WASHCost

Working Paper 4

Cost-based decision support tools for water and sanitation

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

Abbreviations and Acronyms

CSO	Country Status Overview
DST	Decision Support Tool
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) [German Society for International Cooperation]
LCCA	Life-Cycle Cost Approach
MDG	Millennium Development Goals
NGO	Non-Governmental Organisation
UNDP	United Nations Development Programme
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization
WSP	Water and Sanitation Program [of the World Bank]

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Key messages

1. In the water and sanitation sector, practitioners need a way to choose among the numerous options available for securing safe water and sanitation. Decision support tools (DSTs) help address this need by guiding practitioners to the best-fitting water and sanitation solutions based on a particular set of criteria for each tool. Cost-based tools help decision makers understand and use expenditure data in their decision making.

2. There are several decision support tools developed by international organisations for the water and sanitation sector that are used for financial planning and which make use of disaggregated costs. This working paper explores some of them. These tools include both online and offline applications. New technologies are developing fast, allowing more technological possibilities with tools and services such as smart phone applications and cloud-based servers. The majority of these DSTs were developed for specific projects or applications and there is little evidence that their use has been scaled up, mainstreamed or even sustained once the projects were completed. More positively, recently developed DSTs that use Google Maps as a platform are attracting widespread interest and uptake.

3. While most of the decision support tools reviewed in this working paper have been developed at international level, their use has been limited. Many potential users at country level continue to use the schedule of rates and various management information systems developed for a specific context and/or application.

4. There is real difficulty in populating DSTs with the full range of financial and life-cycle cost data required, yet most of the tools that use disaggregated cost data assume that the data is present. In practice very few of them are actually fed with reliable and up-to-date cost and financial data. The use of these tools by decision makers will not be truly justified until reliable and up-to-date information is available.

5. Choice in technology for water and sanitation is not synonymous with the services delivered to the population. It is not possible to make planning and budgeting decisions without analysing contextual data on the intended quality, quantity, reliability and accessibility of the services to be provided. The largest limitation of all the tools reviewed is that none of them include well-developed components on either the services delivered or planned for. They do not include desired outcomes linked to cost inputs, nor do they take into account actual lifespans of the different components of technology for calculating annual costs (as opposed to 'ideal lifespans'), nor the number of real users per system in cost comparisons.

Summary

This working paper provides an overview of Decision Support Tools (DSTs) using disaggregated costs in the water and sanitation sector. The DSTs have been developed by international organisations for planning and budgeting interventions in low income settings. It highlights the disaggregated costs used for each tool and makes recommendations for matching them to practitioners' needs and capacities.

The first section of this working paper describes the Life-Cycle Cost Approach (LCCA) and the cost components required for ensuring services that last. The second section reviews different offline and online DSTs developed and used by international organisations in the WASH sector during the last 10 years. The third section summarises gaps in disaggregated costs that have been identified and used by these different tools. Considerations for design and use of future tools in the water and sanitation sector are explored in the last section of the working paper. Annex 1 describes the different cost categories required to provide sustainable services as identified in the life-cycle cost approach.

1. Introduction

The WASHCost initiative researches the life-cycle costs of water, sanitation and hygiene (WASH) services in rural and peri-urban areas in four countries. The rationale behind WASHCost is that decision-making in the WASH sector will improve at all levels, as decision makers and stakeholders understand the costs of sustainable, equitable and efficient services and put their knowledge to good use. To this end, WASHCost is exploring different dimensions of WASH governance including the potential merits of using decision support tools to improve financial planning, benchmarking and ultimately WASH services.

Life-cycle cost approach

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. The *Life-Cycle Cost 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.

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 (e.g. training, planning and institutional pro-poor support). Sustainable services requires that systems are in place to ensure the replacement of infrastructure at the end of its useful life and to extend delivery systems in response to increases in demand. This is the 'life-cycle' at the heart of the life-cycle cost approach.[1]

As the name suggests, Decision Support Tools (DSTs) combine contextual information with information on available technologies and approaches to help practitioners make informed decisions (Palaniappan et al., 2008). Modern DSTs are members of the information systems family, which also includes Management Information Systems (MIS), Decision Support Systems (DSS) and other intelligent systems[2]. DSTs were developed in the 60s to respond to the increasing need of the business sector to make more rational decisions, and in response to specific requirements and technologies and they have greatly evolved since then (Power, 2007). The WASH sector has been using simple, paper-based tools for some time, primarily for estimating engineering costs. In most cases, these paper-based tools are owned by a government department and costs are updated on an annual basis. A wide variety of tools, including non-paper based tools, have been developed and thorough reviews have been produced since the 90s in the WASH sector[3].

All the DSTs that have been reviewed were selected because they had been developed for the WASH sector and used disaggregated costs as input and/or output data.

1 For a detailed explanation on what the different life-cycle cost components are, please see Annex 1.

2 It is difficult to establish one typology on these intelligent systems. The boundaries between categories of intelligent systems are not always clear in the literature and the terminology is not homogeneous across sectors (private, public, NGOs etc). We define decision support tools as specific tools based on and using a Management Information System to support the analysis of a given situation in the WASH sector. Arguably, the difference between decision support tools and systems lies in the complexity of the analysis and the frequency of actual decision making.

3 A thorough review of DST tools in the WASH sector was published by the Pacific Institute and Environmental Change and Security Program (Palaniappan, 2008).

2. WASH sector DSTs using disaggregated costs

This section focuses on providing an overview of mostly computer based DSTs developed at international level. Many DSTs using disaggregated costs developed for and by the WASH sector are found in handbooks. These DSTs have been primarily developed with the purposes of:

- **improving WASH services delivery,** more specifically to improve the sustainability, equity and cost-efficiency of WASH services provision;
- **measuring costs and benefits of WASH interventions,** with the main motivation of collecting costs to prove to finance ministers and others with influence on budgeting, the wider benefits of investing in improved WASH services;
- **building scenarios for investments in the WASH sector,** to estimate, analyse and compare the costs of different WASH service delivery models and technological options for a specific geographic location; and/or
- **assessing the financial gap to be covered before the achievement of the Millennium Development Goals (MDGs),** using estimated aggregated expenditure.

Most of the earlier computer-based DSTs, which have been developed and made accessible to local-level decision makers, have limitations when data needs to be shared and analysed at national or international levels. In recent years, DSTs have become increasingly sophisticated as they make better use of innovations such as GPS-enabled smart phones and cloud-based applications and databases.

DSTs using disaggregated costs analysed in this working paper can be broadly divided into three categories. The first category encompasses DSTs based on spreadsheet applications; the second category looks at other computer-based DSTs; and the third category deals with web-based DSTs. A lack of published or grey literature has put some constraints on the scope of this review and it was not possible to gain detailed insights into the practical use of these tools. Therefore we will base our presentation on the original purpose of each tool.

2.1 DSTs using spreadsheet applications

The first set of tools use spreadsheet applications (e.g. Excel) and have diverse functions. Some are designed at country level and include both water and sanitation components, others have more specific targets, such as urban sanitation or rural water supply. All tools reviewed here are available upon request.

2.1.1 Sector investment plan spreadsheet

This DST is a spreadsheet for use by the WASH sector in developing countries. It was developed in 2005 by PEM Consult[4] for a disaggregated cost study in Kenya with the support of the Water and Sanitation Program of the World Bank (WSP) and the Kenyan Ministry of Water and Irrigation. The associated study presents a step by step methodology for developing sector investment plans. Some critical steps include:

- estimation of disaggregated costs based on bill of quantities,
- documentation of disaggregated costs based on actual expenditure, and
- development of generic expenditure functions.

The spreadsheet developed for this study was used to estimate the costs of different water and sanitation technologies in the seven areas falling under the responsibility of Water Service Boards in Kenya. The spreadsheet is set up to include hardware costs (including rehabilitation and replacement), operation and maintenance, direct support costs such as design and support, community mobilisation and hygiene promotion. Rehabilitation costs include both

4 More information on PEM Consult at: http://www.pem.dk/page/en/Home

depreciation and renovation (due to backlog in maintenance). Data can be analysed using per capita and per cubic metre costs. Further, the spreadsheet also calculates the cost for the various technologies according to a standard bill of quantities and compares these costs with the actual cost of projects that have been implemented or planned in Kenya over the previous five to ten years. This DST integrates a high level of cost component details to calculate disaggregated costs and then uses these to compute macro level aggregations.

2.1.2 Millennium Development Goals costing and financing spreadsheet

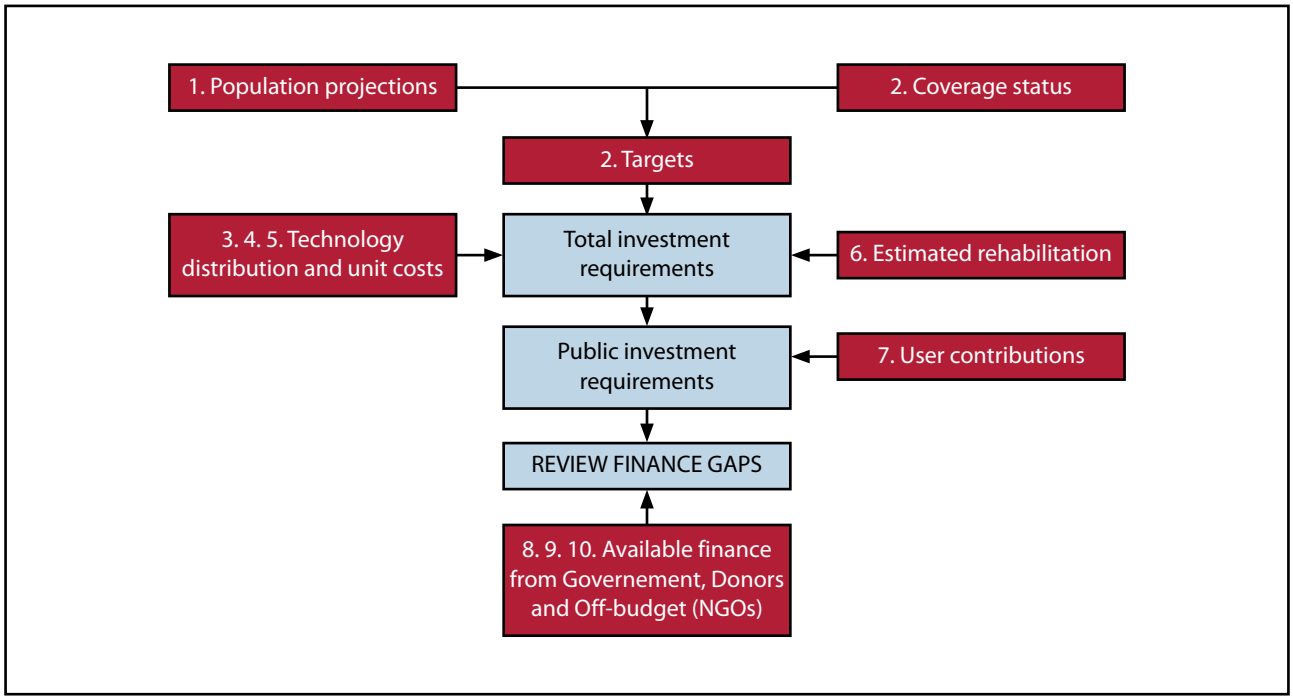
The Millennium Development Goals (MDG) costing and financing spreadsheet developed in 2005 by WSP is part of the Millennium Development Goals Country Status Overview (CSO) reports on water and sanitation. The CSO reports intend to support:

- improvements in the design of demand-driven and results-oriented national programmes;
- co-ordination of water and sanitation programmes and projects, by analysing current gaps; and,
- enhanced co-operation for proper implementation of programmes and projects, based on peer review and strategic assessment.

'Ultimately, these CSOs [...] should help African countries to align their national priorities with global targets on water supply and sanitation, in terms of policy reforms, institutional change and resource allocation and to link country efforts to existing supportive regional frameworks' (WSP, 2011).

The spreadsheet uses cost data from either national or regional/global publications to support the analysis of quantitative data and to prepare the illustrative tables and charts. The data is collected by a group of institutions including the African Minister's Council on Water, the African Development Bank, national governments, NGOs etc., and the costs collected are assessed by broad-based consultative national platforms (Mehta, 2005). To calculate the investment or finance requirements for respective countries, the spreadsheet accommodates the use of MDG targets or country specific targets as described in Figure 1. The CSOs along with the relevant costing and financing spreadsheet aim to support the implementation of MDGs until at least 2015.

Figure 1. Quantitative analysis to support the country status overviews



Source: Mehta et al. (2005)

2.1.3 Water and Sanitation Needs Assessment Tool

This spreadsheet[5] and its companion user guide *Water and Sanitation Needs Assessment Model*[6] were developed in 2006 by the United Nations Development Programme (UNDP) to assess the estimates and associated costs needed to support water and sanitation interventions as part of a national investment strategy for meeting the Millennium Development Goals. This DST comprises a four step process:

1. Developing a list of interventions
2. Setting targets for the interventions, for example the proportion of the population to be covered by 2015
3. Estimating the financial, human and other resources needed
4. Aggregation of all the financial needs assessments and creation of a ten-year MDG framework

According to Wiemers (2005), this Excel-based needs assessment tool integrates the information input by the user to generate these estimates. It uses outcome targets, coverage targets and ratios, and disaggregated costs to develop aggregate estimates as well as intervention-by-intervention estimates of resource requirements. Similarly, simple ratios between beneficiaries, HR parameters, and infrastructure yield the non-monetary results. A simple ten-year scale up path allows users to map out the yearly investments needed to meet 2015 targets'.

This DST is used at macro level and the disaggregated costs are assumed to be known and aggregated for different types of selected interventions (Tandon and Pizarro, 2006).

2.1.4 Water Supply Costing Processor (WSCP)

In 2010, the WSCP spreadsheet was developed by the World Health Organization (WHO) in collaboration with the University of Geneva as part of a manual prepared for the Department for the Protection of the Human Environment of the WHO. To support the achievement of the MDGs, this spreadsheet identifies, collects, estimates and compares costs of different available technical options that have the potential to provide access to safe drinking water in low-income communities. The WSCP analyses technological options according to their main system components (i.e. water sources, collection, conveyance, storage, treatment and distribution).

The WSCP was developed for data analysis. The tool takes into consideration capital maintenance and other post-construction support costs. However, these are not clearly defined. Software costs do include 'administrative costs of the system, training, promotional and educational costs' (Carlevaro and Gonzalez, 2010), but it is not clear if they concern only the expenditures incurred during the project implementation.

This methodology and the data were tested in 2007 and 2009 by WHO in several contexts: Peru, Cambodia, Indonesia, Laos, Philippines, Thailand and Vietnam. According to Carlevaro and Gonzalez (2010), the next versions of the tool should include an extended costing method.

2.1.5 The Sector Wide Investment and Financing Tool (SWIFT)

SWIFT (Virjee, 2007) was developed by WSP in 2007. The main purpose of the DST was to assist African governments in analysing the financial status of their water sectors. The DST can be used to gain an improved understanding of resource flows and relationships between financing and outcomes.

5 Excel spreadsheet available at: www.content.undp.org/go/cms-service/stream/asset?asset_id=2548672

6 User guide developed by The Millennium Project and available at: www.content.undp.org/go/cms-service/stream/asset/?asset_id=2548671

> 'The primary function of a SWIFT analysis then is to understand the financial balances in the water sector of a given country and to allow strategic analysis of options available to close those gaps. […] The model analysis can help sector decision makers to understand the strengths and weaknesses of their existing sector information and monitoring systems. Given that the data inputted to SWIFT is provided by the users of SWIFT, data gaps that exist, and sensitivity analysis around those gaps, facilitates an understanding of the planning implications and costs linked to poor information' (Virjee, 2007).

The tool comprises of five modules:
1. Sector definition and target setting
2. Public finance
3. Sector development
4. Service delivery
5. Policy scenarios

The model innovatively includes expenditures with indirect support (called sector management activities), going as far as allocating mandates – and corresponding percentages for expenditures - to different institutions (policy setting, regulation and sector information and monitoring systems). SWIFT has been tested at different stages in Zambia, Mozambique and Kenya with the objective of developing a DST for a sector-wide application in African countries. However, Virjee (2007, pp. 23) mentions that for SWIFT to be used at country level, it implies a large degree of customization to specific country requirements and context.

2.1.6 The Borehole Costing Model

This DST is a model that was developed in 2009 by Cranfield University[7] and SKAT[8] with support from UNICEF. The aim of the DST is to look specifically at borehole costs. Its accompanying spreadsheet enables drilling companies and clients to estimate the cost of drilling boreholes taking into account the depth, geology, fuel prices, equipment used, labour costs, as well as a number of other key factors.

It considers costs that are incurred in six steps of a drilling process:
1. Baseline costs
2. Mobilisation
3. Drilling
4. Completion
5. Well development
6. Results

The DST calculates capital expenditures (hardware and software) detailed in a bill of quantities. The DST is part of a wider initiative by the Rural Water Supply Network and SKAT to develop cost-effective boreholes.

2.1.7 City Sanitation Plan

The *City Sanitation Plan*[9] DST was developed in 2009 by WSP-South Asia for city planners to build seven-year investment scenarios. It includes four possible city-wide sanitation interventions:
1. Septic tanks with soakaways or pit latrines,
2. Partly septic tanks with soakaways or pit latrines with an off-site (conventional sewerage) component,
3. Small bore sewerage, and
4. Conventional sewerage.

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7 Available upon request from library@cranfield.ac.uk

8 Available upon request from rwsn@skat.ch

9 Database and spreadsheet developed by Ravikumar et al. (2009).

It considers capital and operational expenditures, arrangements for household contributions, calculations for recovery from user fees, but does not include capital maintenance expenditures (costs of rehabilitation). It provides different forecasts for population growth, but it lacks clarity on the inflation rates and cost projections. It is currently being used in several Indian cities.

2.2 DSTs using other software

2.2.1 Suivi Technique et Financier (STeFI)

STeFI (Suivi Technique et Financier) is an institutionalised method for monitoring the functionality of water facilities and the financial costs of small town and rural water services. It is a Management Information System (MIS), but it does have decision support capability for formulating recommendations aimed at improving functionality. It was developed and tested between 1994 and 2004 by the National Water Supply Directorate (DNH) with German assistance. Subsequently, it has been used in parts of Mali, Niger and Chad. In Mali, for example, the STeFI was used by two operators, who are in charge of:

- checking the functionality of water facilities,
- collecting the bi-annual financial accounting of water service providers,
- reporting every six months to the local water authorities (i.e. communes), the local water service providers and the users through technical and financial reports,
- formulating recommendations in order to improve functionality and planning, and
- consolidating cost data and reporting to the government.

STeFI is limited to monitoring the costs for which communes are ultimately responsible, such as operation expenditures, rehabilitation expenditures and direct support costs. As capital investments and other costs are covered by government and international donors, these costs are not considered in the STeFI.

Data is communicated by the providers to the operators via a radio system, and the data is compiled in SARI SAGE accounting software. The information is available to the participating communes and service providers and is reported to the government. The total monitoring costs are divided between the users (via tariffs established by providers), the communes and the government. Communes pay the STeFI operators two thirds of the monitoring fee either annually or every six months.

There is evidence that STeFI has made a remarkable difference, illustrated by the following outcomes:

- higher network productivity has been registered,
- economies of scales have been observed,
- small networks' life expectancy have been doubled (with accompanying cost savings),
- water prices and tariffs have decreased, and
- advocacy for fundraising both from the government and the communes has been facilitated.

STeFI is an interesting DST because it relies on an institutional framework which allows the government to play its regulatory role without being directly involved in or responsible for water provision. The monitoring provided by STeFI operators is independent and can be used more easily to arbitrate conflicts between water authorities and service providers. However, Faggianelli et al. (2009) argue that STeFI cannot be generalised in Mali (to all water systems and communes) unless it comes under the umbrella of a sustainable service programme which integrates regulators and providers.

2.3 Web-based DSTs

The following DSTs are also based on spreadsheet applications, but they have been upgraded to support web interfaces. These DSTs can support online queries and data registration. They also allow broader sharing possibilities.

2.3.1 The International Benchmarking Network for Water and Sanitation Utilities (IBNET)

The IBNET Toolkit[10] offers a range of financial, technical and process indicators (Table 1), primarily meant to capture the institutional context in which the utilities are operating. This set of indicators is designed for the assessment of utility performance in the provision of water and sewerage services and as the basis for cross-utility and cross-country comparisons. The emphasis is on local ownership of the data and use of benchmarking as a good management tool. IBNET is currently managed by WSP.

IBNET indicators are set according to the following categories:

- Service coverage
- Water consumption and production
- Non revenue water
- Metering practices
- Pipe network performance
- Costs and staffing
- Quality of service
- Billings and collections
- Financial performance
- Assets
- Affordability of services
- Process indicators

As one of the major objectives of IBNET is to develop and update a dataset with comparable indicators, the website provides a useful data list that uses standardised data definitions. The IBNET database contains information from over 85 countries, but the type of information varies according to national capacities and priorities. Indeed, IBNET developed over 70 indicators, but it allows the users to progressively collect and share additional data to fulfil an increasing number of indicators over time.

2.3.2 FEASIBLE

FEASIBLE is a software tool developed by COWI, an international consultancy group, to support the preparation of environmentally-sound financing strategies.[11] A first model was developed during the early 2000s in close co-operation with the Organisation for Economic Co-operation and Development (OECD) and financed by the Danish Ministry of the Environment under the Danish Co-operation for Environment in Eastern Europe. The model and support guidelines are available on the OECD website[12].

The basic approach of FEASIBLE is to consider targets for water supply and sanitation, determine the costs of achieving these targets and compare the required expenditures with the available resources to identify the finance gaps. The tool is based on cost calculation functions, which can be adapted to local situations from which it is possible to develop various scenarios to determine how these finance gaps can be closed. It covers drinking water supply, wastewater, sanitation and solid waste. It can be applied countrywide or to specific regions or large cities.

In addition, FEASIBLE provides interesting components such as calculations on the debt service, calculations of user charges and affordability measurements. The tool has been tested at length and reports are available for different countries including Lesotho, Egypt and Kyrgyz Republic. A recently developed second model now allows FEASIBLE to support financing strategies for the rural sector.

10 For more information on IBNET (last accessed in 2011), visit: http://www.ib-net.org/

11 Additional information on FEASIBLE can be found at: www.cowi.com/menu/project/EconomicsManagementandPlanning/Financialanalysesandlaw/Pages/feasiblemodel.aspx

12 To access documentation and database, visit: www.oecd.org/document/56/0,3343,en_2649_34335_33719928_1_1_1_1,00.html

2.4 Other interesting DSTs

DSTs using disaggregated costs in the WASH sectors of developing countries are mainly based on either spreadsheet applications or web interfaces (with the notable exception of STeFI). However, many other tools are being developed in other sectors. DSTs are being developed that make full use of ongoing innovation in IT software and hardware, for example, GPS-enabled smart phones and tablets, mapping applications and cloud-based servers and databases. Many of these new DSTs are being created by NGOs and are widely disseminated. The following examples focus on success stories and on the next generation of DSTs that could eventually lead to disaggregated cost analysis being used more broadly in planning and financing water and sanitation services. They also illustrate how disaggregated costs can be better integrated into these tools.

2.4.1 TR61

TR61[13] is the United Kingdom's water utilities joint costs database. It was developed by the Water Research Centre (WRC) in 1977 and aims to provide costs estimates of water and wastewater treatment. Its business model is based around a membership structure (predominantly UK water companies). This system has now been self-sustaining for over 30 years following the evolution of new technologies.

Members supply information on an annual basis using data from capital investment and service contracts as the main source of information. In 2005, for example, 2200 contracts of all sizes were processed, and anonymised data was included in the dataset at an aggregated level so that the source could not be determined.

Individual members pay an annual subscription fee and in return for supplying information, members can access the data. The level of the membership fee is determined by the costs of managing and maintaining the database. TR61 is being managed by a steering group whose members come together every six months to discuss the data.

2.4.2 CostIt

CostIt[14] has been developed by the World Health Organization (WHO) for the health sector. The DST is an Excel spreadsheet designed to record and analyse cost data for the purpose of calculating the economic cost of interventions. It uses separate templates to report and analyse costs of primary health facilities and hospitals at the programme and household levels.

This DST covers what is missing from most of the DSTs used in the water sector: a level of detail that includes direct and indirect support costs, consideration of post-implementation costs, inclusion of GDP deflators and consideration of depreciation values. The programme level template includes the costs 'incurred at different levels of the health system (national, regional and district), which is above the level of direct delivery of care to beneficiaries,' (Adam et al., 2007) and the household templates include the travel time to health facilities. The programme costs also distinguish between start-up and annual post-implementation costs. Start-up costs are the equivalent of capital expenditures in the water sector (both hardware and software). The post implementation costs considered 'comprise capital and recurrent categories and are meant to be the costs of running the programme for one year' (Adam et al., 2007). Concerning the currency calculations, CostIt integrates GDP deflators which automatically convert the costs for any given year to the base year chosen. Finally, a depreciation function can be set on or off.

2.5 What the future holds: mapping tools and mobile phones

This section presents some of the latest DSTs being developed to support decisions related to improved and sustained WASH services delivery. Although they do not include disaggregated cost components at this stage, they offer user-friendly potential for capturing costs against service levels and routinely updating them.

13 To see the latest developments on TR61, visit: www.wrcplc.co.uk/default.aspx?item=838

14 The CostIt database is available at: www.who.int/choice/toolkit/cost_it/en/index.html

2.5.1 FLOW

Field Level Operations Watch[15] (FLOW) is an open source, dynamic baseline and monitoring DST developed by Gallatin Systems in 2010 for Water for People. It can be used to map WASH infrastructure along with information on the condition of the infrastructure.

FLOW maps and records information relevant to the following questions:

- Is the water point or sanitation solution in use and functioning?
- How many people have access to water and sanitation in the area?
- Are the services able to expand along with population increases in the community?
- Is the quantity and quality of water meeting the needs of the community?
- Are sufficient tariffs being collected to ensure ongoing operation, maintenance, repair and eventual replacement?

Since March 2011, FLOW was not being used to record or map cost data. However it is anticipated that FLOW will be upgraded so that operational expenditure can be collected.

2.5.2 Water Point Mapper

Also launched in 2010, the Water Point Mapper tool[16] (WPM) developed by WaterAid is based on experiences from its country programmes in Southern and East Africa regions. WPM is a DST that uses Excel and Google Earth to generate maps. It allows easy aggregation and presentation of data to local WASH authorities and practitioners.

WPM can be used to:

- identify water sources that are no longer functional,
- show the distribution of improved water sources so that inequalities in services can be identified,
- show the distance communities must travel to find the nearest improved water source,
- identify areas where investments are needed, and
- map contaminated water sources.

WPM can also be used as a low-cost data acquisition system which can feed into a national level asset management system. Financing operational expenditure is one cost element identified in the database but additional details are not currently easily accessible.

2.5.3 h2.0 initiative

The h2.0 initiative[17] is testing innovations in WASH monitoring and seeking to put in place powerful and effective monitoring systems on a global scale. h2.0's aim is to develop DSTs which service providers can use to better manage WASH services and contribute to the realisation of the related MDGs.

The h2.0 platform was launched in 2010 and involves at pilot stage, stakeholders and expert organisations in East Africa who are interested in advancing a monitoring agenda. The initiative tests monitoring methodologies and places data in the public domain where it can be easily accessed, as well as updated and validated by a broad set of users. Pilots are being implemented in collaboration with national and local authorities and NGOs. Google.org, UN-HABITAT, GIZ, The University of Twente and WaterAid are currently contributing to the consortium.

Many of the DSTs to be used by the h2.0 initiative are still in development. All launched in 2010, these DSTs show promising possibilities. However, they do not currently handle disaggregated costs. Further developments could include cost data to support the assessment of WASH technologies and services.

15 Details on FLOW can be found at: www.waterforpeople.org/assets/pdfs/publications/flow.pdf

16 The WPM tool is available for download at: www.waterpointmapper.org/Default.aspx

17 For more details on h2.0 visit: www.h20initiative.org/

3. Comparing tools: the cost components in the decision support tools reviewed

The DSTs reviewed above are supported by computer software and, in most cases, are implemented as spreadsheets. Web interfaces, mapping and mobile applications are extensions of this that aim to improve data collection, aggregation and interpretation.

Each DST was developed to meet a specific objective however, not all DSTs were developed with the specific purpose of collecting disaggregated costs. Some are designed to use existing cost information found in publications, bills of quantities or sector databases, while others are designed to collect and process field data. Moreover, there is little consistency in the way in which cost and expenditure is defined across the various DSTs. Indeed, some costs can fall under different categories according to differing interpretations.

Table 2. **Decision support tools and the use of disaggregated cost components**

Components included in the tools	Excel spreadsheets DSTs							Other soft-ware	Web based DSTs		Other interesting DSTs	
	PEM	MDG costing and financing	W and S needs assessment tool	SWIFT	Borehole costing model	City sanitation plan	Water supply cost processor	STeFI	IBNet	FEASIBLE	CostIt	TR61
Scope (urban/rural)	U+R	U+R	U+R	U+R	R	U	U+R	R	U	U+R	Health sector	U+R
Sector (water/sanitation)	W+S	W+S	W+S	W	W	S	W+S	W	W	W+S		W+S
Capital Expenditure – hardware and software	Y	Y	Y	Y	Y	Y	Y	N/A	Y	Y	Y	Y
Capital maintenance expenditure	Y	Y	Y	Y	N/A	N	Y	Y	N	Y	Y	N/A
Operating and minor maintenance expenditure	Y	Y	Y	Y	N/A	Y	Y	Y	Y	Y	Y	Y
Cost of Capital	N	N	N	N	N	N	N	N/A	Y	Y	Y	N/A
Expenditure on direct support	Y	Y	Y	Y	N/A	Y	Y	Y	Y	N	Y	N/A
Expenditure on indirect support	Y	Y	Y	Y	N/A	N/A	N	N/A	N/A	Y	Y	N/A
WASH services delivered*	N	N	N	L	N/A	L	N	L	L	L	N/A	Y

Y = costs considered even if limited
N = costs not considered
N/A = not applicable to the tool purpose
L = Limited data on services available

* For example, a water service level should include indicators on quantity, quality, accessibility, and reliability. See WASHCost working papers 2 and 3 at http://www.washcost.info/pubs

Interestingly, most of the DSTs developed by the sector have captured most of the life-cycle cost components in a conceptual way. Table 2 (on previous page) summarises the scope, type of costs and services data used by each tool reviewed in the previous section. Notably, the cost of capital is missing from many of these tools. While a wide variety of fairly disaggregated costs are considered theoretically in the development of the tools, there are exceptions. STeFI is clearly dedicated to collecting costs of service providers and the borehole costing model is only concerned with initial capital expenditure. Since no costs have been identified in the mapping tools, they were not included in this summary.

Even when the DSTs include cost components, there is a real difficulty in populating the conceptually well-developed tools with the complete range of disaggregated costs data since most of the data is not available or incomplete. This makes it difficult to retrieve completed, reliable and up-to-date cost information from any of the DSTs discussed in this paper. In addition, if DSTs have not been designed to deal with missing data, they are of no practical use for decision makers. A well-designed DST should take into account not only the specific needs of the decision makers but the constraints on data collection, the capacity required to use the DST and the finances needed to run it.

Although this working paper provides a limited number of DST examples, a brief exploration of these tools suggests that DSTs are not being used optimally in the sector to inform financial decisions (Moriarty, 2010). The whole range of disaggregated costs is not systematically available, collected and updated to support decision making in the WASH sector. This is symptomatic of a sector that relies on funds that are allocated and utilised as and when they are available. Another explanation is the weakness of the practitioner/tool developer relationship. The importance of strengthening this relationship for the successful use of decision support tools is explained in more detail in the next chapter. Further, even when DSTs fulfil their initial role (such as STeFI), data is not shared with other initiatives. The last section of this working paper explores how to bridge the gap between theory and practice and support optimal development and use of DSTs using disaggregated costs.

4. Ensuring optimal development & use of DSTs

Most of the DSTs discussed in this working paper are expensive software which have involved many people in their design, testing and development. Many of the reasons behind failed management information systems also apply to decision support tools. Some of these include:[18]

- a lack of understanding of the problems and needs of users in the early stages of development;
- a lack of understanding or capacity to handle the system, as well as too much reliance on the procedures for handling data used by computer systems;
- a lack of concentration to low levels of data processing because of an assumption that data is already digested, easily accessible and understood.

On the other hand, organisations can judge how successful the DST is by looking at:[19]

- level of use: is the tool actually being used?
- level of user satisfaction: do users like the tool?
- accomplishment of original objectives: has the tool helped in solving the problems specified?
- appropriate use: is the tool being used correctly?

The WASHCost expert meeting on WASH data (WASHCost, 2009) provided a series of considerations to ensure optimal use of financial data. These considerations do not directly provide ways to improve the above mentioned DSTs, but to explain why they are not used in an optimal way. The following considerations are not exhaustive, however they offer insight into explaining why DSTs fail when disaggregated costs are assumed to be readily available, and cost information is assumed to already inform decision making.

4.1 Meet WASH practitioner's needs

Gaps in DST developers' (whether they are international organisations or research institutes) understanding of the practitioners' capacities cannot be underestimated (Winpenny, 2010). Developers are eager to produce comprehensive DSTs using the latest concepts, methods and technologies, but these tools are often developed by international organisations or research institutes to support national and international monitoring and cross-country comparisons. In many cases the development is not initiated by the intended user or based on an expressed and experienced end-need.

It is debatable whether the existing need and capacity assessments produced by DSTs really reflect what practitioners are looking for, or can cope with. Most practitioners are grappling with day-to-day challenges rather than long-term international targets. Among the DSTs reviewed in this paper, many have the specific aim of monitoring MDG achievements. This is rarely a priority of WASH practitioners working at the intermediate and local levels.

To provide reliable and accurate information for decision makers, data must be processed and manipulated before being integrated into a DST. Practitioners, especially those working at local or regional level, do not always have the capacity to collect, process and aggregate (or disaggregate) the data required for the DSTs. Far from all practitioners are at ease with statistic and data manipulation and often even estimates of required data is difficult to obtain from the field. The DST's interface should be user-friendly and the equipment and supporting environment to make proper use of the tool should be made available (e.g. computer, internet, electricity, documentation, technical support). Ultimately, the tool must meet the practitioners' needs as they are the intended users.

18 For a general introduction go to: www.antonine-education.co.uk/ICT_A2/Module_4/topic_2__management_information.htm

19 Ibid.

Filling the gap between developers and practitioners can be done in many ways. The highest priority is to undertake a proper needs assessment. Another possible way is for the developers to allow progressive uptake.[20] The IBNET experience shows the advantage of flexibility. Initially, not all practitioners could provide information on all indicators managed by IBNET, but over the years they saw the benefit of supplying cost information as they could use the overview from the database for their own business planning. As a result, they started to supply more information on indicators they were previously not reporting on.

Another way to ensure the relevance and appropriateness of tools is to bring tool developers closer to the practitioners. Ideally, the practitioner should also contribute to the development of the tool they want to use. By developing a tool that is based on the existing and readily available data, it can help practitioners see its advantages and encourage its use. It can also help the developers better understand the challenges behind tools and data collection.

4.2 Disseminate information produced

To ensure not only the long term use but also the quality of data, including disaggregated costs, DSTs must allow the information to circulate back to the users it comes from. Ideally, the information must find a level of ownership by those who contributed data. Communities and institutions have provided information in many questionnaires and surveys from which they have never seen any outputs. A quote taken from the WASHCost expert meeting (WASHCost, 2009) illustrates the issue: 'There are no consequences for being truthful in the questionnaire because nothing will be done with it anyway'.

It is important to avoid data collection fatigue which results from numerous questionnaires with no obvious benefit or feedback to those involved in the process. Providing direct feedback to the institution which organises and/or supplies the data will help ensure the sustainability of data collection and the proper use of the DST. This information loop allows the data to be reviewed by the providers for quality control purposes. It can also support a better understanding of the value of a DST with up-to-date information. Finally, it allows the developers to adjust the tools where needed.

Completing the information loop (and providing open access to information) not only reinforces the added value of DSTs, it also allows practitioners to share and compare data[21]. Users and practitioners will have a better understanding of the reasons behind a decision (especially if the decision is made by a third party), and can make arguments to responsible entities based on the available information. DSTs cannot support this alone, but as part of an open-access MIS they can contribute to further transparency. Paradoxically, confidential data and data sources can encourage sharing. Confidentiality can be relevant for business-oriented tools such as the TR61, because many organisations (in this case urban utilities) reluctantly relinquish their exclusive hold on data for various reasons (competition, trade secrets, liability, etc).

One of the main challenges in developing and using DSTs is to encourage data disclosure and sharing, especially when it comes to financial data. This data supports advocacy messages to governments and other international stakeholders. The International Aid Transparency Initiative (IATI) has published a standard so that implementers and donors can publish and share their financial data on projects in a shared electronic format. Initiatives like IATI which promote interoperationality between tools and open access to information may prove catalytic in improving data disclosure and sharing.[22]

20 Progressive uptake is a system where simple data is initially collected (often through questionnaires) then followed by progressively more complicated questions and information

21 Interesting insights can be read at: www.circleofblue.org/waternews/2011/world/do-it-and-prove-it%E2%80%94information-technology-opens-up-the-water-sector/

22 For more information on IATI see: www.aidtransparency.net and www.iatistandard.org

Given the lack of information on the actual use of the tools reviewed, there remain some unexplored issues. These include the level of user confidence in using some of these DSTs and how these tools handle the uncertainty of data.

5. Conclusions

This working paper provides an overview of existing DSTs in the sector which make use of cost components. It also looks at some of the reasons why little importance is given to disaggregated costs in the decision-making processes. Disaggregated cost collection also has to get more attention from the WASH sector, in order to improve the existing databases, to ensure the integration of costs in new or updated DSTs, and ultimately to support better decision-making. Additional attention will have to be given to desired and actual service levels as it is not possible to make decisions on life-cycle costing without these.

WASHCost does not aim to develop another DST but rather bridge the current gap in existing DSTs in three ways. Firstly, WASHCost has collected recent and reliable disaggregated cost data that can be inputted into existing DSTs and used to support the optimisation of these DSTs. Currently, WASHCost supports DST optimisation in Mozambique, Ghana, Burkina Faso and Andhra Pradesh through its data collection methods and analysis.

Secondly, WASHCost research teams have developed a methodology that can be easily transferred and used by other parties to collect disaggregated cost data and keep existing DSTs up to date. WASHCost, WHO and WSP are working together in an international initiative to produce a shared spreadsheet to collect relevant data.

Finally, WASHCost aims to help national and decentralised sector bodies embed the use of the life-cycle costs approach so that it becomes institutionalised, owned and actively used within countries. This way, disaggregated cost data will be incorporated into practices and in decision-making processes and subsequently in the tools designed to support decision-making.

Decision support tools offer tremendous possibilities in assessing financial gaps, building and monitoring investments scenarios and assessing costs and benefits of WASH interventions and services. With the life-cycle cost approach, WASHCost works with practitioners to better use financial data in their decision-making, and consequently, to make better use of the available technologies. By doing so, it contributes to bridging the gap between technologies, developers and practitioners, with the objective of ensuring sustainable water and sanitation provision in developing countries.

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Annex A:

Life-cycle cost components

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. See WASHCost Briefing Note 1, Life-cycle costs approach: costing sustainable services for a detailed description[23]. The life-cycle cost components include:

Capital expenditure – hardware and software (CapEx)
The capital invested in constructing fixed assets such as concrete structures, pumps, pipes and latrines both to develop or to extend a service. Investments in fixed assets are occasional and 'lumpy' and include the costs of initial construction and system extension, enhancement and augmentation. In addition to investment in 'hardware', there is a complementary necessity to invest in CapEx 'software' which includes one-off work with stakeholders prior to construction or implementation, extension, enhancement and augmentation (including costs of one-off capacity building). These costs also include 'household coping costs' by which households spend money to achieve a satisfactory level of service i.e. storage tanks or water filters. *See briefing note 1b for further details.*

Operating and minor maintenance expenditure (OpEx)
There is a requirement for recurrent (regular, ongoing) expenditure on labour, fuel, chemicals, materials, purchases of any bulk water, and community support. Most cost estimates assume OpEx runs at between 5% and 20% of capital investments. Minor maintenance is routine 'everyday' (every month also) maintenance needed to keep systems running at design performance, but does not include major repairs or renewals which are not recurrent. These costs also include 'household coping costs' by which households spend money to achieve a satisfactory level of service i.e. cleaning products for sanitary facilities, energy costs, etc. *See briefing note 1b for further details.*

Capital maintenance expenditure (CapManEx)
Expenditure on asset renewal, replacement and rehabilitation costs is best based upon serviceability and risk criteria related to service degradation and failure. CapManEx covers the work that goes beyond routine maintenance to repair and replace equipment, in order to keep systems running. Accounting rules may guide or govern what is included under capital maintenance and the extent to which 'broad equivalence' is achieved between accounting charges for depreciation (designed to build up a reserve for renewal) and actual expenditure on capital maintenance. Capital maintenance expenditures and potential revenue streams to pay those costs are critical to avoid the failures represented by haphazard, and almost always late, system rehabilitation. *See briefing note 1b for further details.*

Cost of capital (CoC)
The cost of capital is the cost of financing a programme or project, that is, the cost of accessing the funds needed to construct a system. This cost is made up of interest on any loans and, in the case of a commercialised public or private sector provider,, including small scale private providers, the return required (usually the dividend) on the CapEx investment by government as owner or the shareholders in the case of a private company. Where the capital has been provided as a grant it is sometimes appropriate to consider an indirect cost of capital. *See briefing note 1c for further details.*

Expenditure on direct support (ExpDS)
Includes expenditure on both implementation and post-construction support activities direct to local-level stakeholders, users or user groups. In utility management, expenditure on direct support such as overheads is usually

23 Find WASHCost research publications at: www.washcost.info/pubs

included in OpEx. However, these costs are rarely included in rural water and sanitation estimates. They include the costs of ensuring that local governments have the capacities and resources to plan and implement, manage contracts or emergency situations when systems break down, and to monitor private or public service providers' performance. *See working paper 5 for further details.*

Expenditure on indirect support (ExpIDS)

This includes macro-level support, policy, planning, and monitoring that contribute to the sector regulation but is not particular to any programme or project. Indirect support costs include government macro-level developing and maintaining frameworks and institutional arrangements and capacity-building for professionals and technicians. *See working paper 5 for further details.*

Total Expenditure (TotEx)

Using fixed asset accounting to compile the costs components described above. The cost components are not directly comparable and cannot all be summed up.