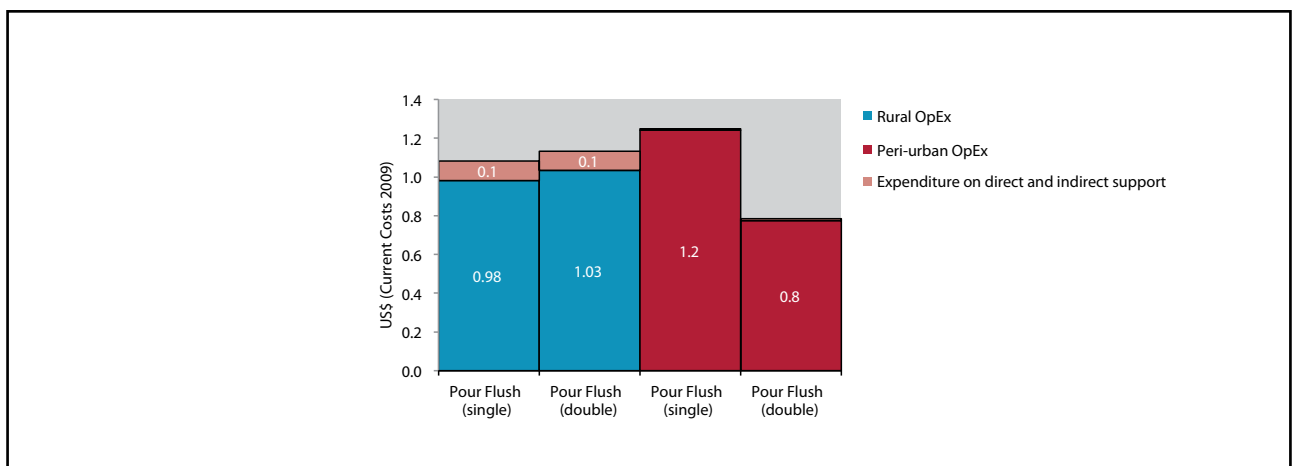


3.2 Recurrent expenditure on latrines in Andhra Pradesh, India

In Andhra Pradesh, operational expenditure on the two latrine types is broadly equivalent at approximately US\$ 1 per person per year across rural and peri-urban areas and represents almost all of the recurrent costs captured. Between 68% and 87% of households spend less than US\$ 2 per person per year on OpEx. For each latrine only a minority, between two and three per cent, spend more than US\$ 10 per person per year. Around a third of households do not spend anything on operational maintenance and no capital maintenance expenditure has been recorded.

Expenditure on direct support has been calculated from state level expenditure on staff salaries and information, education and communication (IEC) activities. This has been combined with indirect support costs estimated using the national and state level budget allocations on activities including planning, research and policy development. Together these represent an expenditure of just US\$ 0.1 per capita year in rural areas and a negligible amount in peri-urban areas.

Figure 4: Median recurrent costs of latrines in Andhra Pradesh (current costs US\$ 2009)



4 Costs and sanitation service levels

4.1 Sanitation service levels in rural areas

This section focuses on the costs of the services delivered as opposed to the costs per latrine. Figure 5 displays the sanitation service levels achieved by households using the latrines which were costed in rural areas. The data from Mozambique, Andhra Pradesh and Ghana is derived from household surveys following a standardised indicator list. However, the use, reliability and environmental protection indicators of the sanitation service levels in Burkina Faso were calculated based on an extrapolation mix of national norms and data assumptions.¹¹

In Mozambique, between 88% and 89% of households with an impermeable slab, the improved traditional pit latrine and the slab latrine, are receiving an overall 'basic service'. All of the latrines sampled are accessible to users and are being used, with only a small percentage failing on grounds of being extremely dirty or causing pollution to the surrounding environment.

The pattern in Burkina Faso is similar, with 70% of households with slab latrines receiving a 'basic service' as above. The remaining 30% are seen to cause significant environmental pollution. However, these figures must be interpreted with caution, as the indicators on which they rely are calculated differently.¹²

Two-thirds of ventilated improved latrines users in Ghana receive a 'basic service' level. The primary reason why the outstanding third are deemed to receive 'no service' is because the latrine is extremely dirty (4%) or because there is no reliable emptying service in the community (29%).

In Andhra Pradesh, the interpretation of sanitation service levels is somewhat more complex. Typically, between 61% and 62% of users of the pour flush single or double pit latrines types receive a 'limited service', with only a very small percentage achieving a 'basic service' – between three and five per cent.¹³ One reason for this is because the majority of latrines sampled are not used by all family members (Table 6). This is evidence of significant slippage in latrine use, especially for households with the single pit latrine. Poor cleanliness and reliability of the latrine is the other factor contributing to between 33% and 36% of households receiving 'no service'. This is in marked contrast with Mozambique, where every household latrine sampled was being used by at least one family member.¹⁴

Table 6: The number of household users per latrine, Andhra Pradesh

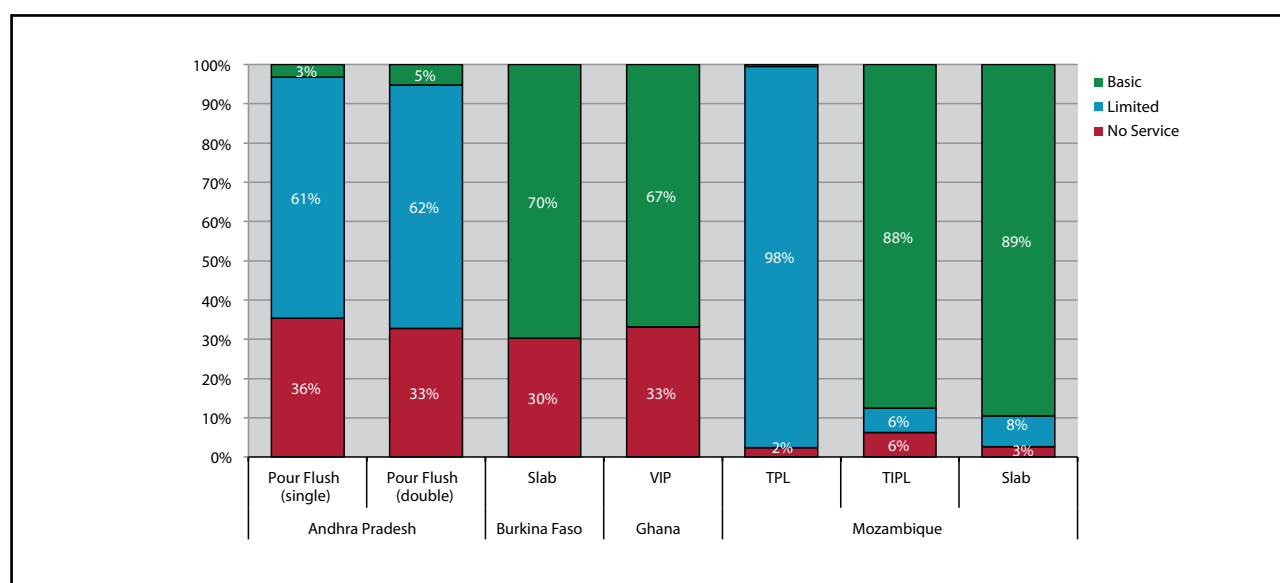
Latrine	All household	Some	None
Pour Flush (single)	30%	54%	16%
Pour Flush (Double)	27%	61%	12%

11 The main difference is that for measuring 'environmental protection', the analysis is based on normative users per latrine, the norm being 10 users per latrine. Any figure higher than 10 is considered to be of significant risk of environmental pollution use, implying the possible failure of the latrine.

12 See previous footnote.

13 The Environmental Protection Indicator has not been included in the Andhra Pradesh analysis as the proxy used was relevant to protection in the community and not at the household level.

14 In Mozambique, the exact number of family members using the latrine was not established during the household survey. Therefore if the latrine was used by the household respondent then a 'basic' level was given without taking into account other household members. In Andhra Pradesh this information about the number of users per latrine was collected and if only some family members use the latrine a 'limited' service was given – this nuance is not possible in Mozambique and likely contributes the higher "limited" service seen in Andhra Pradesh.

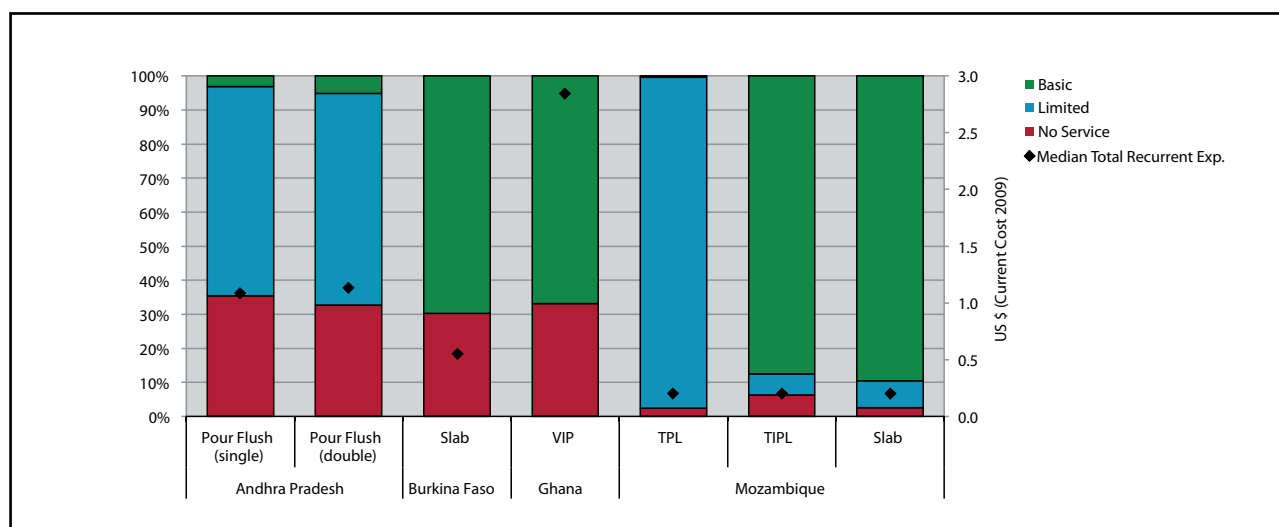
Figure 5: Sanitation service levels of rural latrines

4.2 Costs versus service levels in rural areas

There is no clear relationship between costs and service levels between countries given the different country contexts and, most importantly, the insignificant amount of expenditure on recurrent costs. Table 7 displays capital and recurrent expenditure and Figure 6 combines the recurrent expenditure with overall service levels delivered by the latrines.

Table 7: Total capital expenditure, recurrent expenditure (per person per year) of rural latrines (US\$ 2009)

Country	Andhra Pradesh		Burkina Faso	Ghana	Mozambique		
	Pour Flush (Single)	Pour Flush (Double)	Slab	VIP	TPL	TIPL	Slab
Median Capital Expenditure	168	181	53	117	7	11	33.6
Median recurrent expenditure	1.1	1.1	0.6	2.8	0.2	0.2	0.2

Figure 6: Sanitation service levels and median recurrent expenditure (per person per year) of rural latrines (US\$ 2009)

The paucity of recurrent expenditure available in Mozambique means little analysis can be done with this data. However, in this context, it seems that the primary driver of sanitation service levels is the existence of an impermeable slab separating the user from faeces. Capital expenditure values show that to construct a latrine with a non-concrete impermeable slab (TIPL) costs US\$ 11 and this increases to US\$ 31 for a concrete slab. Despite this cost difference, both latrines are likely to give a basic level of service. However, for planning purposes it is worth considering that the expected lifespan of a slab latrine is likely to be longer than that of the TIPL latrine.

In Andhra Pradesh, the latrines with higher levels of recurrent expenditure, primarily operational expenditure, have fewer households receiving 'no service'. This is not surprising given that the reliability indicator in Andhra Pradesh is a function of operational expenditure. The higher the operational expenditure, the cleaner and more sanitary the latrine.

4.3 Peri-urban/small town costs and service levels

Across peri-urban/small town areas, the vast majority of households achieve a 'basic level' of service if they have a latrine with an impermeable slab. If the latrine does not have an impermeable slab – as with the traditional pit latrine – 90% of users attain a limited service. Figure 7 displays the sanitation service levels achieved by households with costed latrines in peri-urban areas and Table 8 displays the corresponding capital expenditure and recurrent costs. Figure 8 illustrates both the recurrent costs and service levels.

Although the existence of a slab is a prerequisite for a 'basic service', the fact that equivalent latrines realise lower overall service levels in rural areas demonstrates the role of reliability and environmental protection indicators in delivering an acceptable sanitation service. In Burkina Faso, for example, 99% of latrines achieve a 'basic level' of environmental protection in peri-urban areas compared to 70% in rural areas. The VIP latrine in Burkina Faso gives a comparable service to the slab latrine but typically costs over US\$ 250 more to construct.

Similarly, a greater percentage of VIP latrines in small towns attain 'basic' reliability (18% higher than the rural equivalent) and although the small town latrine is marginally cheaper to construct, indicative findings (from seven data points) suggest that twice as much is spent operating and maintaining these latrines.

The service levels achieved in peri-urban communities of Andhra Pradesh are higher than those in rural areas, with approximately ten per cent fewer households receiving no service. Once again there is very little difference between the service delivered by single or double pit latrines with poor cleanliness and household use of the latrines being critical factors.

Figure 7: Sanitation service levels of peri-urban latrines

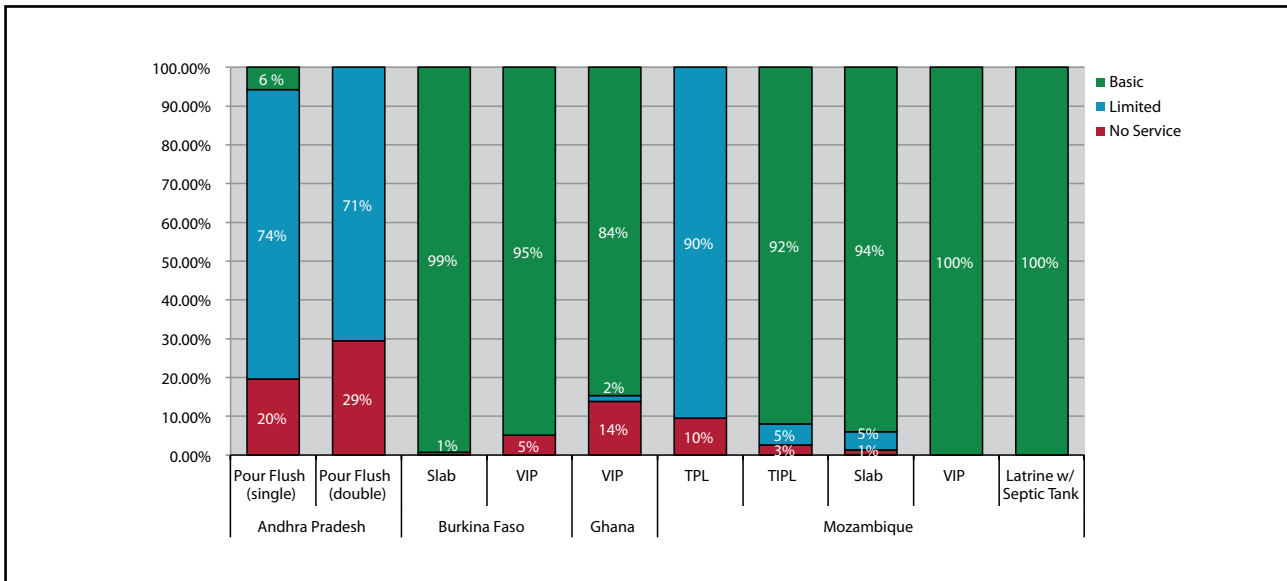
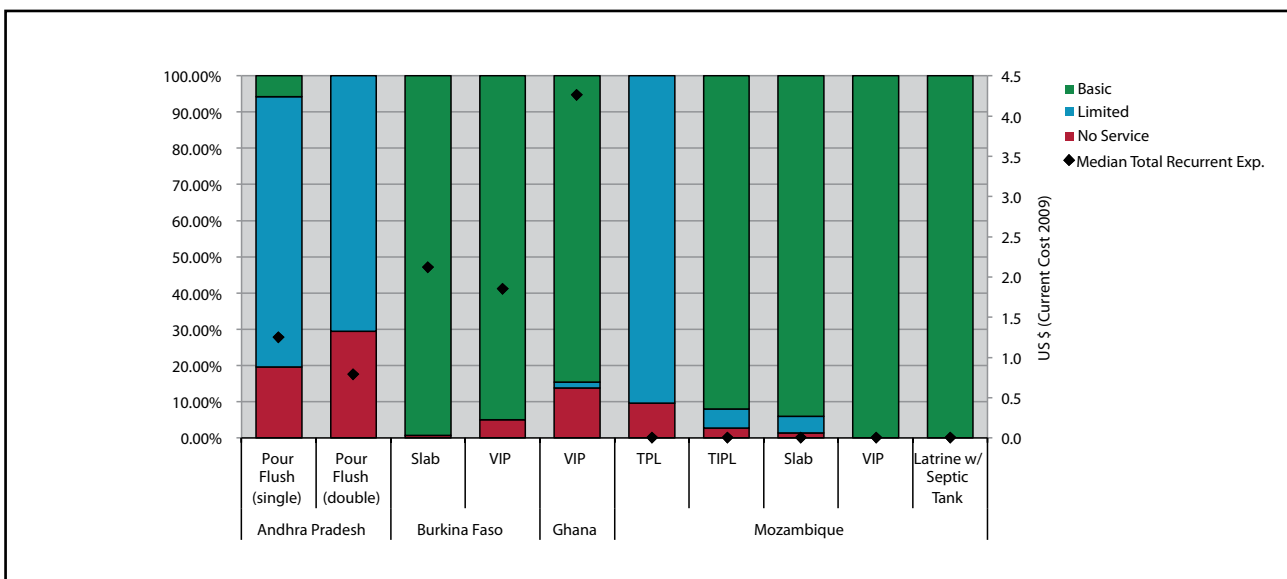


Table 8: Total capital expenditure and recurrent expenditure (per person per year) on peri-urban latrines (US\$ 2009)

Country	Andhra Pradesh		Burkina Faso		Ghana	Mozambique				
TecÚology	Pour Flush (Single)	Pour Flush (Double)	Slab	VIP	VIP	TPL	TIPL	Slab	VIP	Latrine w/ Septic Tank
Median CapEx	208	186	171.5	542	107	11.3	25.1	70.5	114	181
Median recurrent expenditure	1.2	0.8	2.1	1.9	4.3	0	0	0	0	0

Figure 8: Sanitation service levels of peri-urban latrines and median recurrent expenditure (per person per year) (US\$ 2009)



5 Conclusions

The life-cycle costs approach is informing discussions and analysis across the water supply and sanitation sector. It looks into the complex relationships between expenditure, service delivery, poverty, effectiveness and sustainability. This cross-country analysis of costs and service levels provides a broad overview of these themes, exposing lack of use and reliability of latrines, to be explored in more detail at national level.

In terms of analysis of expenditure, there is considerable variation in both construction and recurrent expenditure on equivalent latrines. In each of the African countries, the more technologically advanced latrines – containing a concrete impermeable slab – can cost hundreds of dollars to construct. Without subsidy arrangements these will be out of reach for the poorest. This concern is more acute for the poor in peri-urban poor areas in the African context, where latrines are significantly more expensive.

The variations in equivalent latrine expenditure between the African countries, by current cost and purchasing power parity analysis, highlights the importance of local socio-economic conditions for the capital cost of latrines. In Andhra Pradesh, India, pour flush latrines have broadly similar construction costs to the more advanced latrines in Burkina Faso and Mozambique. Yet under purchasing power parity analysis, pour flush latrines are equivalent to the most expensive in Africa.

Expenditure by households, the public sector or service providers on capital maintenance and direct and indirect support is virtually non-existent across all countries. Expenditure on operations and minor maintenance can vary greatly but is low for the vast majority of latrines sampled. Corresponding low service levels in some cases where sophisticated latrines exist may reflect a large gap in expenditure which is unable to ensure the sustainability of sanitation services delivery.

In Africa, higher levels of service, by service ladder definitions, are achieved in peri-urban/small town areas in comparison with rural areas, due to improved environmental protection and reliability. This coincides with generally higher expenditure on construction and recurrent costs. It also coincides with the need for higher-quality sanitation, apparently recognised by households, for improved services in higher-density urban areas where alternatives are more restricted.

The latrine type and construction costs are not the sole drivers of service levels provided. Latrines such as improved traditional pit latrines deliver similar levels of service to more expensive latrines. This does not, however, take into account the expected lifespan of different latrines and the interrelationship with recurrent expenditure. These are areas of further research.

The difficulties of extracting reliable data on the cost of capital expenditure and on expenditure on direct and indirect support are likely to mean that total recurrent expenditure findings represent a “lower bound” of expenditure and not the expenditure needed to achieve a basic level of service. The modelling of “ideal” or “normative” expenditures, along with the detailed exploration of linkages between service levels, lifespans, and poverty are going to be the focus of upcoming WASHCost publications.

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Annexes

Annex 1 – Comparable sanitation facilities glossary

The table below describes comparable sanitation facilities in the research focus countries of WASHCost. The facilities which are analysed in this briefing note are in grey.

Table 9: Sanitation glossary of WASHCost countries

International	India	Ghana	Mozambique	Burkina Faso
Open defecation	Open defecation	Open defecation	Defecação a céu aberto	Défécation à l'air libre
Traditional pit latrine	Single pit latrine	Traditional latrine	Latrina tradicional	Latrine traditionnelle
Improved traditional pit latrine			Latrina tradicional melhorada	
Slab latrine			Latrina com laje	Latrine San plat
VIP Latrine	Individual sanitary latrine (comparable to VIP)	Ventilated Improved Pit (VIP)	VIP	Latrine VIP
Kumasi Ventilated Improved Pit (KVIP)		Kumasi Ventilated Improved Pit (KVIP)		
Pour flush latrine	Pour flush latrine	Pour flush toilet		Toilette à chasse manuelle (TCM)
Pour flush latrine with septic tank	Pour flush latrine with septic tank		Sistema ligado a fossa séptica (usando balde)	TCM avec fosse septique
Toilet with sewerage connection	Toilet with sewerage connection (urban)		Sistema com água corrente ligado a sistema geral de esgoto	WC raccordé au réseau d'égout
Toilet with septic tank	Toilet with septic tank	Water closet	Sistema com agua corrente ligado a fossa séptica	WC à chasse avec fosse septique
Aqua privy		Aqua privy		
Public latrine	Community toilet	Public latrine	Latrina pública	Latrine publique

Annex 2 – Calculation tables US\$ 2009

Table 10: Detailed capital expenditure for all latrines (current cost US\$ 2009)

Country	Area	TecÚology	Mean CapEx	Median	Min	Max	25 th percentile	75 th percentile
Andhra Pradesh	Rural	Pour Flush (single)	197	168	21	1642	116	237
		Pour Flush (double)	222	181	41	766	143	268
	Peri-Urban	Pour Flush (single)	253	208	61	1170	162	292
		Pour Flush (double)	207	186	62	494	134	262
Burkina Faso	Rural	Slab Latrine	67	53	2	174	39	87
	Peri-Urban	Slab Latrine	220	172	27	896	103	275
		VIP	537	542	327	734	488	615
Ghana	Rural	VIP	168	117	21	538	85	185
	Small Town	VIP	136	107	25	516	71	142
Mozambique	Rural	TPL	11	7	0	62	4	8
		TIPL	40	11	1	189	5	20
		Slab Latrine	49.2	34	12	161	21	43
	Peri-Urban	TPL	21	11	1	190	5	22
		TIPL	42	25	1	189	10	47
		Slab Latrine	111	71	1	513	32	128
		VIP	90	114	21	434	33	215
		Latrine w/ Septic Tank	225	181	24	669	117	225

Table 11: Operational and maintenance expenditure for all latrines (current cost US\$ 2009)

Country	Area	TecÚology	n. OpEx	% 0 values	Mean OpEx	Median OpEx	Min	Max	25 th percentile	75 th percentile
Andhra Pradesh	Rural	Pour Flush (single)	1770		1.7	1.0	0.0	103.3	0.2	1.7
		Pour Flush (double)	87		2.0	1.0	0.0	15.6	0.6	2.2
	Peri-Urban	Pour Flush (single)	248		1.5	1.2	0.0	9.0	0.6	2.1
		Pour Flush (double)	47		0.9	0.8	0.0	4.6	0.4	1.0
Burkina Faso	Rural	Slab Latrine	144	30	1.0	0.6	0	26	0	2
	Peri-Urban	Slab Latrine	137	7	4.1	2.1	0	79	1	6
		VIP	33	0	3.5	1.9	0	26	1	5
Ghana	Rural	VIP	43	0	4.0	2.8	0	43	1	6
	Small Town	VIP	7	0	4.1	4.3	1	9	2	6
Mozambique	Rural	TPL	504	98	0.1	0.0	0	2	0	0
		TIPL	31	87	0.0	0.0	0	1	0	0
		Slab Latrine	37	89	0.6	0.0	0	8	0	0
	Peri-Urban	TPL	222	98	0.1	0.0	0	10	0	0
		TIPL	72	94	0.1	0.0	0	4	0	0
		Slab Latrine	143	92	0.5	0.0	0	22	0	0
		VIP	19	89	0.2	0.0	0	24	0	0
		Latrine w/ Septic Tank	44	95	0.6	0.0	0	11	0	0

Table 12: Capital maintenance expenditure across rural latrines (current cost US\$ 2009)

Country	Area	TecÜology	n. Cap-ManEx	% 0 values	Mean Cap-ManEx	Me-dian Cap-ManEx	Min	Max	25 th percentile	75 th percentile
Andhra Pradesh	Rural	Pour Flush (single)	0	0	0	0	0	0	0	0
		Pour Flush (double)	0	0	0	0	0	0	0	0
	Peri-Urban	Pour Flush (single)	0	0	0	0	0	0	0	0
		Pour Flush (double)	0	0	0	0	0	0	0	0
Burkina Faso	Rural	Slab Latrine	145	70	0.1	0.0	0	6	0	0
	Peri-Urban	Slab Latrine	137	56	0.3	0.0	0	7	0	0
		VIP	33	58	0.6	0.0	0	6	0	1
Ghana	Rural	VIP	10	100	0.0	0.0	0	0	0	0
	Small Town	VIP	2	100	0.0	0.0	0	0	0	0
Mozam-bique	Rural	TPL	497	99	0.0	0.0	0	0	0	0
		TIPL	32	97	0.0	0.0	0	0	0	0
		Slab Latrine	38	97	0.1	0.0	0	6	0	0
	Peri-Urban	TPL	219	95	0.1	0.0	0	13	0	0
		TIPL	72	90	0.0	0.0	0	3	0	0
		Slab Latrine	142	81	0.2	0.0	0	5	0	0
		VIP	18	78	1.0	0.0	0	95	0	0
		Latrine w/ Septic Tank	38	74	0.7	0.0	0	11	0	0

Annex 3 – Calculation tables US\$ PPP 2009

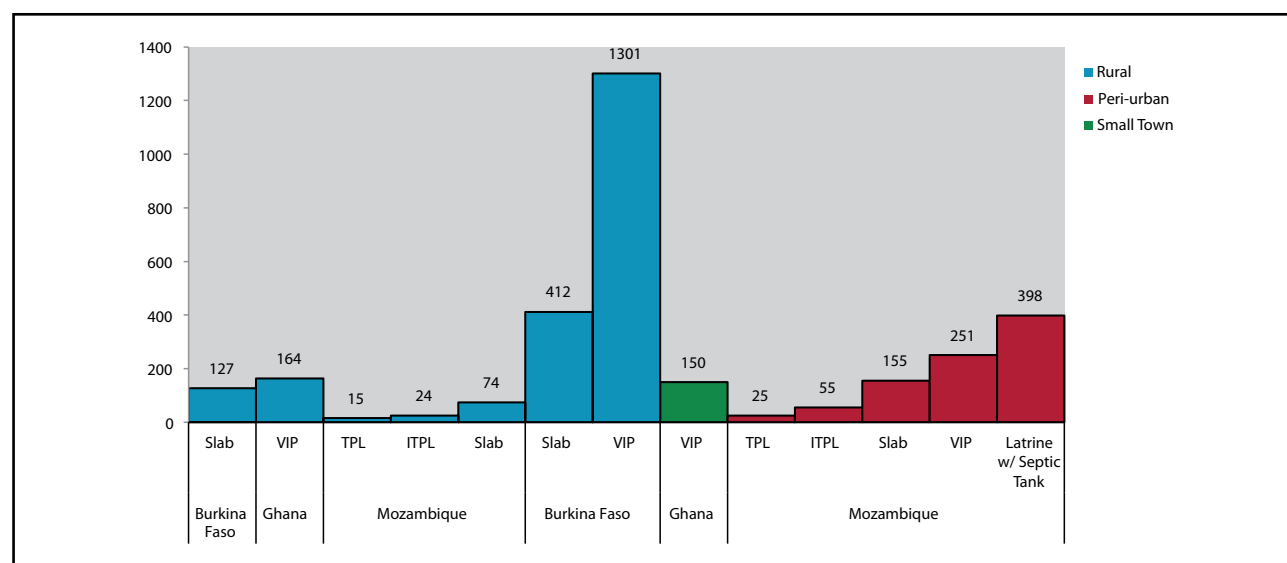
Figure 9: Median capital expenditure on latrines Burkina Faso, Mozambique and Ghana (US\$ PPP 2009)

Figure 10: Median capital expenditure on latrines in Andhra Pradesh (US\$ PPP 2009)

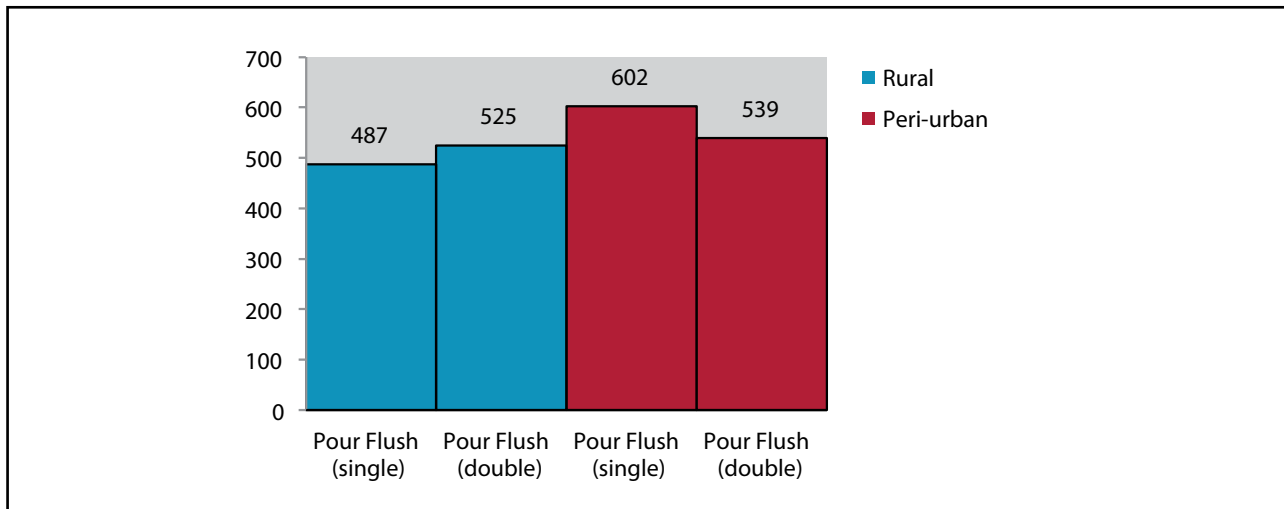


Figure 11: Median recurrent costs of latrines in Burkina Faso, Mozambique and Ghana (US\$ PPP 2009)

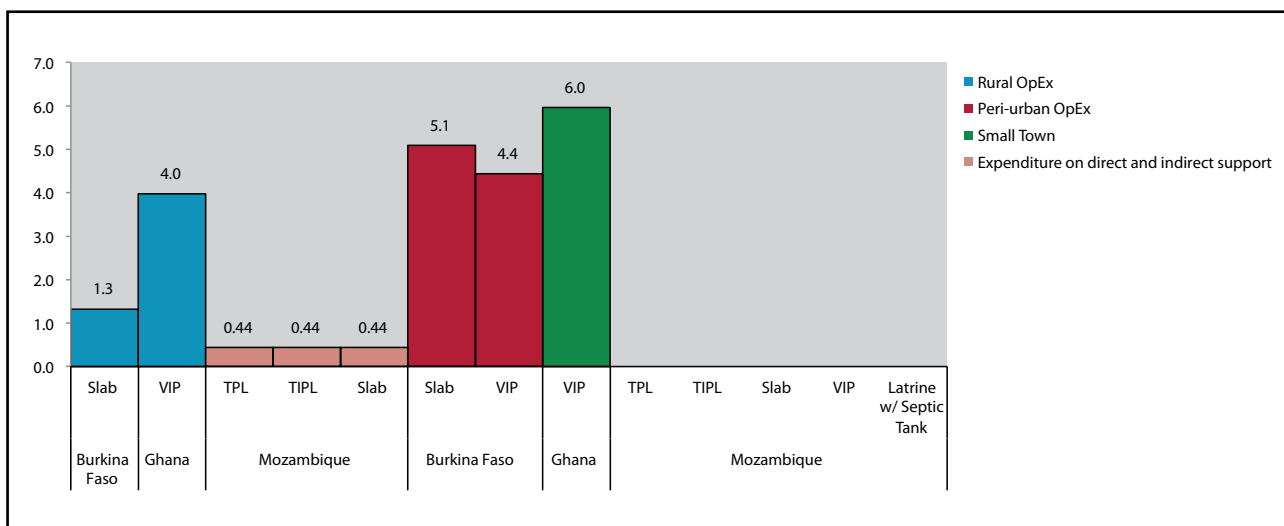
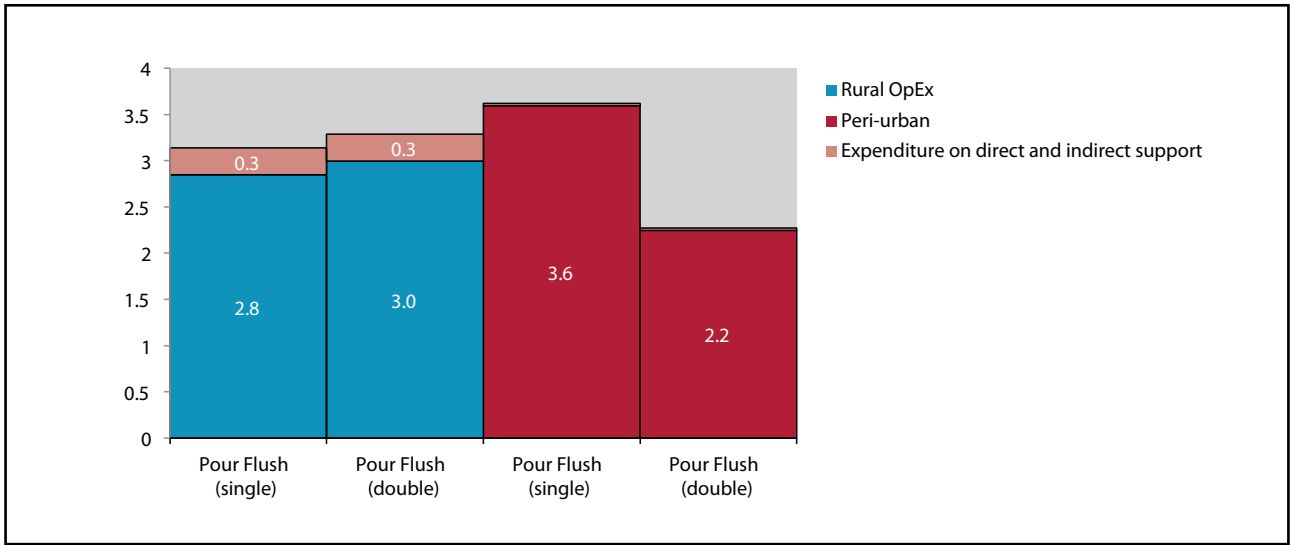


Figure 12: Median recurrent costs of latrines in Andhra Pradesh, India (US\$ PPP 2009)



Annex 4 – Breakdown of subsidy expenditure

Figure 13: Comparison of median of capital expenditure on latrines in Andhra Pradesh, India (current cost US\$ 2009)

