



A multi dimensional framework for costing sustainable water and sanitation services in low-income settings:

Lessons from collecting actual life cycle costs for rural and peri-urban areas of Ghana, Burkina Faso, Mozambique and Andhra Pradesh

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Abbreviations

CapEx	Capital Expenditure
CapManEx	Capital Maintenance Expenditure
CESS	Centre for Economic and Social Studies
CoC	Cost of Capital
DST	Decision-Support Tools
ExpDS	Expenditure on Direct Support
ExpIDS	Expenditure on Indirect Support
IRC	International Water and Sanitation Centre
GoAP	Government of Andhra Pradesh
LCC	Life-Cycle Costs
LCCA	Life-Cycle Costs Approach
MDG	Millennium Development Goals
MIS	Management Information Systems
NGO	Non-Governmental Organisation
O&M	Operation and Maintenance
OpEx	Operating and Minor Maintenance Expenditure
WASH	Water, sanitation, and hygiene
WASSAN	Watershed Support Services and Activities Network

Executive Summary

The water and sanitation sector faces a sustainability challenge because of the emphasis on installing pipes and pumps instead of ongoing service delivery. When a WASH service is unreliable or completely fails, it is the people without access to safe alternatives who are most affected. People lose the essential services they have come to expect. One way to face this challenge is to assess and estimate the life-cycle costs of providing WASH services.

What are the construction, operation, and maintenance costs for ensuring delivery of adequate, equitable and sustainable WASH services? What are the renewal, replacement and rehabilitation costs needed to ensure sustainability? How much does it take to support post-construction activities? As life-cycle costs become mainstreamed, governments, donors, NGOs and the private sector will be better able to plan for service delivery and know how and where to invest to keep service quality from falling back.

Understanding, collecting and using these life-cycle costs is the aim of the WASHCost project. Guided by Learning Alliances, WASHCost is taking place in Andhra Pradesh (India), Burkina Faso, Ghana and Mozambique. The collection and disaggregation of cost data over the full life-cycle of WASH services provides a better understanding of costs drivers and enables cost effective and equitable service delivery.

WASHCost has adopted an action-oriented or stakeholder-driven approach to research. This means that research priorities are set in each country to feed into government requirements. At the same time, the overall research questions of WASHCost as one project need to be answered. There is a constant balancing act between the priorities at country level and those at international/global level – while ensuring that all teams progress at the same speed. The country teams keep a balance between these priorities.

This document brings together different components of the WASHCost research methodology and sets out the minimum standards for the collection and comparison of life cycle costs. It will be useful to those improving the planning, budgeting, and implementation of accountable WASH services.

This research report is the result of two years of piloting and conducting data collection in the four

WASHCost countries (Ghana, Burkina Faso, Mozambique and India - Andhra Pradesh) involving several members of the country Learning Alliances platforms and several research meetings with the WASHCost research team and the international advisory group.

We are making this draft document available outside the WASHCost team, to

- i) Enable others to use the methodology to assess the costs of their own programmes;
- ii) To get feedback from experts in the sector in order to improve and simplify our approach.

Further refinement of this methodology and the data collection tools used is needed to ensure simplicity and usefulness to a global audience. Ultimately we aim to produce a 'WASHCost light' approach.

Disclaimer: The set of methodologies described in this document have not yet been fully tested at scale and are work in progress. This working paper will be updated every six months.

Updated versions will be posted on the WASHCost website: www.washcost.info

1 Scope of this research report

Water, sanitation and hygiene (WASH) services are central to addressing poverty, economic development, livelihoods and health. Lack of accurate information, especially on and in rural and peri-urban areas in the developing world, has made it impossible to estimate the true cost of extending sustainable and good quality water and sanitation services to the poorest. The WASHCost project has developed and tested a multidimensional framework to contribute better quality information for more sustainable, equitable and efficient WASH services delivery. The main elements of the framework are the life-cycle cost components and the service level indicators. This framework has been used to analyse the data being collected.

The WASHCost Draft Research Report attempts to make clear what is the minimum 'common core' set of methodologies for achieving the WASHCost global research objectives. This common core includes among others the cost components, service level indicators, variables to be collected, methods & tools for data collection and lessons learned from data collection.

Other organisations and governments might decide to collect additional data to fit their priorities and use other methods. The set of methodologies described here have been designed to ensure, throughout the project, a minimum consistency across the WASHCost participating countries and the development of a methodology which is robust enough to be applicable in different contexts.

Some of the teams have been testing methodologies which go beyond the scope of this document (for example using detailed GIS to map costs and equity issues or community scorecards for input/output tracking). The reports from the different country teams on additional methods and tools can be found in the countries' specific websites.

Several components of the methodology have already been published in separate Briefing Notes and Working Papers. These papers highlight different areas presented in this research report and are all available on the WASHCost website.

Table 1: WASHCost published documents on the research methodology

Name of document	Content description
Briefing note 1: Life-cycle cost approach: Glossary and cost components	What are life-cycle costs (LCC) and how are they evaluated? At the heart of the WASHCost approach is understanding the full costs of water or sanitation services through the whole cycle of installation, wear, repair and renewal. .
Briefing Note 1b - Services are forever: the importance of capital maintenance in ensuring sustainable WASH services	Introduces the concept of capital maintenance expenditure as a way forward to filling the lack of information around full life-cycle costs. .
Working Paper 2 - Ladders for assessing and costing water service delivery	Introduces the concept of service level ladders as a way of differentiating between broad and recognisable types of service
Working Paper 3 - Assessing sanitation service	Sets out a common framework to analyse and compare sanitation cost data across countries with different service delivery standards.

levels	.
Training module on field work methods for assessing unit costs of WASH service delivery in rural and peri-urban areas	Aims to explain the objective(s) of the WASHCost project; to enlighten participants on existing WASH service delivery systems; develop better understanding among participants on WASH governance; to impart the necessary skills in participatory research techniques and data collection and to gain first-hand experience on tracking inputs..
WASHCost Data Organization and Coding Protocol	Describes the agreements reached on how we organise, code, store and share our research data in the WASHCost project..
Working Paper 1 - WASHCost's theory of change: reforms in the water sector and what it means for the use of unit costs	Initial findings from a series of country sector scans carried out during the inception phase of WASHCost. It provides a comparative overview of the decentralised structures, services being provided and the use of unit-cost information in decision making.
Briefing Note 2 - Decentralisation and the use of cost data in WASHCost project countries	This briefing note looks at the WASHCost method of needing to include maintenance and indirect support costs or life-cycle costs.

This version of the research report includes the following sections:

- Section 2 describes the main concepts and terminology used throughout the research report.
- Section 3 explains the purpose and reasoning behind the data being collected and sets out the research questions to be used throughout the five year project.
- Section 4 describes the process of data collection in the four WASHCost countries.
- Section 5 explains the common limitations for comparing existing cost for water and sanitation in low-income and peri-urban area and explains how costs can be aggregated and reported

A checklist with the full list of variables (500 in total) and questionnaires developed for data collection at all institutional levels, is available on request to WASHCost. For more details see Section 4

2 Introduction

This section describes the main concepts and terminology used throughout the research report. These are explained in detail in the following documents: [Briefing note 1: Life-cycle cost approach: Glossary and cost components](#); [Working Paper 2 - Ladders for assessing and costing water service delivery](#); and [Working Paper 3 - Assessing sanitation service levels](#).

2.1 Life cycle costs for sustainable service delivery

The concept of life cycle costs for sustainable service delivery is used throughout the research report. Life-cycle costs (LCC) represent the aggregate costs of ensuring delivery of adequate, equitable and sustainable WASH services to a population in a specified area. These costs include the construction and maintenance of systems in the short and longer term, taking into account the need for hardware and software, operation and maintenance, capital maintenance, the cost of capital, source protection, and the need for direct and indirect support, including training, planning and institutional pro-poor support. The delivery of sustainable services also requires that financial systems are in place to ensure that infrastructure can be replaced at the end of its useful life and to extend delivery systems in response to increases in demand (Fonseca et al., 2010).

The term life-cycle is not meant to mean cradle-to-grave. But in a sustainable system, the costs follow a cycle from capital costs to operation and minor maintenance, to capital maintenance and finally to replacement of infrastructure that has come to the end of its useful life. This may then be extended with more capital maintenance or renewed with additional capital expenditure. The life cycle can refer to the individual system components or/and to the overall costs required within a context of maintaining sustainable services which are (ideally) eternal. The main components of life cycle costs which are going to be used are the following (table 2):

Table 2: Life cycle cost components

Terminology	Description
Capital Expenditure - hardware and software (CapEx)	The capital invested in constructing fixed assets such as concrete structures, pumps and pipes. Investments in fixed assets are occasional and 'lumpy'. It includes the first time the system is build, extension of the system, enhancement and augmentation. CapEx software includes one-off work with stakeholders prior to construction or implementation, extension, enhancement and augmentation.
Operating and minor maintenance expenditure (OpEx)	Expenditure on labour, fuel, chemicals, materials, regular purchases of any bulk water.
Capital maintenance expenditure (CapManEx)	Expenditure on asset renewal, replacement and rehabilitation costs, based upon serviceability and risk criteria. Accounting rules may guide or govern what is included under capital maintenance and the extent to which broad equivalence is achieved between charges for depreciation and expenditure on capital maintenance. Capital maintenance expenditures and potential revenue streams to pay those costs are critical to avoid the failures represented by haphazard

	system rehabilitation.
Cost of Capital (CoC)	Expenditure on the weighted average cost of capital representing interest payments on debt and dividend payments to the equity providers. However, many non-networked services are provided based on grants or soft loans.
Expenditure on direct Support (ExpDS)	Includes expenditure with post-construction support activities for local-level stakeholders, users or user groups. In utility management, expenditure on direct support such as overheads are usually included in OpEx. However, they are rarely included in rural water and sanitation cost estimates. The costs of ensuring that the local government staff has the capacities and resources to help the communities when systems break down or to monitor private sector performance are usually overlooked.
Expenditure on Indirect Support (ExpIDS)	This cost component includes macro-level support, planning and policy making. Indirect support costs include government macro-level planning and policy-making, developing and maintaining frameworks and institutional arrangements, capacity-building for professionals and technicians.

Sources: Adapted from Franceys, Perry and Fonseca, 2006; Fonseca, 2007

2.2 Costing service levels: water and sanitation indicators

The life-cycle costs approach (LCCA) seeks to raise awareness of the importance of life-cycle costs in achieving adequate, equitable and sustainable WASH services, to make reliable cost information readily available and to mainstream the use of LCC in WASH governance processes at every level. A significant element of the LCCA is an understanding that costs can only be compared and properly assessed when they are related to particular levels of service.

Methodologically, one of the options to compare like with like in terms of costs is to compare the costs of a service provided and not, as it is common in the water sector (see Annex 1), comparing the costs of the technologies used to provide the services. By developing the service levels, it is intended to provide a structure to analyse the costing data being collected in different countries and settings. One challenge faced by planners and providers of water services, who want to use cost comparisons to underpin policy decisions, is to be sure that the comparisons they are making are legitimate.

The motivation for using a different service levels has been driven by two main assumptions or hypotheses. The first is that the service levels proposed reflect operational reality in the field - namely an emerging intermediate level of service that mixes elements of basic point source/communal latrines services with those of modern utility services provided through household taps/sewerage systems. The second is that differences between levels of service are non-linear and not directly comparable. Therefore, it is more accurate to compare costs between similar services within a single service level and that by doing so cost ranges will be narrower than those created between aggregated service delivery across all levels.

2.2.1 Service levels for water supply to analyse costs

To compare the costs of providing a service in different contexts or with different technologies, it is essential to first agree on 'what is a service'? What does a service consist of? The service levels for water supply have been developed by identifying a set of core indicators of WASH services and grouping these together

into broad categories of service delivery levels. A pragmatic approach has been taken in which only those indicators that can realistically be identified and relatively easily assessed have been chosen; while the groupings of service levels is informed by the differences in service that are recognisable to most service users and service providers. The existing norms from four very distinct countries (Burkina Faso, Mozambique, Ghana and India) have been used to calibrate the levels.

The five main indicators chosen include quantity, quality, accessibility, reliability, and status of source (Moriarty et al, 2010) as explained in detail in [Working Paper 2 - Ladders for assessing and costing water service delivery](#) and illustrated in Table 3.

Table 3: Service level indicators for water supply

Indicator	Description
Quantity	Quantity is the simplest indicator conceptually and the most commonly used for monitoring and comparing between services. It is typically measured in terms of litres per person per day of water.
Quality	Quality refers to both microbial and chemical quality of water provided. Quality includes a number of different sub-indicators (i.e. biological contamination and several physical parameters). It does not, typically, differ according to service level.
Accessibility	Accessibility refers to the ease (or lack of it) with which people can get water. The time per day spent fetching water incorporates a number of traditional barriers to reducing access such as distance and waiting/queuing time. The most common indicators we see used in national norms are arguably proxies for time (which can be difficult to measure) including: maximum permitted distance to a water point, and maximum permitted crowding (i.e. how many people should share a given point).
Reliability	Reliability (or security) refers to the extent to which the service performs according to expectations. Typically this is expressed as the percentage of time that the service is not fully functional. In India, the concept of security is based on the assumption that all services will fail at some point in time, and therefore that full security can only be achieved by having access to more than one source of supply.
Status of source	This is included to allow direct comparison with the UNICEF Joint Monitoring Programme ladder, the most used in the sector, and basically refers to whether a water supply system is considered 'improved' or 'unimproved'.

Source: Moriarty et. al, 2010

The service ladder which will allow costs for water supply to be compared contains five levels (Table 4), three of which represent different types of acceptable service, with the bottom two representing below standard or unacceptable services.

An acceptable level of service is one that meets agreed norms for each of these indicators. Turning this mix of indicators into a single objectively identifiable aggregate indicator could be complex. However, one simple way to deal with the mix is to say that *the level of service accessed by a person is set by the level of the lowest individual indicator*. That is, a person spending an hour a day taking 30 litres from a reliable borehole of acceptable quality would have access to a sub-standard service because of the time required to undertake this activity - despite other indicators all suggesting a basic service.

Table 4: Indicators and service levels for water supply

	Quantity (l/c/d)	Quality	Accessibility (min/c/d)	Reliability	Status
High	>60	Good	<10	Reliable/ Unreliable	Improved
Intermediate	>40	Acceptable	30		
Basic (normative)	>20		60		
Sub-standard	>5		>60		
No service	<5	Unacceptable	>60	Unreliable/ Insecure	Unimproved

Source: Moriarty et al., 2010

The five levels of services can be broadly defined as described in Table 5.

Table 5: Service level descriptions for water supply

Service level	Description
No service	Less than 5 lpcd of water, or water from a source that is unimproved, provides water of unacceptable quality, or where it takes more than one hour per day to collect.
Sub-standard service	A 'better than nothing' level, between the basic and no-service levels. This level probably corresponds most closely to services that are suffering from endemic problems or where due to context specific issues (such as low population density) it is not possible to meet all service delivery parameters.
Basic service	Providing at least 20 lpcd of acceptable quality drinking water from a secure improved source and requiring no more than 30 mpcd to collect. This level of service is typical of most rural water supply schemes, and also of some informal schemes in peri-urban and slum areas. Also in emergency situations. It is most often provided by point-sources such as boreholes, wells and springs.
Intermediate service	Providing at least 40 lpcd of acceptable quality drinking water from a secure and improved source and requiring no more than 30 mpcd to collect. This level is a mix of basic and high levels of service. It is typically found in small towns and peri-urban areas, and is most often provided by small piped networks. Typically there is more treatment of water than at the basic level and more complex management structures are required.
High service	This level reflects a modern utility service involving taps in the homestead. It provides 60 lpcd as an absolute minimum, but often much more, treated to higher levels of quality and with secure on-demand availability.

Source: Moriarty et al.,2010

2.2.2 Service levels for sanitation to analyse costs

Given that sanitation services are fragmented across a chain of service delivery activities or functions, each with their own associated costs and institutions or actors, a full sanitation service implies both that these functions are fulfilled, and that the linkages in the chain are well articulated. This represents a substantial shift away from an MDG-driven focus on latrines or facilities for the containment of excreta to a service delivery approach that takes the entire delivery chain into account.

This approach allows for context specific variations and operation and maintenance disparities in the ranking of sanitation facilities or technology options. For example, a well operated and maintained VIP is arguably a higher level of service than a badly maintained septic tank system or a full flush system with inadequate water supply. In fact, 'higher' or more sophisticated technology options that are not well operated or maintained represent a substantially graver public health and environmental risk than options lower down the traditional sanitation technology ladder.

The service delivery approach also accommodates the reality that appropriate technology options are highly contextual and dependent on a range of factors including settlement densities, soil conditions, geo-hydrological conditions, the availability of water and socioeconomic conditions. The service parameters and respective critical indicators which point to a 'sanitation service' are described in Table 6. The four main indicators chosen and explained in detail in Working Paper 3 - Assessing sanitation service levels are accessibility, use, reliability and environmental protection (Potter et. al,2010).

Table 6: Service level indicators for sanitation

Service parameters	Service indicators
Accessibility	Distance from users, effort required for use, safety, privacy ¹ , dignity, minimises flies and bad odours, waiting time in the case of communal facilities.
Use	Safe and hygienic use by all members of the household, day and night and in all seasons, and infant faeces disposed of in the latrine.
Reliability	Effort required for operation and maintenance of the toilet, e.g. pit desludging (mechanical) or emptying (manual). Operation and maintenance safe for users and service providers. Longevity and robustness of top and 'underground' structures.
Environmental protection	Environmentally safe containment, collection, treatment, disposal and re-use of excreta and urine. Productive re-use of safe by-products.

Source: Potter et al, 2010

Scale and affordability are also important service parameters. Scale refers to the number or proportion of people who are covered by a service in the area of study. In WASHCost this will be addressed, not through

¹ This indicator does not refer only to individual household latrines. Privacy is also possible with communal facilities and refers to having a door and walls for privacy and safety.

monitoring specific indicators but through data aggregation and analysis. Affordability can be analysed as a correlation between costs at different service levels and household income levels.

Based on the four service parameters above, detailed indicators (see Potter et al, 2010) and taking into account the reality of sanitation services in the focus countries and all functional areas of the sanitation service delivery chain, we propose a service ladder of five broad categories or levels (Table 7): highly improved service, improved service, basic service, limited service and no service or unacceptable service. 'Limited' service is included in recognition of the fact that there are some practices (such as deep burial of faeces) which do not meet the standards for a basic service but have to be regarded as better than open defecation. A contradiction that emerges from these definitions is that while a limited service may be better than nothing, it does not really qualify as a service at all. It is a least-worst, self-help solution.

These proposed parameters and indicators have been developed from the perspective of the users, the provider and the wider population (environmental protection), and are based on the principle of something better, for all, forever.

The WASHCost sanitation ladder is designed as an analytical tool to allow for cross country comparison. It is suggested that the indicators of service delivery not only take into account the international sustainable sanitation service criteria but also relate specifically to various country contexts (an aggregation of national norms and standards) to effectively construct country specific ladders.

Table 7: Indicators and service levels for sanitation

	Accessibility	Use	Reliability (O&M)	Environmental protection
Highly improved service	Each family dwelling has sufficient toilets for all members	Used by women, men and children, and infant faeces are disposed of in toilet.	Routine O&M service requiring little user effort	Positive environmental impact, e.g. productive reuse of safe by-products
Improved service	Each family dwelling has a toilet in the compound		Regular O&M service requiring minimal user effort	Non problematic environmental impact/ safe disposal
Basic service	Cement slab (hh or shared) at national norm distance from hh	All family members use toilets	Weak O&M requiring high user effort	
Limited 'service'	Platform separates faeces from user	Used by some family members	O&M difficult to access/ doesn't happen	Significant environmental pollution, increasing with increased population density
No 'service'	No separation between user and faeces, e.g. open defecation	No use	Not applicable	

Source: Potter et al, 2010

The five levels of services can be broadly defined as detailed in Table 8.

Table 8: Service level descriptions for sanitation

Service level	Description
No service	There is no separation between the user and faeces, e.g. open defecation, and there is significant environmental pollution increasing with population density.
Limited service	A platform separates the user from faeces, and there is significant environmental pollution increasing with population density.
Basic service	All household members have reasonable access to and use a safe, relatively robust, private facility, available hand washing facilities, weak maintenance provisions, and non problematic environmental impact or safe disposal of sludge.
Intermediate service	At this level, all household members have easy access at all times and use a convenient, private, safe, robust facility which seals against flies and bad odours, have nearby hand washing facilities, regular O&M, and there is non-problematic environmental impact or safe disposal of sludge
Highly improved service	At this level, all household members have immediate access to and use at all times a convenient, private, safe, robust, secure sanitation facility which seals against flies and bad odours, as well as immediate access to hand, anal and latrine cleansing facilities with soap, with routine O&M, and there is positive environmental impact, e.g. productive re-use of safe by-products.

Source: Potter et al, 2010

2.2.3 Hygiene services

Hygiene covers a range of health and environmental issues, including the use of water and sanitation to block the transmission of related diseases and towards better health. Hygiene is a central component in both water and sanitation services and cannot be an add-on to either the water or sanitation service ladders.

It is widely accepted that effective, sustainable hygiene promotion cannot be achieved through a once-only intervention but requires ongoing activities from multiple sources. Hygiene promotion can be seen as a public or environmental health function and therefore 'a service', either undertaken by public or environmental health departments or by the sanitation provider or utility. However, water and/or sanitation infrastructure related hygiene promotion is usually an intervention that happens between one and five times in a project cycle and is unlikely to result in sustainable improvement in hygiene practices on its own.

Arguably, hygiene promotion will only result in sustainable behaviour change if it is an ongoing, integrated service. This is an important advocacy issue and also has important implications for the development of a WASHCost hygiene ladder. It seems likely therefore that a hygiene service ladder could be described as ideal, basic and unimproved (see table 9).

It is beyond a realistic scope of WASHCost research to collect cost and service level data for the full range of hygiene services in any focus country. However, it is necessary to concentrate data collection on hygiene promotion related to water and sanitation infrastructure development. WASHCost will cost selected hygiene interventions that are believed to be successful and where that cost data is available. Hygiene cost data

collection will focus on CapEx software (hygiene promotion and sanitation demand creation) and direct and indirect support costs for hygiene interventions linked to water and sanitation infrastructure improvement.

Table 9: Service level descriptions for hygiene interventions

Hygiene intervention	Description
Unimproved	Inadequate water and sanitation infrastructure-related hygiene promotion
Basic	Adequate water and sanitation infrastructure-related hygiene promotion
Ideal	Environmental or public health driven hygiene promotion integrated/linked to water and sanitation infrastructure development promotion activities

Source: Potter et al, 2010

3 WASHCost research questions

This section explains the purpose and reasoning behind the data being collected and sets out the research questions to be used throughout the five year project.

3.1 Purpose of the information being collected in WASHCost

Collecting and understanding costs and service levels is a primary aim of the WASHCost project. However, the life cycle costs approach (LCCA) goes beyond achieving the technical ability to quantify and make costs readily available. The LCCA seeks to influence sector understanding of why this approach is central to improved and sustained service delivery and to influence the behaviour of sector stakeholders, so that life cycle unit costs are mainstreamed into WASH governance processes at local, national and international levels. WASHCost therefore aims to increase the ability and willingness of both users and those involved in service planning, budgeting and delivery, to make informed and relevant choices between different types and levels of WASH service.

A significant element of the LCCA is an understanding that costs can only be compared and properly assessed when they are related to particular levels of service. WASHCost specifically aims to draw attention to the LCC of pro-poor WASH services delivery, including water for small-scale productive uses. WASHCost aims to help national and decentralised sector bodies embed this understanding and use of life-cycle costs so that it becomes institutionalised, owned and actively used nationally and internationally. National bodies are encouraged to develop and maintain their own LCC databases and incorporate them into management information systems (MIS) and decision-support tools (DST).

The overall purpose of collecting information in WASHCost is to contribute to more sustainable, equitable and efficient WASH services delivery. The four purposes below should be considered within an overall context of improving WASH services delivery.

The first purpose for collecting information using an LCCA is to understand the relative magnitude of different costs over a period of time with a goal towards setting policy and policy-informed planning and budgets. This information is to be used by sector professionals which are interested in providing a long term service in a geographically-limited area. International and national policy makers will have a better perspective on:

- the range of costs for different types of infrastructure. For example, hand-pump and shallow borehole based services versus gravity fed spring systems. (see Research Question 1)
- the range of costs for different service levels. For example, the cost of a basic service where people access a minimum of 20 litres per capita per day of acceptable quality water from an improved source spending no more than 30 minutes per day; or the cost of an intermediate service where people access a minimum of 40 litres per capita per day of acceptable quality water from an improved source spending no more than 30 minutes per day; (see Research Question 2)
- the cost to move from one service level to another (enhancement). (part of Research Question 2)
- the relative weight of different cost components (e.g. capital versus operation and maintenance costs for different types of systems and services over a period of time). (Research Questions 1 and 2)

This information helps planning at 'macro level' and will shed light on some areas we still do not know much about. The outputs can, using statistical analysis, determine the expected range of such costs (maximum and minimum within specified confidence limits). Alternatively, the information can be used in reverse, i.e. based upon a set budget what can be delivered in terms of population served and level of services.

The second purpose is for poverty analysis and improved effectiveness for planning new services (Research Question 3). WASH services are central to addressing poverty, economic development, livelihoods and health. Lack of accurate information, especially on and in rural and peri-urban areas in the developing world, makes it impossible to estimate the true cost of extending sustainable and good quality water and sanitation services to the poorest.

WASHCost research will look at unit costs to serve the poorest within a district or specific communities and the differences between ‘designed for’ and ‘received’ quality of service. This is a fundamental issue for WASHCost, as almost all existing data on costs is for ‘as designed’ service with almost no exploration of the real costs that people pay for actual services received. Even within areas that are nominally covered, closer disaggregation at household and individual levels, identifies pockets of reduced access to services that, when taken together, represent a substantial part of the population nominally served.

The third purpose is to understand cost drivers (Research Question 4). What are the factors that explain the overall magnitude and relative magnitude of costs? What are the main factors that affect the costs and by how much? (For example, components of infrastructure; how costs change based on population density or hydro-geological characteristics and if the delivery mechanism is a cost driver).

The fourth purpose is to achieve cost efficiency through benchmarking (Research Question 5) and the development of ‘golden indicators’ for WASH services not provided by formal utilities. The WASHCost theory of change suggests that capital investment costs are higher than necessary because there is lack of effectiveness in setting up infrastructures and transparency on real costs. Similarly, operation and maintenance costs are undervalued and direct support costs ignored altogether. This analysis requires a list of inputs into water and sanitation services (e.g. drilling borehole through x type of rock to 300 metres, replacement parts, staff time for follow up and monitoring, etc) that are going to be used in all countries. It is not an extensive list or a bill of quantities, but should cover the critical elements which are part of a specific system construction and maintenance.

The goal is to collect information on official costs (as completed, as invoiced, etc.) for each of these items. This information can be used to compare different cost component across projects, across districts and regions or across countries. Potentially, an analysis of inputs versus outputs will be able to reveal if and why costs are set unnecessarily high or if set unrealistically low to allow sustainable services.

3.2 The WASHCost research questions

The purpose of collecting information can be translated into the following research questions, sub-questions and possible analysis (with increasing level of complexity). They follow a list of priorities taking into account the needs of country stakeholders and the priorities of the WASHCost project to achieve its aims.

Research Question 0

How are budgeting and planning decisions for WASH made at present by national and decentralised bodies? What are the main drivers for budgeting? What costs are used for such decisions?

This is a critical question which allows us to define the WASHCost strategy in each country and at international level to improve budgeting and planning decisions for WASH. This part of the work is being conducted through case studies and reflective learning with Learning Alliances in each country. Initial findings have been collected in [Briefing Note 2 - Decentralisation and the use of cost data in WASHCost project countries](#) and [Working Paper 1 - WASHCost’s theory of change: reforms in the water sector and what it means for the use of unit costs](#). Additional work will be done to study the extent to which decision support mechanisms and tools are being used in countries and at international level. The details of this work are not

part of this research report.

Research Question 1

What is the current, actual and relative magnitude of different cost components (Capital Expenditure, Operational Expenditure, Capital Maintenance Expenditure, etc.) per technology, per capita, per household, per m3 delivered?

For most country stakeholders and donors this is an important question. It's a valid question but limited as costs per technology say little about the service actually provided. It refers to the cost per type of infrastructure (bore well, pump, stand posts, latrine, etc.). Both water and sanitation infrastructures will also be considered and we will be able to calculate the amount of household contribution.

Frequently Asked Questions (FAQs) related to this research question:

- How much is spent on system rehabilitation versus new system construction?
- Considering expenditures in capital infrastructure: What is the relative weight of software and hardware costs in current projects and in different types of projects? How has the relative weight changed over time?
- Do maintenance costs increase in older systems?

Research Question 2

What is the current, actual and relative magnitude of different cost components (CapEx, OpEx, CapManEx, etc.) per service level?

This is the critical question for the WASHCost LCCA. It relates to the costs of a specific service delivered (service level). It includes the quantity provided, the quality provided, the time to access water or sanitation service and the reliability of the service provided. The units of analysis are very broad: costs per person, household, village, district, region or equivalents.

FAQs related to this research question:

- What is the magnitude of household level spending/investments in improving service levels?
- Comparing income levels with household required expenditures: are costs a barrier to move from one service level to another?
- Do household investments decline as investments in infrastructure increase?
- As systems become larger or population density increases, do direct support costs per capita decrease proportionally? What's the turning point when costs start increasing proportionally to increase in coverage? (In urban utilities, it is about 500.000 customers.)

Research Question 3

How do service levels received by poor and non-poor households differ?

This research question is to compare the service level received by the poorest with non-poor, but also to gauge the difference between 'designed for' and actually received quality of service. How much will it cost to move from one service level to a higher one?

FAQs related with this research question:

- How much are households contributing towards services?
- What are the costs components of delivering services to the lowest income quintile?
- What proportion of a population is allowed to experience a sub-standard quality of service before the entire service is seen as failing?

Research Question 4

What are the main cost drivers for providing a sustainable service?

This question looks into the most important cost components and externalities that determine the overall costs of a service. It will consider the prices of primary inputs such as: energy (90% of cement costs are driven by energy costs), labour and oil (critical input for costs of plastic pipes, generators, motors, etc.).

FAQs related with this research question:

- Within a specific technology what are the main components that drive the costs?
- What are the drivers of Capital Expenditure for different technologies?

Research Question 5

What are the ‘golden indicators’ for analysis of sustainable and equitable WASH service delivery?

In the urban water sector there are several indicators which are useful to understand the performance of the utility. These indicators also form the basis of benchmarking systems. For rural water there are no sector-recognised benchmarks for conducting sustainability audits.

FAQs related with this research question:

- What is the average weight of expenditure on indirect support for WASH given overall government expenditure?
- What are the specific ratios related with value for money, accountability, cost effectiveness?

Other general sub questions which apply to all the above:

- Actual versus ideal costs: actual expenditures against should be (or norms) expenditures.
- Cost projections: adjusted by inflation and other specific price indices.
- International cost comparisons.
- What type of cost analysis fits under different approaches towards budgeting/planning: cash account, fixed asset accounting (regulation), economic cost?

3.3 Timing of data analysis outputs

During 2010, first level analysis using basic statistic packages will provide the initial answers to research questions (RQ) 1 and 2. During 2011, more details and in-depth analysis will be undertaken on RQ1, RQ2 and RQ3. Additionally, with more sophisticated data analysis, including Bayesian networks, first analysis for RQ3 and RQ4 will also be presented in 2011. Development of RQ5 – the benchmarks - will be undertaken throughout 2011/2012.

3.4 The core of the information required to cost service levels

Taking into account the research questions, the purpose of data collection, costs and service levels, the core data and information to be collected can be broadly grouped under the following categories (Table 10):

Table 10: Summary of core information required to cost service levels

Main Component	Sub-components
General and contextual information	Sample data; geographic data (GPS); climatic and geological data; demographic and coverage data; socio-economic indicators
Technologies and infrastructure	Water infrastructure; sanitation infrastructure
Cost information - Water	Capital expenditure (hardware and software), including costs and time spend by households; capital maintenance expenditure; operational and minor maintenance expenditure; costs of capital; expenditure on direct support; and expenditure on indirect support
Cost information - Sanitation	All costs mentioned above apply also to sanitation
Cost information - Hygiene	Captured within the cost information of water and sanitation (and then disaggregated when possible)
Service levels - Water	Quantity; quality; accessibility; reliability; status
Service levels Sanitation	Accessibility; use; reliability; environmental protection
Hygiene interventions	Additional questions on interventions not captured with the service levels for water and sanitation
Cost drivers	At the moment mainly capital expenditure cost drivers
Currency and financial	Market exchange rates; PPP exchange rates; inflation (GDP deflator; inflation)

For each of these components there are several variables that need to be collected. A checklist with the full list of variables (500 in total) and tools used and triangulation process for each variable, is available on request to WASHCost. The questionnaires developed for data collection at all the institutional levels is also available.

Data will be entered under strict guidelines to ensure that each database can be aggregated from the four countries and international comparisons can be made. A detailed description of that process is outlined in [WASHCost Data Organization and Coding Protocol](#) (Verhoeven et al, 2010).

4 Data collection: lessons learned from the methodologies used

This section describes the process of data collection in the four WASHCost countries. A set of conditions were embedded to ensure that data collection on relevant costs could take place: sampling strategies were defined, a list of variables was developed, location of the cost data was identified, tools tested and specific research undertaken to make many of the costs explicit.

4.1 Requirements for data collection (ensuring that data is used)

To be credible, the change needed in the current system of costing WASH services has to be based on evidence. For conclusions to influence a range of institutions and actors, it requires that the data collection and analysis is well embedded in the sector, and that the LCCA is understood and reflected in policy making, budgeting and planning.

An objective of this framework is to ensure that cost data is used by those that make allocations decisions. One of the methodologies used to achieve broad influence geographically and within the sector (including the most influential stakeholders: donors, NGOs as well as different government departments) is called the Learning Alliance (ref). A Learning Alliance can facilitate this change as a multi stakeholder body functioning at various levels (national / state / district / local government) and create spaces, not only for information exchange, but also to learn from experience and research. Government institutions, local government, donors, NGOs (national and international), CBOs, academic departments of universities resource centres and other sector institutions can take part in this process. The learning spaces in such platforms are facilitated to ensure the greatest possible participation and that real learning takes place. The key elements for success are the openness of the institutions present, a space where learning takes place (as opposed to planning, or defending/promoting a specific agenda) and the fact that lessons learned are taken back into the organisations and influence practice.

Country teams that have used this framework have created or linked up with existing Learning Alliances. These platforms bring together a diversity of WASH stakeholders which have a direct or indirect interest in the information being collected and analysed. In some countries the Learning Alliances are called Sector Platforms, Advisory Groups, Steering Committees or Working Groups or a combination of these.

Some critical requirements for data collection in all the countries have included:

- Institutional embedding with and within national WASH governmental departments and large project implementation agencies to facilitate the data collection, testbed site selection, approval of sampling strategies, engagement and debate in data analysis.
- Engagement with national sector information and monitoring initiatives for the use of existing data, statistics and coding procedures to enable synergies of data collection and to strengthen access to secondary data and facilitate embedding beyond the project duration.
- Establishing specific partnerships with operators and formal utilities for access to peri-urban data and information.
- Formalising relationships with universities and research institutions who are willing to mobilise researchers and students for data collection, conduct specific side studies, replicate the

methodology (social sciences and economics departments) and support data analysis and visualisation (departments of applied maths/statistics).

- Establishing agreements with regional/district staff when conducting data collection. Some government staff will want to be part of the team and cost-sharing arrangements (transport, initial contact with communities) make it easier and faster to keep to a schedule.
- Facilitation of a number of sector meetings at central and provincial level contribute to the discussion of relevant sector issues such as data collection and storage, service level and decentralisation support to districts.
- Providing regular (minimum bi-annual) cycles of feedback and preliminary data analysis to Learning Alliance members.

4.2 Sampling strategies for costing technologies and service levels

The sampling strategies for collecting cost data have to follow different criteria at different (governance) levels. The research teams together with the Learning Alliance (LA) platforms have selected the study regions based on the following criteria.

The criteria for the first level – mainly regions and provinces - has been:

- hydro-geological and hydro-climatic conditions prevailing in a country maximising diversity of infrastructures and therefore providing different costs for different technologies and different service levels;
- the presence of development partners or donors to guarantee that there has been implementation of improved water supply services and sanitation, maximising both data availability and interest in the outcomes.

Criteria for the second level concerns the selection of rural communities and small towns within the districts:

- Population size and point source intensity of use (for the rural communities), ensuring a diversity of dispersed and more densely populated areas;
- Socio-economic status of community within the district has been a mix between the poorest areas and the not so poor;
- Infrastructures available within the communities (to keep ensuring technological diversity mentioned in the first set of criteria);
- Age of water supply facilities. Communities with a point source more than 10 years old are preferable. However, within a district if most of the point sources have ages less than 10 years then those with at least 3 – 5 years old are chosen.

The third and last level is the selection of households within each community. The first stage involves light household surveys for all houses. The second stage involves detailed household surveys, including:

- main economic activity of household is used as a proxy to group poor and non-poor households.
- 30 – 40 households per rural community randomly chosen at different distances from water points.
- an initial quick survey giving the teams basic estimates of service levels gathered in a focus group discussion, observation of a water point and discussion with water users. Once the basic information

is analysed, the teams decide which communities will be revisited to complete a full set of household interviews.

Table 11 summarises the sampling strategies for the different countries.

4.3 Main advantages and limitations of the sampling strategy

The approach to sampling outlined above has four main advantages:

- One can draw a sample of villages that is representative of a geographic area (country, region, district, etc);
- Having information about all components of unit costs in a number of cases makes it possible to compare the relative magnitude of different costs in particular cases (and ideally to identify the factors that explain these differences);
- Possibility to relate unit costs with detailed information about service levels at the village and household levels;
- Possibility to gather information on some cost components in a larger number of villages and to make an informed strategic choice about where to spend the energy conducting detailed household surveys. For example, household surveys might not be done in villages with unreliable CapEX or OpEx information, or preference may be given to villages with very different cost structures to determine if there is a relationship between cost and service level.

The approach also has a number of disadvantages:

- Collecting the full range of unit cost components for a single case is hard. Information about CapEX, CapManEx and OpEx varies a lot across sites and even across systems within a particular site. To fill in each cost component for every site requires a combination of data points of different qualities – real data, estimated data, etc. The variation across cases will be largely based on the assumptions made to create estimates where real data is not available.
- The entire sampling strategy and analytical strategy has a focus on water. In Ghana there is 58% water coverage and 20% sanitation coverage, which explains why trying to put sanitation into the water framework is not working. In each village, every single latrine is visited. There is little information currently available on sanitation. This situation is reflected in the realities of the countries, but does not provide the answers on the costs of sanitation.
- If a main policy question in a particular country is to compare costs of two different specific approaches to providing sanitation services, then one might instead choose to create a sample that includes x cases of each service approach.



Table 11: Summary table of country teams sampling strategies first half 2010

	Mozambique	Ghana	Burkina	India (Andhra Pradesh)
	<p>46 rural communities (20HH/com)</p> <p>22 peri-urban areas (20HH/town)</p> <p>Total: minimum 1.360 HH surveys</p>	<p>90 rural communities (minimum 30 HH/com)</p> <p>18 small towns (80 HH/ town)</p> <p>Total: minimum 4.140 HH surveys</p>	<p>44 sections of 6 rural sites</p> <p>2 small towns and 1 peri-urban area</p> <p>Total: minimum 7.300 HH rapid surveys and 500 HH detailed surveys</p>	<p>90 rural habitations (50HH/hab.)</p> <p>9 to 18 peri-urban areas (50HH/hab.)</p> <p>Total: minimum 4.950 HH surveys</p>
First level sampling: Regions, Provinces and Zones	<p>5 Provinces out of 10 Rural Provinces, additional Province: peri-urban area of Maputo</p> <p>Criteria:</p> <p>Regional spread to capture main different hydro geological areas</p> <p>National rapid assessment on main technologies available</p> <p>Levels of decentralisation and presence of completed and ongoing large programmes to enhance data availability and usage of data</p>	<p>3 Regions out of 10 Regions (Northern, Ashanti and Volta) and 3 districts in each Region</p> <p>Additionally: peri-urban area of Accra</p> <p>Criteria:</p> <p>Hydro geological and hydro climatic conditions</p> <p>3 different donors involved in infrastructure implementation (and therefore data availability)</p>	<p>3 Regions out of 13 Regions</p> <p>Additionally: 2 small towns and peri urban area of Ouagadougou</p> <p>Criteria:</p> <p>Hydro geological and climatic conditions</p> <p>National inventory of infrastructure water and sanitation</p> <p>Decentralisation levels (Region-Commune-Community)</p> <p>4 different donors involved in infrastructure</p>	<p>9 zones out of 9 zones</p> <p>Criteria:</p> <p>9 agro-climatic zones of the State – reflect rainfall, water quality, water source and scarcity</p>



<p>Second level sampling: rural communities, peri-urban areas and small towns</p>	<p>Within the 6 Provinces: 46 rural communities 22 small towns/peri-urban</p> <p>Criteria for rural communities: Communities using improved water supply (40) and 6 without improved supply Randomised sampling to cover variance in households, following the sampling strategy of the MICS2 of the bureau of statistics (BS) In addition, 20% of sample in rural areas expected to have small systems.</p> <p>Criteria for small towns/peri-urban areas: With improved water supply (21) and one without Poorest areas reported by BS</p>	<p>Within the 9 districts: 90 rural communities 18 small towns/peri-urban</p> <p>Criteria for rural communities: Population size (small/medium or large village) Intensity of use per source (high, normal, low) Socio-economic status: communities tagged as poor and no-poor Diversity of infrastructure Age of water supply facilities</p> <p>Criteria for small towns/peri-urban areas: Diversity of water supply technology options Socio-economic features (same features as rural communities)</p>	<p>Within the 3 Regions: 18 rural communities 3 small town 6 peri urban</p> <p>Criteria for rural communities: Spread of technologies/ diversity of infrastructure Coverage data Diversity of management systems</p> <p>Criteria for small towns/peri-urban areas: Spread of technologies/ diversity of infrastructure Diversity of management systems Specific case of study: role of new decentralised entity in both water management and public latrines management</p>	<p>Within the 9 Zones: 90 rural communities 9 peri-urban areas (detailed info) 9 peri-urban areas (only secondary data)</p> <p>Criteria for rural communities: Status of WASH per habitation (fully covered, partially covered, no safe source) Different population sizes Availability of data at District level</p> <p>Criteria for peri-urban areas: Peri-urban users are those not directly or fully served by (conventional) urban utilities but located on the periphery or very close to the urban areas. Select the locations predominantly with poor households</p>
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<p>Third level sampling: household level</p>	<p>Expected HH surveys: 20HH per community plus 22HH per peri urban areas</p> <p>Rapid assessment: MICS study</p> <p>Criteria for hh survey:</p> <p>Random starting from main water point</p> <p>Every second hh in rural and every third in peri urban and small towns</p>	<p>Expected HH surveys: minimum 30 HH per community (up to 50HH) plus 80 HH per small town</p> <p>Rapid assessment: in all HH</p> <p>Criteria for hh surveys:</p> <p>In communities with point source all HH are surveyed (up to 50HH)</p> <p>In the small towns, the main economic activity of breadwinner drives the sample (for indication of poverty status)</p>	<p>Expected HH surveys: 40 HH per area (water) plus 55 HH per area (sanitation) plus minimum 87 water points surveys</p> <p>Rapid assessment: census (all HH); focus group (all areas)</p> <p>Criteria for hh surveys:</p> <p>Poverty status;</p> <p>Identification of HH at water point survey</p>	<p>Expected HH surveys: 50HH per habitation both in urban and rural area</p> <p>Rapid assessment: in all HH</p> <p>Criteria for hh surveys:</p> <p>Segregating HH as head reach, middle and tail end of water supply</p> <p>Within each category separate HH based on caste classification and land holding</p> <p>Use lottery method for final selection</p> <p>Criteria for hh survey in urban areas:</p> <p>Annual income and caste category</p>
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¹ MICS: Multiple Indicator Cluster Survey

4.4 Variables required and sources of information

As explained in section 3, several variables and data had to be collected both for costs and for the service levels. Country teams have reported where they have obtained the information on costs and service levels.

Table 12 indicates the sources of the most critical components.

Table 12 Required cost and service level information per main source

Cost information	Where can the information be found?	
	Expenditures made by government; NGOs; private sector, etc	Expenditures made by households
CapEx – water	Donors; Gov. departments at national and provincial level; regional and district level; NGOs; private sector: design and project completion reports	CBOs; HH: surveys
CapManEx –water	Regional and district level; small town boards; CBOs; user associations; area mechanics: mainly interviews	
CapEx/CapManEx – sanitation	NGOs; HH: surveys	HH level: surveys
OpEx	District; CBOs; operators; spare part shops: records	HH level: surveys
Cost of Capital	National water and sanitation departments; World Bank	
Exp. Direct Support	Regional/district level/NGOs: contracts with NGOs for training and awareness raising; budgets for supervision of regional/district authorities; NGO budgets; private consultants	
Exp. Indirect Support	Budget Ministry Water	

Other variables	Where can the information be found?
Service levels – water	Community/HH level: surveys
Service levels – sanitation	Community/HH level: surveys
Costs of main system components	Spare part shops, private sector and CBOs

4.5 Tools used for data collection

This section describes the main tools used to collect the 500 variables and data as described in an excel annex available on request to WASHCost.

4.5.1 Tools used at village, community and household level

Geographic Information

There is general agreement that the design of WASH schemes could be improved if good topographical quality maps were more readily available showing the location and status of existing WASH infrastructure, the location of safe reliable water sources and existing patterns of demand for and actual to WASH services.

Looking at access and exclusion is made simpler if maps are available. In India, a total station surveying tool is used to make detailed (house/street level) maps including contours (for drainage). In other countries, the outlines of villages, main roads and the water points are being identified with GPS. Having these maps also makes household sampling easier in terms of identifying a sample. Ideally, the maps should be completed before starting to apply the following tools – as it can help with many other activities – such as triangulating between household and water point surveys in areas with more than one water point.

System technical (and financial) surveys

For each system identified (borehole, pipe-network, latrines etc.) a technical survey is made. This involves looking at the system from source to user – including at least some technical assessment of household activities such as storage and treatment. The technical survey clearly identifies the system which is then linked to the household surveys. The 'technical' survey also seeks information on costs – particularly on CapEx and CapManEx.

Focus Group Discussions (FGD)

A focus group discussion is a group discussion of approximately 6 - 12 people guided by a facilitator, during which group members talk freely and spontaneously about a certain topic or issue. A FGD is a qualitative method whose main purpose is to obtain in-depth information on concepts, perceptions and ideas of a group. A FGD aims to be more than a question-answer interaction. FGDs at and around the system (stand post, pump etc) are very useful for providing a broad brush understanding of key issues of service levels such as use and access. This can be done using a qualitative information system based approach integrated into the questionnaires.

Key Informant Interview (KII)

A key informant is a knowledgeable person who has specific knowledge in an area of interest to a project. This person could be young or old or from any social group. (S)he may have had specialist training (e.g. a university degree); be someone with authority within a government department or an NGO; be an artisan (e.g. a pump operator or waterman); be a community leader (e.g. an elected official or a village elder), be a member of the community; or even a vagrant with no fixed abode. Valuable information can be obtained from a key informant (or a group of key informants) during an interview that can take many different forms - an informal discussion over lunch, driving to a meeting, a formal structured discussion based on a questionnaire, a semi-structured discussion based loosely around a questionnaire or a telephone interview. KIIs are very useful sources of background information and can help to give context or to fill in gaps in other data sources and are particularly useful for developing a timeline (history) of services in the study area or to collect expenditures made throughout the years which are not recorded anywhere.

Household surveys

These surveys are at the heart of getting a detailed and statistically valid understanding of key issues. These issues range from access and use of services, to expenditures and own contributions to maintain and increase service levels. The questionnaires also capture time to allow for economic analysis.

Other tools used at village level:

Auditing of village level records - Where available, village level records - such as management committee reports from within the community – are invaluable in providing direct input into the cost components.

Village start-up and validation meetings - this concerns a meeting at the start and end of the work to tell villagers what the teams are planning to do and to discuss findings afterwards.

4.5.2 Tools used at district, regional and national level

The next series of tools are for use at the district, regional and national level. At this level, most of the support expenditures (direct and indirect) are collected and where national and community information can be triangulated. In many contexts it is also the only way to find about CapEx, CapMan costs and costs of capital. It is also the main source for national level contextual information, demographic and economic data, statistical analysis of poverty and collect cost drivers.

The challenge faced is that most of this data is not recorded or records cannot be found. Therefore, a mix of specific research using several tools is required. Collecting this information takes time and requires well recognised, respected and very skilled staff.

District level key informant interviews - Similar to village level key informants: interviews with key actors (such as district engineers, planners, health extension staff, area mechanisms, etc.)

Regional and national level key informant interviews - Can be particularly useful for collecting donor/consultant reports which seem to have vanished, for developing a timeline (history) of services in the study areas and to collect expenditures made throughout the years which are not recorded anywhere.

Official government data - A catch all to get project completion reports that might have information on CapEx or expenditure on direct support for village schemes but also to get district level demographic information, hydrology aspects, water resource availability etc.

4.5.3 Specific research – in combination with the tools above

District level capacity survey - This tool is essential for calculating expenditure on direct support costs to communities. The survey makes an inventory of what capacities and structures are in place to support the WASH services in the village post construction: people, machines, computers, salaries, etc – and together with KII and data collection calculates the cost. It is also useful to identify where gaps exist between actual capacity and what is planned under national human resources strategies etc (if such exist) which is relevant data to feed into Learning Alliances discussions.

Regional and national level focus group discussions - Ideal to triangulate, validate and collect additional information. Critical for the future use of the life cycle cost approach in planning, budgeting and monitoring. These can take the form of Learning Alliances, advisory groups, task forces and discussions within existing multi-stakeholder coordination platforms.

4.6 Which tool for which type of information?

The sources of data for one variable can be found with different tools at different levels. Table 13 revisits the primary sources of information adding which tool is most useful for each of the components.

The excel annex shows the second and third sources of information suggesting triangulation possibilities. Some examples of possible triangulation include: comparing community CapEx contributions with CapEx figures given in project completion reports, and comparing CapManEx figures from water and sanitation Boards with the information obtained from area mechanics. For rural boreholes and handpumps the area mechanics and spare part dealers could be very helpful in providing information about OpEx and even about CapManEx. Service providers can supply information about sanitation. CapEx information about sanitation from household surveys can be triangulated with information from the district water and sanitation office. Between governmental data and data obtained from NGOs, CapEx can be triangulated by checking information and quotes from contractors. If there is a discrepancy of more than 20 percent in the triangulations, then data collection needs to be rechecked.

Table 13: Primary sources of data: count of variables per cost categories and tools

Cost Categories	Tools used to collect variables							Grand Total
	Specific research	HH survey	Technical survey	Official government data	KII	FGD	GIS	
General	2							2
Contextual Information	12	17	7	36			18	90
Technologies and infrastructure	16	10	30	2	5			63
Water - Cost components	131	17	27	6	3	13		197
Sanitation - Cost components	61	14			17	7		99
Water - Service levels	1	31		3		2		37
Sanitation - Service levels		12				1		13
Hygiene (which have not been collected above)		3						3
CapEx cost drivers	20							20
Currency and financial variables	4							4
Grand Total	247	104	64	47	25	23	18	528

4.7 Lessons learned from data collection

Some specific difficulties in collecting data have been reported. These include:

- Collecting data at household and community level is not a problem, but collecting cost data at national level is mostly based on personal connections with senior staff;
- Getting hold of good quality completed project reports is difficult. Even if they are available, they simply give lump-sum (rather than disaggregated) costs, especially for water point sources;
- Some NGOs that installed water points no longer exist and the data has disappeared with them;
- Finding data older than three years is a problem. In one specific country, everyone mentions a “box with data”, but the team cannot find it. A government staff member, who knows the agency well and

is also working with the data collection team, knows where to look and said: “The box containing the documents from ten years, nobody knows where it is.” Far from anecdotal, this is a message heard frequently all across the four country teams;

- Data is especially limited for sanitation. In rural areas traditional toilets are hardly said to have costs, while in urban areas, emptying toilets is very irregular;
- Sources of information are extremely scattered as shown in an example below from Burkina Faso on only two cost elements for water (Figure 1). This is made more of a challenge because with decentralisation different departments change their responsibilities and records are very difficult to recover. Institutional maps for locating and discussing cost information are useful before data is collected – only to find at the end that critical stakeholders have the data needed.

BURKINA FASO - SOURCES OF DATA				
Costs	Infrastructure	National level	Regional level	Local level
CapEx hardware	Standpipe			
	Borehole			
	PEA (tapstand)			
CapEx software	Standpipe			
	Borehole			
	PEA (tapstand)			
CapManEx	Standpipe			
	Borehole			
	PEA (tapstand)			

Figure 1: Sources of information for Capital Expenditure (CapEx) and Capital Maintenance Expenditure (CapManEx) cost data, WASHCost Burkina Faso team, 2010

- Problems arose reconciling data collected at village level with official government figures. There is a tendency with some data collectors to rapidly deny that the data from villages was valid if it did not match the official figures.
- Elections in two of the countries prevented collection of any data at community level for three months.
- During the testing phase, collaboration agreements were set up, but issues remained with data ownership when the data collection was commissioned to other organisations and the WASHCost team could either: 1) not access the raw data or 2) the organisation did not really understand why the data was being collected or have any use for it themselves. This led to several mistakes which were not cross-verified (coding, units of measurement). During the large data collection phase, the new enumerator teams were directly hired and supervised by WASHCost staff members and paid on the basis of the quality of the work they did. The WASHCost teams have also more direct control over the raw data.
- There are several gaps in the data sets. Once the first large scale data collection is finalised ideal or normal costs can be modelled. For instance, for OpEx we can bring together people experienced in

running systems to brainstorm how many operators and how many staff are needed to build up an idealised costs framework with minimum salaries and costs of chemicals.

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5 Comparing (international) costs: a step by step approach

This section explains the common limitations for comparing existing cost for water and sanitation in low-income and peri-urban areas, proposes a few rules of thumb and explains how costs can be aggregated and reported. This final component is still work in progress.

5.1 Limitations of how costs for low-income rural and peri-urban area are reported in the sector

Currently, the first limitation is the lack of a consistent accounting framework being used for rural water supply and sanitation costing in developing countries. Unit costs being used in the literature refer to how much it costs to construct a specific technology but also to the amounts paid by households for receiving water services. Price is confused with costs. The costs paid by households are not the same as the costs of producing and distributing water. Furthermore costs are considered only from the perspective of the implementing organisation, not from the perspective of how much its costs overall to the society. A subsidy to a family to be able to buy a slab is still a cost. A household contribution to capital expenditures is still a cost. Confusion also derives from the terms used to disaggregate the unit costs. For expenditures with direct and indirect support there are different terminologies being used: software; administration costs; costs of running a programme; sector costs, etc. Software usually refers to the training and sensitisation campaign elements of capital expenditures. For rural water supply and sanitation there is not yet a consistent accounting framework similar to the one used by (urban) utilities.

Secondly, most costs reported do not make explicit which unit costs are estimations and which are based on empiric evidence. Most cost estimates depart from a micro analysis of considering every single component of a piece of infrastructure. These are useful estimates for engineers and are based on Bills of Quantities available. Most of the country-wide studies use this methodology. The limitation of reporting on these unit costs is that they are mostly not real expenditures but estimated. In South Africa and India the existing official Bills of Quantities provide the very high costs used with an acceptable ceiling. On the other hand, there are also many other costs reported which are based on data collected from contractors reports, therefore reflecting real costs more accurately.

Thirdly, most unit costs for non-networked services are calculated per capita or per household per year for easier comparison of existing available data. In networked water supply services, it is most common to use the cost per cubic metre, as this measures to some extent the efficiency of the utility but it doesn't reflect the existing and potential coverage. In non-networked (mostly rural) water supply services, the cost per cubic metre is rarely available given the non-existence of metred connections. Most of the sanitation unit costs are usually provided per household and for reaching a figure per capita -all data is divided by the size of the (estimated) household - which differs per country and within countries. However, water unit costs are either reported per capita using a normative population and not the de facto population served. In many instances only the cost per infrastructure is provided without a measure of the population covered.

Most cost estimates are actual, not the ideal, and therefore do not reflect inefficiencies caused by tied aid and procurement systems which lead to more expensive (imported) options or other factors such as weak utility management, high leakage, limited supply chains, limited road coverage, etc.

Another limitation is that for cost comparisons, CapEx and other costs are annualised. This is done by estimating the lifespan of the infrastructure component and dividing CapEx (and other costs) over the ideal lifespan years. The longer the lifespan estimates, the lower the annual cost expenditures. Each author uses its own lifespan for different system components (limiting comparability) and the lifespans are usually much longer than in reality, making CapEx look lower per year, when in reality many hand pumps will last 3-5 years.

Finally, the cost of yesterday is not the same as the cost of today. Most costs are reported in US Dollars or Euros. They have been converted from local currency units to an international currency using a market exchange rate. The exchange rate is usually not mentioned, neither is the original local currency unit or the date. Comparing like with like becomes a challenge because it is not possible to transform the local currency in a current year using PPP or the market exchange rate.

5.2 Rules of thumb for comparing and reporting costs

In 1992, Rassas, B. described succinctly what is required for comparing and reporting costs in 'A primer on comparing and using cost data in water and sanitation reports'³. The list below (Table 14) adapts and expands the rules of thumb to address the limitations mentioned above:

Table 14: A step by step approach for comparing and reporting costs

Steps	Purpose	Description
1	Costs of what?	Make sure that the cost (and not price) of different components is clearly stated. Mention which components are included in the costs and which are not
2	Units of costs	Make clear the unit in which costs are reported: annual costs, per capita, per household, per volume
3	Real vs estimated costs	Mention what costs are real and which ones are estimated: <ul style="list-style-type: none"> - For the annualisation of costs refer if actual or ideal life spans have been used - For the population served mention which one is real and which is by design. - For the volume mentioned if it is real or by designed and provided or received - Refer to the source of the costs or the methodology used for collecting them
4	Comparing costs over time	Choose a reference year and adjust all costs to account for changes over time in the value of money. Choose the market inflation or another index such as the GDP deflator whichever is most sensible given the situation (explained below)
5	Compare costs from country to country	Convert all figures into a single currency (usually US dollars, because the most complete database ⁴ which contains comparable financial data around the world uses it as a base for all calculations). Choose the market (US\$) or the purchasing power parity exchange rate (PPP US\$) whichever is most sensible given the situation (explanation below)
6	Financial or economic approach	Finally, mention which costs are reported using financial analysis ("nominal" or "real/ current" costs) or economic analysis ("present costs") – explained below

5.2.1 Comparing costs over time: GDP deflator and market inflation rates

Cost data is mostly collected/reported in different years and from several countries. As an example 'Operational and minor maintenance expenditures for VIP latrines in Ghana have been collected from 2002, 2004 and 2007. What are the OpEx in 2008?'. It is unlikely that these costs are the same in 2008 and therefore the figures need to be adjusted for greater precision. The first step in this process is to be able to compare costs from different years in a specified local currency. There are two methods (among others) which can be used: using the GDP deflator or the market inflation rates.

In the example below, the inflation rate (GDP deflator) has been used to bring all costs to their value in the year 2008. Unlike an inflation rate based on price index (consumer price index), the GDP deflator is not based on a fixed basket of goods and services. The basket is allowed to change with people's consumption and investment patterns. (Specifically, for GDP, the basket in each year is the set of all goods that were produced domestically and weighted by the market value of the total consumption of each good.) Therefore, new expenditure patterns are allowed to show up in the deflator as people respond to changing prices. The advantage of this approach is that the GDP deflator measures changes in both prices and the composition of the basket - i.e. as prices and consumer preferences change, the GDP deflator accurately tracks both automatically. For this reason, the GDP deflator is in most ways a more accurate, and more ideal measure of pure price changes in the overall economy. GDP deflators⁵ are available for most currencies at the Databank⁶.

$$\text{Local Currency}_{(\text{current prices 2008})} = \text{Local Currency}_{(\text{year } x)} * \text{Deflator multiplier}_{(\text{year base 2008})}$$

Alternatively, the consumer price index (CPI) can be used to measure the inflation. Inflation refers to the percentage increase in general price levels from one year to another. The official exchange rates (Consumer Price Index) are available from the Databank⁷.

$$\text{Local Currency}_{(\text{current prices 2008})} = \text{Local Currency}_{(\text{year } x)} * \text{CPI}_{(\text{year base 2008})}$$

For water supply and sanitation (sewerage) projects it is sometimes possible to collect country specific construction indices prepared by the respective Department of Public Works or the GNP deflator. However, these are less relevant for international comparisons.

5.2.2 Comparing costs from country to country: market (US\$) and purchasing power parity exchange rates (PPP US\$)

After having all costs from all countries inflated/deflated for the year 2008, in a second step, all the currencies need to be converted into US\$ market rates or US\$ Purchasing Power Parity (PPP). 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 goods and services in both countries. PPP is used because exchange rates can be misleading. Since market exchange rates are based on short-term factors and are subject to substantial distortions from speculative movements and government interventions, comparisons based on exchange rates, even when averaged over a period of time such as a year, yield and mislead results. Example: the imbalance in apparent water implementation costs between many African countries and India is partly explained by the undervaluation of the rupee, perhaps by a factor of almost three, and by the sophistication of the Asian supply chain which reduces their costs and the dependence of the African supply chain on rent-seeking international imports which increases their costs. The PPP conversion factors⁸ are available from the Databank.

$$\text{US\$ PPP}_{(2008)} = \text{Local Currency}_{(\text{current prices 2008})} / \text{PPP conversion factor}_{(\text{LC 2008 per international \$})}$$

Alternatively, all the unit costs can also be analysed using the official market exchange rate. This is useful because if an X amount of US\$ are needed to drill 100 boreholes in a specific country, then the cost of implementation must be related to the amount it costs to drill the boreholes in the local currency. For the purpose of knowing how much budget is needed in a specific country to implement programmes, the market inflation rates are recommended and that cost calculations are based on the official exchange rate. This step is also more accurate in situations when most of the labour and materials are imported.

$$\text{US\$}_{(2008)} = \text{Local Currency}_{(\text{current prices } 2008)} / \text{Official exchange rate}_{(\text{LC } 2008 \text{ per US \$})}$$

5.2.3 Financial or economic approach: current, nominal and present costs

Current or real costs typically refer to a financial approach which considers past costs that have been brought to today's values by removing the effects of inflation. Present costs are typically an economic approach and refer to future costs brought to today's values by discounting against the time value of money.

Financial approach: Nominal or Real (Current) Costs

A nominal value is the actual amount of currency in a specific date "*in 1990, the cost of a latrine was US\$10*". In contrast, the real or current value reflects the purchasing power of a given expenditure. The real or current value has been calculated above. Current values are relevant because with inflation, the value of money decreases over time and governments, and eventually consumers, have to pay more to obtain the same service. This can be a serious problem with projects which are based on fixed grants or loans but where construction lasts for several years. It is similarly a problem where budgetary allowances from government departments for OpEx and CapManEx are not increased to allow for inflation. When there are user charges for WASH services provision there is also a challenge that those charges are regularly raised in line with inflation and not allowed to lag by several years. If governments allow too many automatic price rises then inflation can become stronger and consumers ever poorer (where income and wages do not increase by the same amount). Where charges are not increased to cover inflation then services deteriorate as managers no longer have sufficient resources.

Real costs or prices have had the effects of inflation removed from past costs. Any nominal costs which need to be reported over a number of years are adjusted by the relevant inflation factor so that they can be quoted according to one specified year, ideally the most recent as real costs. In some accounting systems this is managed through current cost accounting where all assets are brought to the current cost each year in order to gain the best understanding of underlying asset value and real profits.

Economic approach: Present Costs

The present value approach incorporates what is known as the 'time value of money'. This idea incorporates the effect of growth in money saved in a bank or other savings institution. The idea is that \$100 in the hand now is worth more than the same amount given or used in a project in a year's time. Because within that year that \$100 could have gained in value from the interest earned or from being used more productively. If the interest rate was 10% then in a year's time, the \$100 would be worth \$110 and in two years time, by compound interest, \$121. The concept of present values suggest that a \$100 in one year's time has a present value of \$90.9 ($\$100/\110) and \$100 in two year's time has a present value of \$82.6 ($\$100/\121), both assuming a 10% discount rate. This is a useful technique to bring future costs to present values, ignoring the effects of inflation (which would have to be added as a guesstimate of future inflation in any budgeting exercise).

Cost benefit analysis brings past and future income into present net value by applying a discount rate which reflects the social opportunity cost of capital (the returns on capital in case the money would have been

applied elsewhere). Because they will be used for cost-benefit analysis, some unit costs in the sector are not reported using current prices but net present values (which use discount rates). The discount rate used by economists varies broadly depending on the assumptions made (institutional structure, government policy and macro-economic conditions) and therefore costs which use different discount rates can only be compared with some caution. The lower the discount rate, the lower the overall cost estimates. For instance, the Copenhagen Consensus (2008) uses a 3–6% range for discount rate for the sector assuming that governments in developing countries have ready access to capital and that this would be the rate of return in case donor money would be invested in alternative projects. On the other hand the World Bank uses a 10% discount rate for (water infrastructure) project evaluation assuming that investment capital in developing countries is scarce and the opportunity costs of the project being evaluated are therefore high. More recently, Carlevaro (2010) has used an 11% discount rate for a WHO cost benefit analysis study of water and sanitation projects.

5.3 Aggregating costs: the building blocks approach

WASHCost seeks to determine what is a reasonable amount to budget for to ensure ongoing services, understanding better the life-cycle of asset systems so as to be able to repair, renew and rehabilitate systems before services fail. This approach is described in further detail in [Briefing Note 1b - Services are forever: the importance of capital maintenance in ensuring sustainable WASH services](#) and a forthcoming WASHCost briefing note will explain in detail how WASHCost is aggregating costs using a building block approach. The building blocks approach indicates the total funding required to keep systems functioning effectively each year and conceptually illustrated in Figure 2.

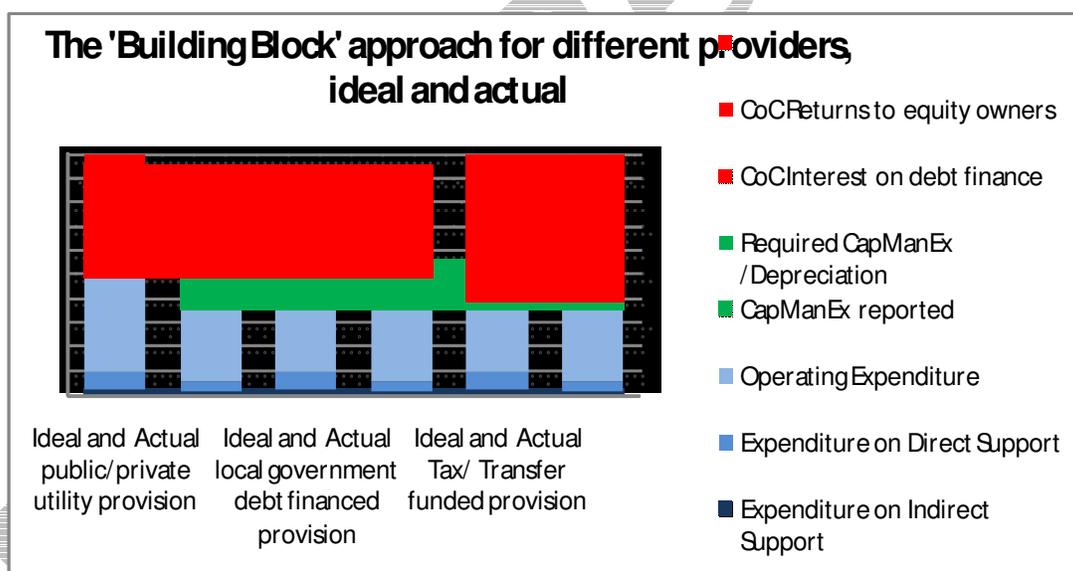


Figure 2: A conceptual example of the building block approach to aggregating WASHCosts

It is likely also that the costs recorded from field work will not be sufficient to maintain services in the long-term at an appropriate level. WASHCost recognises that the actual costs are likely to be somewhere between what is presently reported (too low) and the normative assumptions for maintenance which are likely to be too generous.

6 Annex: Frequently Asked Questions for WASHCost researchers

6.1 What kind of cost data is WASHCost going to provide?

The five-year WASHCost project (2008-2012) will collect and collate information relating to the real disaggregated costs in the life-cycle of water, sanitation and hygiene service delivery to poor people in rural and peri-urban areas. For more details see cost components in section 2. It will involve decision makers and stakeholders in analysing this information and support them in using it in the planning and governance of WASH service delivery. WASHCost will embed improved pro-poor decision-making processes in lead WASH organisations.

6.2 Is WASHCost developing any type of web based tool or other decision support systems?

At the international level: WASHCost has started to assess and analyse how (web based) decision support tools are being used for planning and decision making in other sectors. We had a first international meeting in January 2009 (report available on the website) and it has become clear that the large databases which are kept up to date and are being used dependent on a group of dedicated paid people to keep them working. During 2009 most of the international requests to the WASHCost team have been about the methodology and how to use it, and not about data. As the research outputs become available throughout 2010 and the methodology is simplified, we will re-evaluate the need for a web based tool, who would need it and for what purpose.

At the country level: WASHCost also aims to help national and decentralised sector bodies to embed the use of life-cycle costs so that it becomes institutionalised, owned and actively used within countries. Another aim is for national bodies to develop and maintain their own LCC databases and incorporate them into management information systems (MIS) and decision-support tools (DST) which already exist and are being used.

6.3 What's the peri-urban definition used in WASHCost?

By 'peri-urban' WASHCost means areas with informal housing, limited infrastructure, high levels of poverty and deprivation and no formal services. They were often referred to as slums, barrios, shanty towns etc. Although the term means "around the city" we are including areas that meet this description even if they are within urban areas. Peri-urban in WASHCost is an area which is better defined by its socio-economic and institutional characteristics rather than its location. This means an area that is poor and disorganised, where services are not formally provided and institutional arrangements are insecure. There is a proliferation of small private entrepreneurs to fill the gaps that government services are not filling. In some areas housing is illegal.

Rural and urban areas are well defined. Peri-urban is not. It is the place where we cannot find out who is accountable and who is supposed to be running the service. If there are utilities, they are being run by the (local) private sector.

6.4 Does WASHCost include costs related to off-site sanitation?

We are not collecting costs related with off-site sanitation, because it has not been found in any of the rural or peri-urban study areas in which WASHCost data collection is taking place.

6.5 Is WASHCost costing sanitation in schools?

Sanitation in schools is part of strategic planning for service provision, therefore interesting at global level for grant allocation. But from a country perspective, influencing the budgeting process of the Ministry of Education is not a priority. These costs can be collected but are not part of the “minimum core” of the project. Each country team can decide to further collect and analyse these costs.

6.6 Is WASHCost costing services to institutional users?

Institutional users include government offices, hospitals and schools. The link with poverty is not immediate and therefore not a priority at the global level. These costs can be collected but are not part of the “minimum core” of the project. Each country team can decide to further collect and analyse these costs.

6.7 How is WASHCost capturing the cost of sustainability? What “ideal costs” make a service sustainable?

Until we have enough data points which will enable us to have the costs of a sustainable service, we can only make extrapolations:

- Comparing the costs of the design with the costs that are spent. For the design costs, manufacturers recommendations can be used (i.e. how often parts should be replaced, if such information exists).
- Using modelling tools with inputs from expert assessments of systems at different ages and have them assess whether anything needs to be replaced. Even if it is not replaced, we can add the cost to arrive at “the ideal costs”.

Experience of urban utilities suggests that recurrent expenditure needs to take a longer term view, especially with regards to capital maintenance. The simple accounting provisions for capital maintenance by using appropriate depreciation provisions has proved to be relatively ineffective. This is especially true with regards to underground network assets with the alternative infrastructure renewals charging system being considered a better, yet still far from perfect, method. However, even this system demands many years of data on costs and performance before any meaningful correlation between spending and level of service can be determined. In 2011/2012 we will use tools to try and answer this question.

6.8 Is WASHCost looking at the costs of bringing the service up to the local specified norm?

For the embedding component, if we are working with government departments, this is what they need/want to know. For a number of different services we are collecting data points to understand the actual cost of services received, and we will be able to provide an estimate on what is required to move from a lower level of service to a higher one. Once we answer the first research question “what are the ranges of costs for specific service levels”, it should be fairly easy to compare with existing norms (and even question the norms from a sustainability and poverty perspective).

6.9 How is WASHCost measuring service levels for different units of analysis?

Service levels can be analysed at the community level and then aggregated higher to other governance levels. The higher the level of service level aggregation, the least relevant and accurate is the cost data related to those service levels.

6.10 How is WASHCost relating service levels to costs when the unit of analysis is the household who is accessing several sources?

The service has a cost overall to the household, independently if the costs are from accessing one source or several. We are collecting these costs. With the service level ladder we are then able to see within a community the percentage of hh who are obtaining X service level which on average is costing Y. Service level includes quantity consumed. We can also increase the level of granularity and analyse services levels during the wet and dry seasons.

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