Ladders for assessing and costing water service delivery

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WASHCost

Working Paper 2

Ladders for assessing and costing water service delivery

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IRC International Water and Sanitation Centre

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WASHCost is a five-year initiative focused on exploring and sharing an improved understanding of the true costs of sustainable water, sanitation and hygiene services. Since 2008, WASHCost has developed new methodologies to better understand and use the life-cycle costs of providing water, sanitation and hygiene services to rural and peri-urban communities in Ghana, Burkina Faso, Mozambique and India (Andhra Pradesh). The objectives of collecting and disaggregating cost data over the full life-cycle of WASH services are to be able to analyse costs per infrastructure and by service level, and to better understand the cost drivers and through this understanding to enable more cost effective and equitable service delivery (see www.washcost.info).

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Abbreviations

BIS	Bureau of Indian Standard
CapEx	Capital Expenditure
CapManEx	Capital Maintenance Expenditure
COC	Cost of Capital
CWSA	Community Water and Sanitation Agency, Ghana
DDP	Desert Development Program
DWAF	Department of Water Affairs and Forestry, South Africa
ExpDS	Expenditure on Direct Support
ExpIDS	Expenditure on Indirect Support
GoM	Government of Mozambique
JMP	Joint Monitoring Programme
Lao PDR	Lao Peoples Democratic Republic
lpcd	litres per capita per day
mcpd	minutes per capita per day
MDG	Millenium Development Goals
MISAU	Ministry of Health, Mozambique
MUS	Multiple-use services (in the context of water)
O&M	Operation and maintenance
ODF	Open defecation free
OpEx	Operating and Minor Maintenance Expenditure
RGNDWM	Rajiv Gandhi National Drinking Water Mission
UNICEF	United Nations International Childrens Education Fund
WASH	Water, sanitation, and hygiene
WHO	World Health Organization

Ladders for assessing and costing water service delivery

This working paper introduces the concept of service levels, grouped as sequential rungs on a ladder, as a way of differentiating between broad and recognisable types (levels) of service. By developing this metaphor, we provide a structure to analyse the data being collected in different countries and settings, not just in terms of the technologies being used, but in terms of the domestic water services being received.

This working paper introduces water service levels and explains how these can be used as integral components of an analytical tool for applied research or benchmarking. It is best read together with *Working Paper 3: Assessing sanitation service levels* (Potter et al., 2011). Both are working papers aimed at providing a framework for data analysis of life-cycle costs. To help in the evolution of the thinking and approach, feedback and comments are sought from interested readers. The second edition of this working paper reflects the experiences of applying this methodology in Burkina Faso, Ghana, Mozambique and India (Andhra Pradesh).

1 Introduction

WASHCost is a five-year action research project investigating the costs of providing water, sanitation and hygiene services to rural, small town and peri-urban communities in Ghana, Burkina Faso, Mozambique and India (Andhra Pradesh). The objectives of the collection and disaggregation of cost data over the full life-cycle of water, sanitation and hygiene (WASH) services are first, to understand better what factors drive costs and second, through this understanding, to enable more cost effective and equitable service delivery.

At the heart of the approach used by WASHCost is the concept of disaggregating the costs of service provision over the different phases of the service delivery life-cycle. This is illustrated in Table 1, which shows a matrix of the main phases of service delivery – initial capital investment, operation and minor maintenance, and major repairs and upgrades. It includes direct and indirect support costs for service provision. The table also incorporates different aspects of service delivery: the management of the water resource base, the provision of service delivery infrastructure, and the costs associated with users and their access to the service. Within each cell of the matrix, different cost data can be collected and analysed. Read *Briefing Note 1: Life-cycle cost approach* (Fonseca et al. 2011) for a detailed explanation of each cell. Typically, data within each cell will require further disaggregation as the main cost drivers become clear.

Since the first edition of this working paper, the WASHCost team collected data on the actual costs of providing services in rural, small town and peri-urban settings and analysed this against the levels of service being provided. The service ladder concept presented here has been refined using the following steps:

- Publication and discussion of the proposed WASHCost water service ladder in appropriate national and international forums (1st edition of this working paper).
- Identification of the main service delivery models used in WASHCost countries and mapping them in the ladder to aid in the classification of service levels in the collection of field data.
- Identification and mapping of national and international norms, and mapping these against the proposed ladder.
- Data collection and preliminary analysis of costs against service levels.
- Finalisation of an agreed set of WASHCost service level indicators and means for their calculation based on data that can realistically be collected (the current edition of this working paper).

WASHCost advocates that planners and providers of water services should increasingly use cost comparisons to underpin policy decisions. Collectively, we face a constant challenge in ensuring that the comparisons we make are legitimate. When one researcher or planner claims that 'it costs US$ 25 per person to provide a water service', the level of service used as the gauge for assessment must be described in order to contextualise cost findings. Levels

of service may vary dramatically, from a low volume water of poor quality, fetched from a distant manually-operated pump, to an essentially unlimited supply of treated water accessed by turning on a tap in the house.

Through the concept of service levels (grouped as sequential rungs on a ladder), we hope to provide a structure to analyse the data being collected in different countries and settings, not just in terms of the technologies being used, but in terms of the services being received. By discussing the concept of service delivery and service levels with sector colleagues, WASHCost contributes to a shift in sector focus: from the roll-out of new hardware, to the provision of sustainable services. We feel that clearly defined, nationally agreed service levels are essential in achieving a more meaningful analysis of whether expectations are being met.

Table 1: WASHCost life-cycle cost components for water services (Fonseca et al., 2011)

Cost components		Brief description
Capital expenditure **The costs of providing a service where there was none before; or of substantially increasing the level of services.**	Capital Expenditure Hardware	Capital investment in fixed assets, such as excavation, lining, slabs, superstructures and pipes.
	Capital Expenditure Software	Expenditure on work with stakeholders prior to construction or implementation, such as community education, demand creation and hygiene promotion.
Recurrent expenditure [1] **Service maintenance expenditure associated with maintaining an existing service at its intended level**	Operational Expenditure	Operating and minor maintenance expenditure; typically regular expenditure, such as cleaning products.
	Capital Maintenance Expenditure	Asset renewal and replacement cost; occasional and lumpy costs that seek to restore the functionality of a system, such as replacing a slab or emptying a septic tank.
	Cost of Capital	Cost of interest payments on micro-finance and any other loans.
	Expenditure on Direct Support	Expenditure on support activities for local-level stakeholders, users or user groups.
	Expenditure on Indirect Support	Expenditure on macro-level support, including planning and policy making, support to decentralised service authorities or local government.

The paper sets out the concept of service levels as a useful way of aggregating and benchmarking critical indicators of water service in a way that aids governance processes including planning and analysis. As this is a working document, and WASHCost current thinking is evolving, there is more agreement and clarity on some aspects than on others. WASHCost, as the name implies, focuses on costs related to water and sanitation[2] services, but this paper concentrates on services; on how to identify and describe services in a way that aids comparison, since this is an essential step towards comparing costs.

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

2 See *Working Paper 3: Assessing sanitation service levels* (Potter et al., 2011).

2 Water service levels and ladders

This section introduces, defines, and discusses the usefulness of the following concepts to the water sector: water service, water service level, and water service ladder.

2.1 What is a water service?

Water services focus on the delivery of water to people. A conceptual difference is made between the service itself (loosely defined as the quantity of water of a given quality accessible by users), and the system (hardware and software) used to deliver water. In practice, the two are often closely related. For example, a borehole and hand-pump operated at the village level provide one type of service; a professionally managed network of household taps another. However, the difference between system and service is critical. By focusing on systems, and specifically on the capital expenditure of rolling out new water supply infrastructure, engineers and planners risk losing sight of what they are, or should be, trying to achieve. Coverage is often calculated by counting the number of systems implemented without considering whether they are in fact providing the planned level of service.

A water service is assessed based on qualitative methods of data gathering. Some questions asked include: Do the systems provide the designed for amount of water? Do they do so every day? Does everyone in the community have access to them? Do they meet national norms for quality? We propose that the water service accessed by an individual can only be said to meet a certain standard or level when the answers to all these questions are considered together and meet normative standards. A water service therefore refers to the provision of access to water in a way that meets a set of key indicators (or norms). Taken together these key indicators define the service.

2.2 What is a service level?

Based on the above definition of a service, it follows that a service level is a term used to describe and differentiate between qualities of service. Service level as a concept can be analysed within the context of a ladder (see next section) in which each level or rung is a step up from the previous one. As a service level is a collection of different indicators – some dependent and some independent of the another – its definition varies across countries. Service levels may be set through a combination of engineering factors (what is easy/ possible) and social and political factors (what is politically acceptable, the cost, the desire and capacity of a community to press for improvements, and historical norms). For example, a rural community may live with a level of service, in terms of distance travelled and quality of water that would be regarded as unacceptable in a town. In an ideal world, the level of service would perhaps be set through agreements made between the providers and the users.

The most common indicators against which the quality of water services can be assessed include: **quantity**, measured in litres per capita per day (lpcd); **quality**, typically composed of one or more separate indicators looking at chemical and biological quality; and **distance**, from a household or the centre of a community to a water point. Countries may also use other national or international norms, such as the **number of people** sharing a point source (also known as 'crowding'), and the **reliability** of the service, typically defined as the proportion of the time that it functions to its prescribed level.

Discussions about how to measure access to water services in terms of service levels are not new. Perhaps, one of the earliest examples may be found in Lloyd and Bartram's (1991) research work. In their work, the authors identify five key indicators for assessing access to water services, namely: coverage, continuity, quantity, cost and quality (analytical plus sanitary inspection). Subsequently the service level concept was further endorsed by the World Health Organization (WHO) in 1997 and 2003. Despite this, the approach has been slow to be adopted at scale, probably falling victim to the broader problem of poor monitoring of access to rural water supplies. Indeed, it is telling that beyond endorsing it in its publications, WHO itself has limited its Joint Monitoring Programme (JMP) of global water coverage primarily to the type of technology used. However, this may change in the future with more recent discussions on post-MDG monitoring.

The main norms used to define services in the WASHCost countries are shown in Table 2.

Table 2: Norms for service delivery in the WASHCost countries

Indicator	Mozambique[3]	Ghana	Burkina Faso	India[4]
Access	**Distance** No norm[5] **Crowding** < 500 people	**Distance** < 500 m **Crowding** BH < 300 people W < 150 people SP < 300 people	**Distance** PS <1000 m SS <500 m **Crowding** SP < 300 people BP < 10 people PDC < 100 people BF < 1000 people	**Distance** < 1600m horizontal < 100m vertical (in hilly area) **Crowding** HP/SP < 250[6] people.[7] **Social exclusion**[8]
Quantity	20 lpcd	PS - 20 lpcd HC - 60 lpcd	PS - 20 lpcd HC - 40-60 lpcd	40 lpcd 70 lpcd (with high livestock density)
Quality	WHO guidelines	Ghana Standards	WHO guidelines	Bureau of Indian Standard (BIS Is:10500)
Reliability	Nothing defined	Rural – nothing defined SS % time available >95%	Nothing defined	Security concept[9] At least once in a day

BH – borehole, W – well, PS – point source, HC – house connection, HP – handpump, lpcd – litres per capita per day, SS – small system, SP – standpipe, BF – Borne Fountaine (a type of public standpipe), PDC - poste d'eau communautaire (a group of standpipes, each dedicated to one family).

Figure 1 (on next page) shows some of the main indicators for assessing service quality in the Indian context. They have been grouped to show how, by setting a baseline for each key service indicator, overall service quality can be assessed as satisfactory or not satisfactory, against an agreed norm. This approach assumes that failure of a received service to meet the norm on each indicator will lead to a non-satisfactory classification of the entire service. In this example, apart from the indicators mentioned above, others have been added. One dealing with **water security**, another indicator dealing with **social exclusion**, i.e. whether people are prevented from accessing water due to caste or other socially related issues. Finally the indicator of **MUS[10] water** refers to access to water for non-domestic productive uses. In terms of

3 Sources: India, RGNDWM 2000; Ghana (for towns) CWSA 2004a, b; Mozambique (general) GoM, 2007, (quality) MISAU, 2004.

4 Norms in India have recently become less exact in terms of figures.
There is an observed shift towards making norms and guidelines broad-based and allowing flexibility to the community to plan water supply schemes based on their needs and to suit the local requirement. It is recommended that desirable service level should be decided in consultation with the community.

5 Until 2007, the norm for Mozambique was at < 500m. However, this has been dropped in current policy, as it was felt difficult to achieve due to the scattered nature of the population in some rural areas.

6 The number of people per source is based on an assumed output of 12 l/m.

7 In case of independent habitation one source with potable water is to be provided even if the population is <250. A habitation not having any safe water source with a permanently settled population of 20 HHs or 100 persons should be provided with potable water source.

8 Desert Development Programme (DDP) areas and Scheduled Cast/Scheduled Tribal Habitations with <100 persons can be covered.

9 In India the concept of security of access is used rather than reliability. Security is based on the premise that even in times of stress households should have access to at least some water. To ensure this, and acknowledging that all systems break down sometimes, security is defined as having access to at least two separate systems.

10 MUS is an acronym for Multiple Use Services that are explicitly intended to meet the needs of people for both productive and domestic water (van Koppen et al., 2009).

overall quantity of water, the India norms are seen to move away from previously precise figures. Earlier norms are detailed below:

- 40 litres of safe drinking water per capita per day (lpcd) for human beings
- An added 30 lpcd for cattle in the Desert Development Programme (DDP) areas
- One handpump or standpost for every 250 persons
- The water source should exist within the habitation or within a distance of 1.6 km. in the plains and with no more than 100 metres difference in elevation
- 'Safe' drinking water defined as free from bacterial contamination, chemical contamination (fluoride, iron, arsenic, nitrate), and brackishness within permissible limits

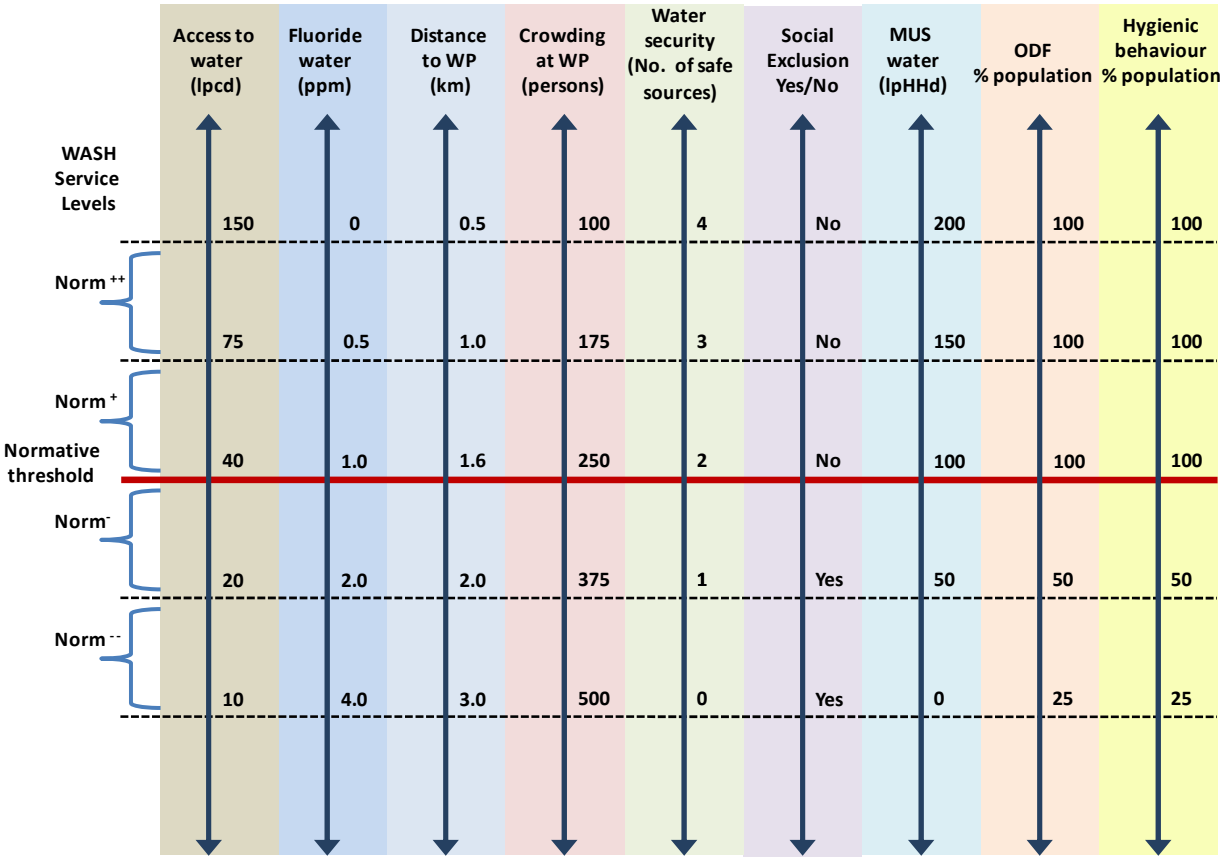
Urban norms in India include:

- Metropolitan cities (one million plus)-135 to 150 lpcd
- Class-I cities (100,000 to 1,000,000)-124 lpcd
- Class II cities (50,000 to 100,000)-83 lpcd
- Overall for urban-150 lpcd

In peri-urban settings no firm quantity has been set.

All data gathered from India (Table 2 and Figure 1) involves the study of 'fully covered' rural habitations. In addition to this, four 'partially covered' service levels are recognised: 30-40 lpcd (PC1), 20-30 lpcd (PC2), 10-20 lpcd (PC3), and 0-10 lpcd (PC4).

Figure 1: Service levels used in WASHCost India work



WWP – Water point; MUS – Multiple Use Service (i.e. quantity of water available for non-domestic activities); ODF – Open defecation free; lpHHd - litres per household per day.

The normative threshold (red line) is the borderline between acceptable and unacceptable services.

Source: WASHCost India team

The study in India demonstrates one of the many problems facing policy makers in trying to define service levels. Each indicator represents a continuum of possible values, and there are (at least in theory) an infinite number of possible combinations of indicators and values. Findings in India demonstrate that on top of the four key indicators, countries can add as many complementary indicators as they wish. In practice, working with several combinations of four, five, or more indicators is possible. In WASHCost, we assess service levels against national norms of each WASHCost country as these norms are political choices that undergo country-specific processes.

In order to define service levels, one must decide on indicators and values to be used for monitoring service quality. For many indicators, there are internationally accepted minimum standards, for example, the WHO's norms for drinking water quality and the Joint Monitoring Programme[11] (JMP) norms for improved and unimproved sources.

2.3 What is a service ladder?

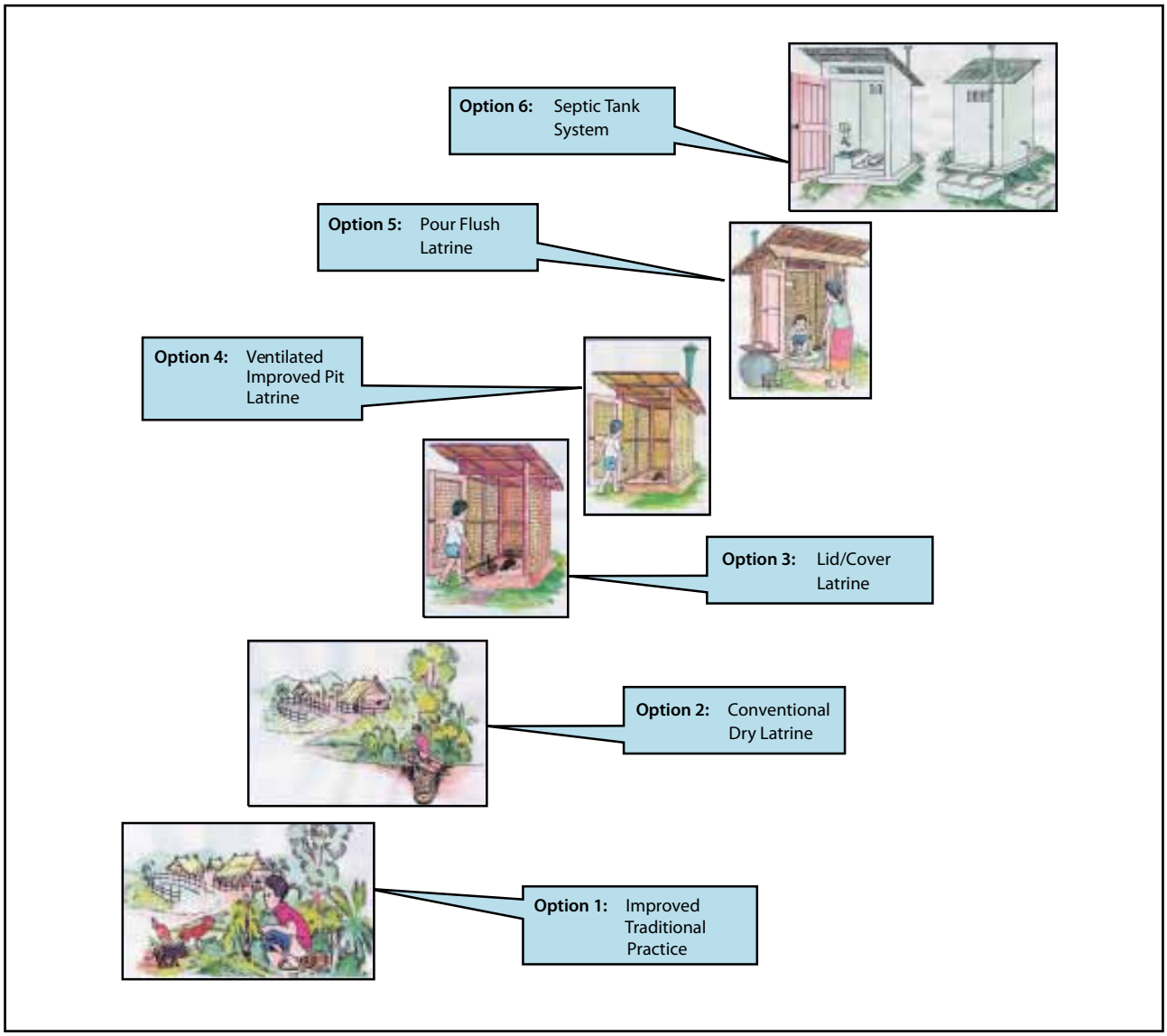
In the WASH sector, the concept of a 'service ladder' was first used in the sanitation sub-sector. More recently it has been extended by the JMP to cover water too (JMP, 2008). A service ladder is a metaphor for the idea of incremental progression between service levels of different quality, starting at the bottom rung and climbing to the top.

A typical sanitation ladder starts with unimproved open defecation, followed by small incremental steps, reaching a condition of desired and improved latrine. Each step, with its own associated costs, is represented as a step on the ladder - with the simplest (and cheapest) rungs that are easy to access and located at the bottom of the service ladder - rising progressively with increasingly complex technology and costs. Typical sanitation service ladders, such as the one from the Lao PDR (Figure 2) include the concept of a smooth progression from one level to another, with each subsequent level being an improvement on, but also incorporating, the previous level. They are highly technology-driven, in that each rung of the ladder is related to specific technical choices.

This is a useful approach when considering water supply, but it presents some problems. While some improvements in water service quality can indeed be achieved by incremental technical interventions, many cannot. Progression from an unlined hand-dug well to one that is covered and lined with a hand-pump on top is a clear example of service improvement of the type illustrated. However, moving from shared use of untreated water from a hand-dug well to a private in-house water supply fed by a multi-village scheme that brings water to as far as 20 kilometers, that makes use of high levels of treatment does not represent an increased service level, rather, a completely new system. The level of service can be thought of as just one or two steps up a ladder but the effort required to get there is far more. The same, of course, can be said about a sanitation ladder if it included a piped sewerage system at the top with a treatment plant. What this really means is that some rungs of the ladder can be climbed by individual household or through the community's effort, while others heavily rely on substantial funding, engineering capacity and professional management. The concept of the service level ladder, we have argued, is about service levels, not infrastructure, but we have to recognise that some service levels, in some settings, can never be achieved without substantial infrastructure development and associated running costs.

11 The WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation is the official UN mechanism tasked with monitoring progress towards MDG Target 7c on drinking water supply and sanitation

Figure 2: Lao PDR sanitation ladder [12]



Source: Adapted from Phouangphet et al. (2000).

2.4 Why use service level ladders?

WASHCost looks at what it costs to provide WASH services to people on a sustainable basis, with the main aim of implementing more cost effective practices. Benchmarking – the systematic comparison of the costs of providing services to different users – is a way of understanding, controlling and reducing the costs. Yet to benchmark a service – or to compare the costs of providing a service in different contexts or with different technologies – it is essential to first agree on 'What is the service'? What does the service consist of? How do we know when we have provided it? How do we know that every community member has access to an acceptable quality of service? How do we define the service, and more importantly, how do we monitor it?

12 Source http://www.sulabhenvis.in/admin/upload/pdf_upload/eap_sanitation_lao.pdf

To be able to compare costs effectively, it is important to ensure that we work with 'like with like' comparisons. To understand whether one technical or management option is 'more efficient' than the other, we have to first agree on what it is we wish to achieve. It is also essential to define the broad range of possible indicators of a service - many of which are unrelated in practice. As we have seen, improvements in service delivery are not linear with respect to infrastructure. In particular there is a major leap in costs when moving from the most basic point-source type services to any form of networked service delivery.

Table 3 illustrates the non-linear nature of services provided by different types of technology in South Africa. Here the level of service is defined in terms of quantity, while the very precise figures given are perhaps less convincing than if a range of figures had been used. However, the main point to note is the order of magnitude leap in costs between the most basic level of point source services and all subsequent 'improved' services. It is particularly striking that the first 'step' up the ladder – from a rural hand-pump to a rural/peri-urban stand post – delivers no more water for a 12-fold increase in capital and a three-fold increase in O&M costs.

Table 3: Incremental costs of providing domestic water supply in South Africa

Service level	Rural - hand pump	Rural/peri-urban - communal standpost	Urban - yard tank (low pressure)	Urban - roof tank (medium pressure)	Urban - piped water and house connection (full pressure)
Typical consumption (lpcd)	15-25	15-25	25	60	120
Capital cost in (€/household)	25	305	390	470	530
O&M costs in (€/household/month)	0.4	1.4	2	2.4	3.8

Figures compiled from 2 studies carried out for DWAF (Vermeulen, *pers. comm.*). O&M costs exclude capital repayment

Source: Moriarty and Butterworth (2003, p. 20).

In South Africa, the concept of a water service delivery ladder is enshrined in national policy.

> *"The policy makes reference to a 'water ladder': the emphasis is on the progressive improvement of levels of service over time. The first step on this ladder involves the provision of at least a basic water supply and sanitation service to all people living in South Africa. Poor households will receive this basic service free of charge. This is highlighted as the most important policy priority. The next step up this service is an intermediate level of service such as a tap in the yard. Water service authorities are expected to assist communities to achieve an intermediate and higher level of service where this is feasible."*[13]

3 A ladder for water service delivery

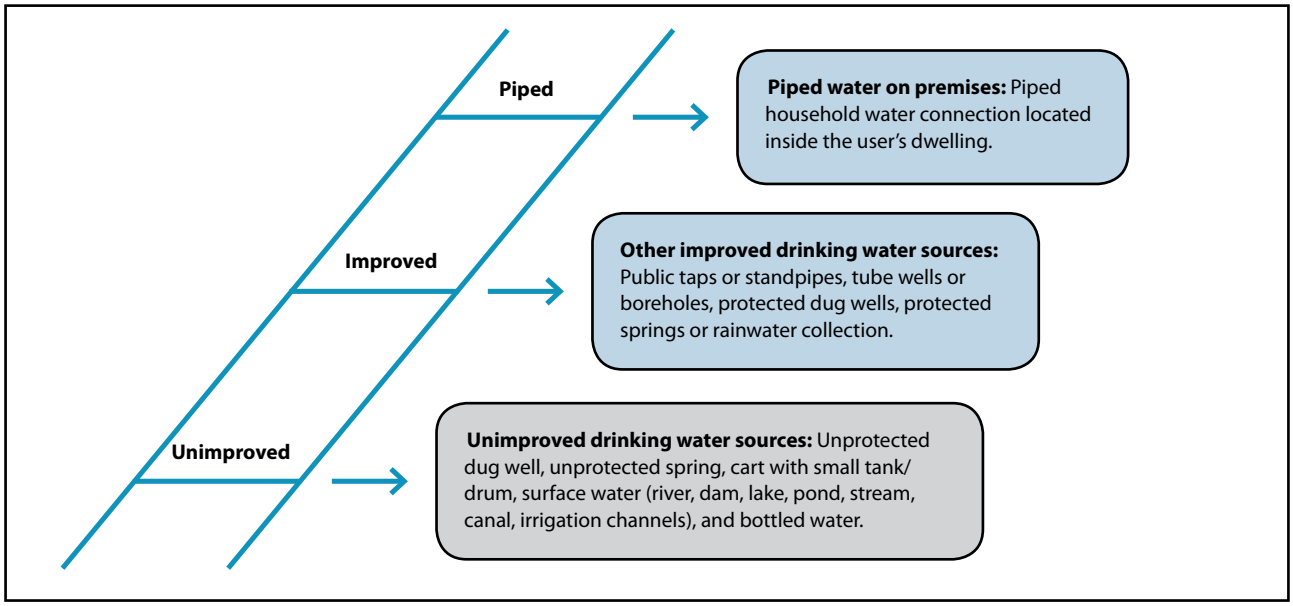
In this section, we briefly present some service ladders currently in use or are being proposed for application in the water sector. This is followed by a presentation of the WASHCost ladder and its different service levels. The WASHCost ladder is based on our own experiences of the types of service that are found in many developing countries. To define the service levels, we propose a number of core indicators and acceptable ranges for each of these. The sets of indicators and indicator ranges make up the different steps of the ladder.

13 http://www.dwaf.gov.za/dir_ws/waterpolicy/toolbox/policy_detail_print.asp?Policy=22

3.1 Existing water sector ladders JMP and MUS

Recently the JMP of UNICEF and the WHO adopted a simple ladder for water supply based on three categories (JMP, 2008). These are: unimproved, improved, and piped water on household premises. According to the JMP, unimproved drinking water sources include sources such as: unprotected dug wells, unprotected springs, carts with small tank/drum, tanker trucks, untreated surface water sources (river, dam, lake, pond, stream, canal, irrigation channels), and bottled water. Improved sources include: public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs and rainwater collection. At the top of the JMP ladder, piped water on premises refers to piped household water connection located inside the user's dwelling, plot or yard.

Figure 3: JMP's water ladder (JMP 2008)



What stands out in the JMP ladder is its focus on technology. Service levels are explicitly linked to technology types, which are in turn linked to the JMP definitions of 'improved' and 'unimproved' water sources. This decision is probably motivated by JMP's status as a global level monitor of WASH MDGs, overseeing a geographically large data set based on a very limited number of indicators – gathered essentially by questionnaires that identify the type of source people use and its location (outside or inside their house). Interestingly on their website, JMP gives no recommendations at all for either the quantity or quality required of water for domestic use, although they do provide a link to the WHO drinking water guidelines[14].

Table 4: Status of water sources as defined by the JMP (2008)

Drinking water source	
Improved	**Unimproved**
• Piped water into dwelling, plot or yard	• Unprotected dug well
• Public tap/standpipe	• Unprotected spring
• Tubewell/borehole	• Small cart with tank/drum
• Protected dug well	• Tanker truck
• Protected spring	• Surface water (river, dam, lake, pond, stream, channel, irrigation channel)
• Rainwater	• Bottled water *

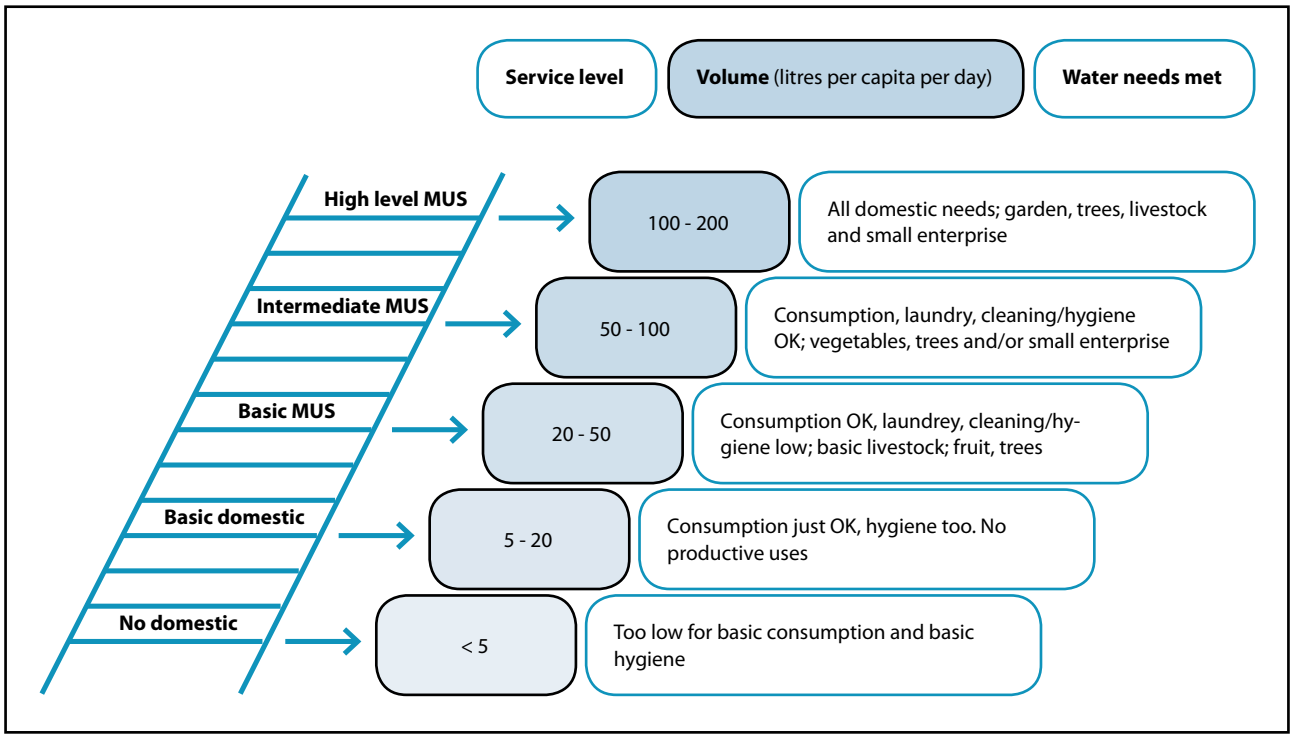
* Bottled water is considered to be improved only when the household uses water from another improved source for cooking and personal hygiene; where this information is not available, bottled water is classified on a case-by-case basis

14 http://www.who.int/water_sanitation_health/dwq/gdwq2v1/en/index.html.

Because of the status of WHO and UNICEF within the UN system, the JMP ladder provides a good starting point, and could serve as the basis for other types of ladders. However, WASHCost regards the level of detail employed by the JMP ladder as insufficient in allowing the cross-comparison of costs, moreover, efforts in monitoring service delivery.

A second service ladder for water was proposed by Van Koppen et al (2009) as part of their work on multiple use water services. A multiple use service (MUS) is one in which water is provided for homestead based productive encouraging activities such as livestock rearing, small businesses or horticulture, in addition to domestic consumption. The MUS ladder (Figure 4) has as its primary indicators the quantity and ease of access (measured through time to collect water). It qualifies each level of access according to the type of domestic and productive activities that such a level of service can support. Like the JMP ladder, the MUS ladder attempts to link typical service delivery options to different service levels, putting household tap connections as the highest level. The MUS ladder maps relatively easily onto the JMP ladder, with the bottom two tiers corresponding to 'no access' on the JMP ladder, and the top three to improved access. The MUS ladder does not differentiate locations and assumes that all households everywhere have a demand for non-basic water consumption.

Figure 4: Multiple Use Services ladder



Source: Renwick, M. et al (2007).

3.2 An improved service ladder for life-cycle cost analysis

In this section, we introduce WASHCost's notion of a service ladder as an improved model for assessing water services in the sector. In here, we present a set of core indicators for a WASH service, grouping them together with service delivery technologies, into different service levels (typology). For both exercises, a pragmatic approach is taken : only those indicators that can realistically be identified and relatively easily assessed are chosen; while the groupings of service levels is informed by what we feel to be service differences that are recognisable to most service users and service providers.

3.2.1 Indicators for service delivery

Four main indicators are proposed: quantity, quality, accessibility, and reliability. In the first edition of this working paper, the JMP status of source was included. Preliminary WASHCost research findings suggest that the JMP status of source is no longer essential in assessing the levels of water service provided - more than it is necessary to showing technology use.

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 capita per day (lpcd).

Quality refers to both microbial and chemical quality of the water, including a number of different sub-indicators (i.e. biological contamination and several physical parameters).

Accessibility refers to the ease with which people can get water. We feel that if there is a single indicator for this, it is time per day spent fetching water, as this would incorporate a number of traditional barriers to reducing access such as distance and waiting time. This can be measured in minutes per capita per day (mpcd). However, the most common indicators we see used in national norms for accessibility 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 share a given point). In India, the Rajiv Ghandi National Drinking Water Mission goes further, identifying among other indicators the frequency, duration and time that water is supplied, as well as the responsiveness of service providers and user satisfaction (RGNDWM, 2000).

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 full security can only be achieved by having access to more than one source and/or system. Reliability does not mean that a service is provided 24/7 but that it is predictably regular. The standard may be that water is provided from standpipes for four hours a day, and if that is achieved then it is reliable.

The justification for choosing these indicators is based on our understanding that the desired outcome of providing water services is a reduction in morbidity and mortality related to water-borne diseases and poor hygiene, coupled with a reduction in the burden – particularly on women and girls – of fetching water for use in the homestead. With a MUS perspective, an additional outcome is reduced poverty through economic activity related to access to water. Yet none of these outcomes can be achieved if there is not sufficient water of acceptable quality, or if the water system is too far or is chronically unreliable.

Based on these four key indicators, and looking at the reality of services currently being provided to be able to relate levels to the JMP ladder, we propose a service ladder comprising of five steps. The different service levels are illustrated diagrammatically in Table 5 (on next page), against the five key indicators.

Table 5: WASHCost proposed service levels and indicators

Service level	Quantity (litres per person per day)	Quality	Accessibility (minutes/capita/day)	Reliability	Status (JMP)
High	>= 60	Good	Less than 10	Very reliable	Improved
Intermediate	Greater than 40	Acceptable	Less than 30	Reliable/Secure	
Basic (normative)	Greater than 20				
Sub-standard	Greater than 5	Problematic	Less than 60	Problematic	Unimproved
No service	Less than 5	Unacceptable	Greater than 60	Unreliable/ insecure	

Two key indicators (quality and accessibility) are typically aggregates of fairly large sets of sub-indicators[15]. For each of these, a range of four ordinal values is proposed to reflect the four levels of service. In practice, the accessibility indicator, is also often based on a number of proxies for the suggested time indicator. These may include, distance to source and number of people accessing the same source (crowding) or the number of hours a day the service is offered.

The 'quantity' indicator

It is proposed that four different quantity levels are set. These are based on expert review of international and national norms and on the standards in WASHCost countries. The absolute minimum for drinking, cooking and basic hygiene in emergency situations is 5 litres per capita per day. A minimum of 20 litres per day is generally required for basic needs. A higher standard that gives scope for some productive use of water (based on standard in India) is 40 litres. At 60 litres, it is assumed that users enjoy more options for water use.

The 'quality' indicator

It is proposed that a high quality service is one that meets or exceeds national norms (or WHO norms) based on regular testing. An intermediate or basic level of service should be perceived by users as being acceptable or one that meets national norms based on occasional testing. A sub-standard service is perceived to fail in meeting user expectations, and no service indicates non-compliance with national water quality norms.

The 'accessibility' indicator

It is proposed that water collection practice exceeding half an hour a day is considered a sub-standard service, while anything exceeding an hour constitute a non-service. A high level of service can only be provided when there is a household tap or one nearby, taking less than ten minutes to collect the water. The proposed measure is minutes per capita per day.

The 'reliability' indicator

A very reliable service is one where people are secure in the knowledge that they can access water that meets all the other indicators from a given source at a given time. Reliability is also measured by the punctuality of a service: where service is provide within an accepted schedule. Even a service that punctually provides water every three days could be considered reliable. A service that is based on using different sources during wetter and drier periods of the year can also be considered a reliable overall service. Problematic services are characterised by down time, significant breakdowns, and slow repairs.

15 See the WASHCost website, http://www.washcost.info, to download the indicator list.

3.2.2 The service levels

No service: People always have some level of access to water. If they did not, they would either be dead or have moved somewhere else. However, this does not meant that they have access to a service. This bottom level of the ladder therefore captures those people whose access to water is of such low quality that it cannot be usefully characterised as a service.

Sub-standard service: In practice, many services fail to provide the basic minimum established by norms, yet are still 'better than nothing'. A sub-standard service level step is therefore added between 'no service' and a basic service level. This added level corresponds most closely to services that are suffering from endemic problems or where context specific issues, such as low population density, make it difficult to meet all service delivery parameters. It is typical of the sort of service accessed by people living on the fringes of better-serviced areas, but is applied to anyone whose service fails to meet one or more key indicators.

Basic service: This corresponds to the type of service found in rural communities, and some poor peri-urban or emergency situations. It is typically provided by point sources including wells and boreholes, and may sometimes include simple gravity systems. The service is typically community managed and focused on providing a minimum level of potable water – it is usually assumed that water for other purposes will be found 'elsewhere'. Although, we have categorised this as meeting 'acceptable' levels for water quality, the majority of such schemes do not include any water treatment; hence the quality of water supplied is dependent on the quality of the underlying water resource.

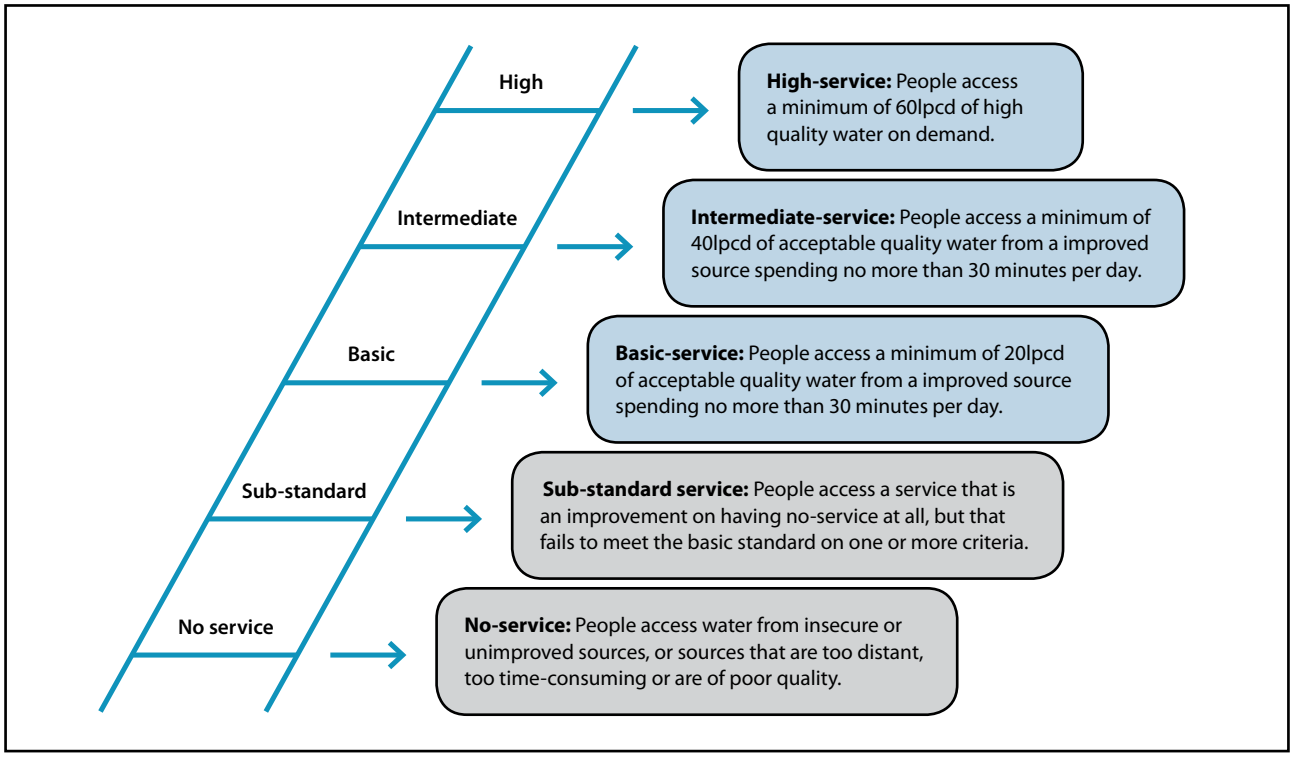
Intermediate level service: These services are typically found in denser rural, small-town or peri-urban settings. They are designed to provide better than basic quantities, closer to the household – indeed they often comprise a mix of household and communal access points. They are typically provided by small networks, fed by ground or surface sources. They involve some treatment – even if it is only basic chlorination. They often involve some level of (semi)professional management and are more likely to involve the payment of user fees. The main reason to include them as a distinct and different service level is partly because of the (typically) greater quantity of water provided, but also because of the very different technologies and management models involved. This type of service is known to be considerably more expensive and demands greater management skills compared to a basic level. In many ways, an intermediate level service is more closely related to a high service level as opposed to a basic level. The initial infrastructural investment (powered pumps; storage tanks, treatment, distribution networks) are a quantum leap from simple wells and boreholes. However, basic infrastructure also allows for incremental improvements in individual levels of services – for example by paying to move up from collecting water at a standpipe to having a household connection.

High level service: High level services essentially refer to the existence of piped water systems in people's homes. A high level service is, when operating properly, a continuous (24/7) service, from which 60 lpcd is considered the minimum. These services are typified by high levels of treatment – and nominally of good water quality. The task of management is assumed by public or private utilities, and relationships are based on a client-service provider arrangement. This arrangement is based on the assumption that the client is an individual household member paying for his/her own (often metered) water use.

The proposed service levels for use in WASHCost are shown in ladder format from no-service, through the basic provision of lifeline quantities of water, to the sort of 'always there' service expected in modern cities (Figure 9).

An acceptable level of service is one that meets agreed norms for each of the four key 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 lpcd from a reliable borehole of acceptable quality would have access to a sub-standard service due to the time required, and despite other indicators suggesting a basic service.

Figure 5: WASHCost water service delivery ladder



4 Using the service delivery ladder in WASHCost

There are two main underlying assumptions or hypotheses behind the WASHCost proposals for a service level ladder. The first is that the five step ladder reflects an operational reality of an emerging intermediate level of service that mixes elements of basic point source service with those of modern utility service provided through household taps. This operational reality is something which it is useful to enshrine in policy in the form of clearly defined and differentiated service levels underpinned by norms.

The second assumption is that differences between service levels with regard to costs are non-linear (i.e. a small increase in service levels is most often accompanied by a high increase in costs). Although it is possible to compare the cost of services at different levels ("What does it cost to get a better service?"), it is central to the ambitions of WASHCost to be able to compare the cost of systems that achieve a similar level of service ("What is the most cost-effective way to achieve X level of service?").

The service levels have been adapted to each WASHCost country context and were tested during WASHCost data collection. The different service levels need to be tested with stakeholders in other countries where the methodology will be used, and within the global WASH sector. Are the different service levels proposed by us recognised by other sector actors? Is the ability to use clearly defined, nationally agreed, sector service levels (underpinned by norms) as a tool for planning and monitoring services recognised as useful? While this seems clear to us, the sector itself is probably more used to thinking in terms of narrower comparisons between different types of technology – for example hand pump and shallow borehole-based services versus gravity fed spring systems.

Based on WASHCost in-country experience, the four proposed indicators seem sufficient in assessing costs and service levels. However, there may be strong arguments to expand the set, or make it more specific to indicators of particular importance within a country.

In WASHCost we are testing the hypothesis that differentiating between service levels in the way we propose helps to usefully narrow the range of cost estimates for providing water services. In practical terms this implies collecting data about services in such a way that it can be assigned to a service level, but also tested as part of an aggregated data set. To thoroughly put our hypothesis to the test, we explore costs in (at least) three levels:

- total aggregate services across the whole population
- within different service levels
- between technology types.

A major area for further research is investigating the differences between 'designed for' and 'received' quality of service, at the level of the community, but also the level of individual households.

This is a fundamental issue for WASHCost; almost all existing data on costs is for service 'as designed' with almost no exploration of the real costs that people pay for real services received. From our experience, even in areas that are nominally covered, closer disaggregation at the level of households and individuals identifies pockets of reduced access to services that, when taken together, can represent a substantial part of the 'served' population. It is also clear that once initial roll-out of services to unserved populations has been achieved, the issue referred to in India as 'slippage' becomes important: that is, the tendency for service levels not to be maintained, but to slip downwards, once the effort of achieving a level relaxes. It is therefore necessary to show the difference between planned and received services at the level of the individual, and then show this per community in terms of percentages of individuals receiving different levels of service. Sustainability is a particularly important consideration given WASHCost's (and the sector's) focus on extending services to the poorest. Again, this is a question for research within WASHCost, and different approaches should be tried and tested for sensitivity and utility.

With WASHCost research data collection and preliminary analysis completed, it becomes clearer to us that service levels may be used to appropriately cost services. The analysis, interpretation and use of information on costs and service levels to improve service delivery is still ongoing and lessons are being shared[16].

5 Summary and outstanding issues

In this working paper we have introduced the concept of water service levels within a service delivery ladder as a potentially useful approach to analysing cost data within WASHCost, but also more widely as a way of thinking about, planning for and monitoring water services and as a practical framework for assessing and mapping service levels in time and space.

We have defined a service level as a collection of indicators of service provision, together with acceptable ranges for these indicators. We find the ladder a useful metaphor for the idea in that there should take place a progression from lower to higher levels of service.

We propose a service ladder involving five levels, three of which represent different types of acceptable service, with the bottom two representing below standard or unacceptable services. The five levels of services are:

- **No service** refers to 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 for collection.
- **Sub-standard service** is a 'better than nothing' service level, between basic and no-service. This level is assumed to correspond more 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** provides at least 20 lpcd of acceptable quality drinking water from a secure improved source,

16 Sign up to the WASHCost newsletter to follow the latest developments via the site: http://www.washcost.info

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, well and springs.

- **Intermediate service** provides at least 40 lpcd of acceptable quality drinking water from a secure and improved source and requires 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 higher treatment of water than at the basic level and more complex management structures are required.
- **High service** essentially refers to 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.

It is difficult to make progress on costs with no prior agreement arrived, amongst key stakeholders of water, sanitation and hygiene services, on the level of ongoing service that is being paid for. Analysing life-cycle costs against service levels is an added level of analysis and not a replacement for other methodological frameworks that analyse across similar technology types, or physical and social settings. Arguably, the WASHCost analytical and methodological framework is best used to assess and measure progress in achieving water sector development goals. Specifically, its application provides a snapshot of the quality of service delivered against what had been planned.

This working paper presents preliminary research findings on a number of important issues. These will require further exploration and clarification through subsequent work and discussion that may go beyond the framework of the five-year WASHCost action research.

- **Multiple uses:** Several of those involved in WASHCost feel strongly that multiple uses should, at the very least, be acknowledged when assessing service levels. On the other hand, as multiple uses often draw on sources that are not specifically designed for domestic use, this can risk complicating and/or distorting both data collection and analysis. An added complication of assessing MUS service levels is that much water use for livestock and agriculture comes from surface sources where use is difficult to measure.
- **Multiple (non-domestic) sources:** In many rural communities people take only a very small proportion of their water from 'official' domestic sources, with the rest coming from 'traditional' sources such as ponds or streams. How should this be dealt with in assessing the service received? Does it matter if a household achieves a total of 20 lpcd by taking 15 lpcd from traditional sources for washing clothes etc., so long as they take the other 5 lpcd from an improved source for drinking, cooking and washing themselves? If households succeed in carefully separating the uses of water of different quality, should they be said to have missed the quality target because they could not drink the water they use for washing?
- **Type of lifting device and physical effort:** There is anecdotal evidence that the type of lifting device has an impact on people's perceptions of the quality of service they are accessing: it is easier to turn on a tap than work with a handpump. Should this be taken into account in assigning norms and indicators for service levels? Or is it adequately catered for in the existing accessibility indicator?
- **Tariffs as a barrier to accessibility:** Do expensive services act as a de-facto barrier to accessibility? And if so, how can these be dealt with in assessing service levels? There is anecdotal evidence that both cost and physical effort are driving forces behind people opting for 'traditional' sources over formal ones.
- **Scale:** The primary scale discussed here is that of the household. However, there are other scale issues that should also be considered. For example, if the service ladder approach is to be entire villages or towns, it may be necessary to develop and use service ladders for institutions such as schools, colleges, clinics and hospitals.

To learn more about the use of the water service ladder to assess service levels and analyse the life-cycle costs of sustainable water delivery, contact WASHCost through the website or by email, washcost@irc.nl.

Through research in India, Burkina Faso, Ghana, and Mozambique, the service ladders have been tested across diverse settings. WASHCost provides specialised training workshops to professionals who are interested in using components in other country programmes. A number of briefing notes, reports and training notes on the methodology are accessible on the WASHCost website.

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