3.1 Analysing life-cycle costs and service levels: an introduction

Module 3 of the Costing Sustainable Services Training package enables users to analyse life-cycle costs and service levels for water and sanitation. It discusses:

▶ **What are my life-cycle costs?** Determine how life-cycle costs impact on overall expenditure in the next 20 years. Which life-cycle cost components are most significant, such as capital expenditure or operational expenditure? What is the impact of rehabilitation and renewal of WASH infrastructure? What is the overall cost of the loan that was taken out?

▶ **Forecasting expenditure: who pays for what?** Over the 20 years following an intervention who will pay for which life-cycle cost components? What is the potential impact of inflation and population growth?

▶ **Comparing sustainability risks with expenditure.** Modelling shortfall in expenditure based on breakdown rates and renewal costs and some typical operational costs. Comparing whether the expenditure expected is going to be enough to ensure the sustainability of the service delivery model.

▶ **Comparing WASH service levels received by users across projects, districts, regions or countries. Identifying gaps between 'designed for' and 'received' services.** Comparing how services differ across population groups.

Module 3 consists of twelve handouts and five Excel 2007 spreadsheets[1] that provide a format to store, clean, validate and analyse life-cycle costs and service level data. The handouts provide guidance on how to prepare data for analysis, explain how to analyse life-cycle costs and service levels and present the information. Each handout can be used independently and is linked to publications with in-depth explanation and research results derived from the WASHCost project on life-cycle costing in Burkina Faso, Ghana, Andhra Pradesh (India) and Mozambique. Module 3 concludes with a quiz that puts your knowledge of analysing life-cycle costs and service levels to a test.

Contents

Module 3 consists of the following handouts and Excel 2007 spreadsheets[2]:

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[1] It is possible to use other programmes such as the Statistical Package for the Social Sciences (SPSS) for data storage and analysis. However in this training package and in the WASHCost project Excel was chosen as it is widely used and many team members were familiar with this software.

[2] A step-by-step guide on analysing the life-cycle costs and service levels of hygiene interventions will be available by mid-2013.

Preparing data for analysis

To prepare data for analysing water and/ or sanitation services, work with the following materials:

3.2   Preparing data for analysis; data entry and validation
3.3   Preparing data for analysis; cost conversion
3.6   Life-cycle costs per service level for water and sanitation
3.7   Currency conversion (excel file)

Water services

To analyse water services, work with the following materials:

3.4.1   Life-cycle costs data for water
3.4.2   Calculating the life-cycle costs of water
3.4.3   Water service levels data
3.4.4   Analysing water service levels
3.4.5   Water cost analysis (excel file)
3.4.6   Water service level analysis (excel file)
3.6   Life-cycle costs per service level for water and sanitation

Sanitation services

To analyse sanitation services, work with the following materials:

3.5.1   Life-cycle costs data for sanitation
3.5.2   Calculating the life-cycle costs of sanitation
3.5.3   Sanitation service levels data
3.5.4   Analysing sanitation service levels
3.5.5   Sanitation cost analysis (excel file)
3.5.6   Sanitation service level analysis (excel file)
3.6   Life-cycle costs per service level for water and sanitation

Test

Test   Test: module 3

3.2 Preparing data for analysis; data entry and validation

This handout provides a step-by-step guide to prepare life-cycle costs and service level data for analysis. In the Costing Sustainable Services Training activity, data is stored and cleaned using Excel 2007 software[1].

Data entry

Listed below are some general recommendations on how to enter data, with tips on working in Excel to minimise data entry mistakes[2]:

- Consider the double-entry of data, meaning the same set of data is entered by two people into two spread sheets. A comparison of the files will reveal discrepancies, if any.

- Allow field enumerators to experience how it is to enter data into an Excel spread sheet so they understand what possible problems can arise in entering data.

- Make a reasonable effort to reduce mistakes in data entry, realise that even a motivated PhD student will make errors when entering large amounts of data.

- Create a separate Excel sheet for questions that you foresee will have diverse and multiple responses. Doing so will make data easier to analyse, and ensures that your database does not get cluttered. This may be applicable for the following sample questions: 'How many members are there in your household (list each member's name, age and gender)?/ How many times has the water point been repaired (list the types of repairs)?/ How many water sources, informal and formal, do you use?'

- In general, when a cell in the spread sheet needs to be left empty, do not enter a number that is found in the answer range. You can either enter a very high number as 999, put a dot '.' or enter NR (No response), NA (Not Applicable) or DK (Don't Know). Negative numbers such as '-2' will create problems when trying to export data from Excel to other software, such as the Statistical Package for the Social Sciences (SPSS), for data analysis.

- To facilitate easy data entry in Excel, consider assigning codes to the questions in your questionnaire. Where possible define a response category for your questions and add these as an answer category. However do not volunteer the range of possible answers to your respondent as this could influence his/ her response.

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[1] In general, the WASHCost project uses Excel 2007 software because it is the most commonly used data analysis software worldwide. However, programmes such as the Statistical Package for the Social Sciences (SPSS) may also be used.

[2] Data quality control and reliability procedures used by the WASHCost project are explained in *WASHCost Data Organization and Coding Protocol.*

3.2 Preparing data for analysis; data entry and validation

Box 1   Data entry and cleaning: example from the WASHCost Ghana team

In Ghana, each question has been labelled with a code and this code is written next to each question on the questionnaire. For some questions the Ghana team categorised the possible answers and labelled them with a number–as for example payment modes–when asking how people pay for water:

(1) Pay-as-you fetch
(2) Weekly
(3) Monthly
(4) Yearly
(5) Others, please specify

These categories with their label (1, 2, etc.) can be inserted as a default list of standard answers into Excel. When entering the data into Excel, fewer mistakes can be made as the person entering the data can only choose out of a pre-determined set of options.

When categorising answers, the Likert scale is most commonly used in questionnaires. The Likert scale constitutes of a five to seven point scale, as for example:

(1) Strongly disagree
(2) Disagree
(3) Neither agree nor disagree
(4) Agree
(5) Strongly agree

This gives the respondent the possibility of a more precise answer than using a 3 point scale of:

(1) Bad
(2) Good
(3) Very good

'Other' is an important option as an answer to a question.

After collecting data in the field, organise a de-brief session every evening with the team of data collectors. Discuss the answers given by respondents and determine which answers that were put into the 'other' category can fit in one of the pre-defined categories.

Decimal Separator

Insert all numbers in Excel without a thousand separator as Excel will convert the numbers to the correct format with the correct decimal separator.

Check: if a number in a cell is aligned to the left side of a cell, then it has been incorrectly inserted as text. This means that you have used the wrong decimal separator. If the content of a cell is aligned to the right side, this means that you have correctly inserted your information as a number and it will be converted in the right way. To check: deactivate any alignment setting by selecting the concerned cells; right click on your mouse; and select the function "Format cells".

3.2 Preparing data for analysis; data entry and validation
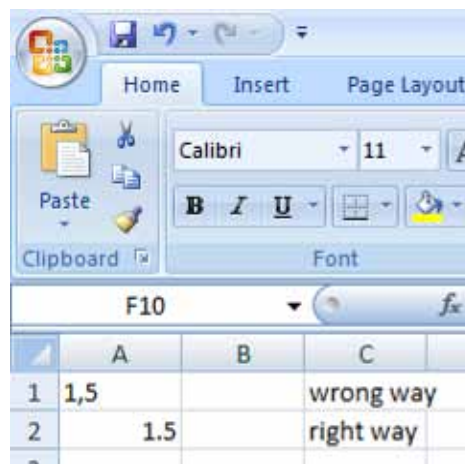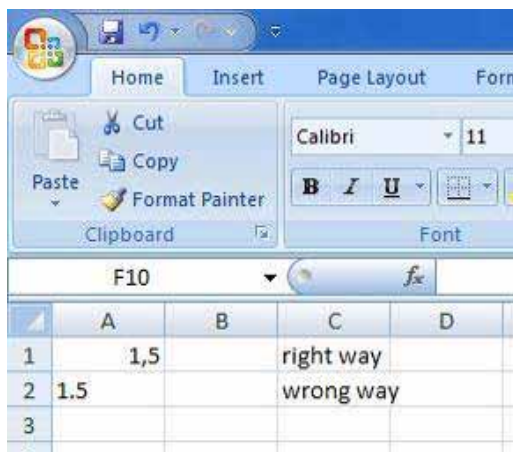
Trim

Always be careful that you do not add any blank spaces behind or in front of text you enter in Excel. In many excel functions you want to refer to a cell with text contents. If they don't exactly match, the formula could give an error or even worse: give the wrong answer. If you are referring to text, it is always useful to wrap this cell referral inside a TRIM-function.

When you use the TRIM() function, you'll see that the first 3 spaces are removed (the same if there are any spaces at the end of the cell content). This will give you the exact content of a cell. This is also very useful if you're working with e.g., VLOOKUP(), HLOOKUP(), MATCH() etc.
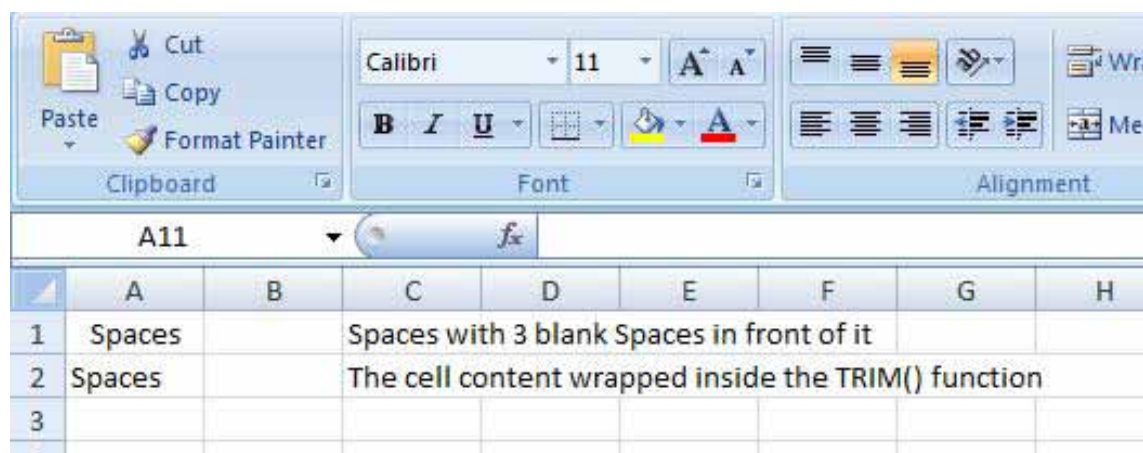

*Formula cell A2 is: "=TRIM(A1)"

Date Recognition

The same as with decimal separators, if you're entering a date, always check if it is entered as a valid date in Excel. An invalid date will be aligned to the left side of a cell. A valid date will be aligned to the right side of a cell.

3.2 Preparing data for analysis; data entry and validation

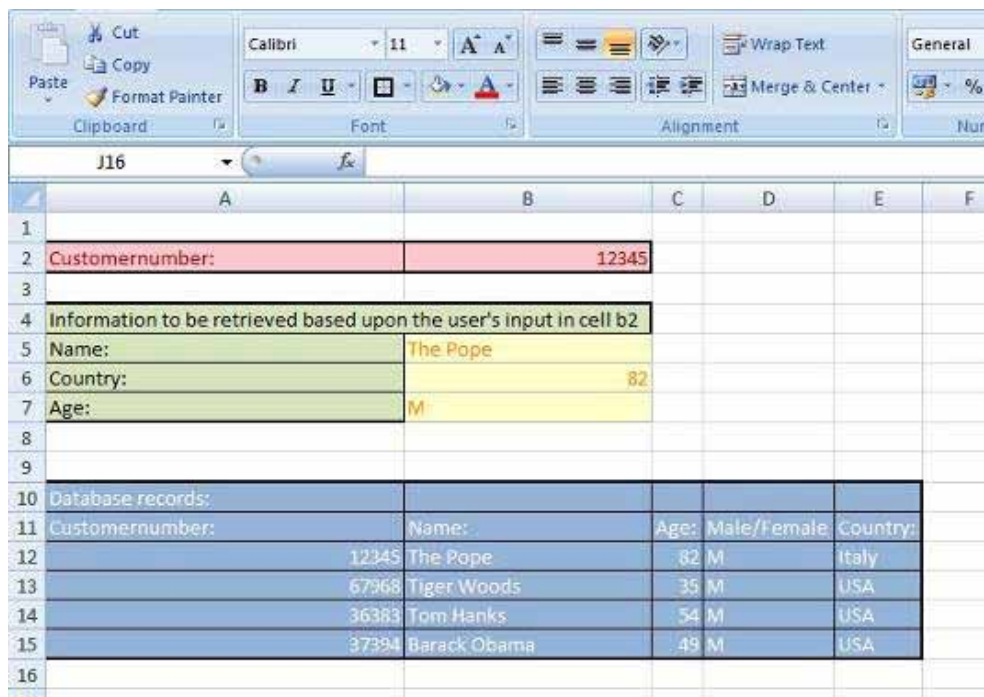|	A	B	C	D	
1	31-2-2010		NOT RECOGNIZED		
2	28-2-2010		RECOGNIZED		
3					
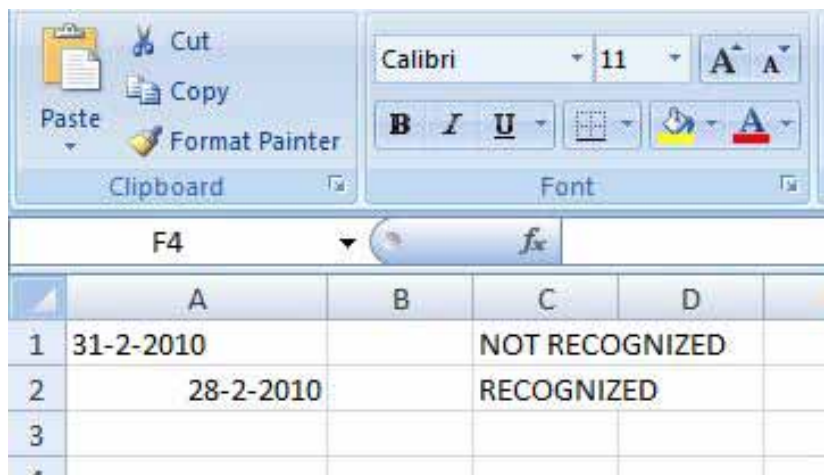
Vlookup()

This function is used often in an Excel worksheet. We can use the VLOOKUP() or HLOOKUP() to find information based upon one specific value. In the example below we're trying to find information about a person.

► The name of the person,
► The country in which the person is living
► The age of the person.

We want to find this information based upon the assigned "Customer number". To facilitate this:

► Insert in cell b2 the customer number.
► In cells b5, b6 and b7, the correct date will appear. The data is then extracted from the table, as seen in rows 10-15 (shaded in blue).

	A	B	C	D	E	F
1						
2	Customernumber:	12345				
3						
4	Information to be retrieved based upon the user's input in cell b2					
5	Name:	The Pope				
6	Country:	82				
7	Age:	M				
8						
9						
10	Database records:					
11	Customernumber:	Name:	Age:	Male/Female	Country:	
12		12345 The Pope	82	M	Italy	
13		67968 Tiger Woods	35	M	USA	
14		36383 Tom Hanks	54	M	USA	
15		37394 Barack Obama	49	M	USA	
16						

3.2 Preparing data for analysis; data entry and validation

In the VLOOKUP() function, four arguments are used.

1   The lookup-value (in this case: cell b2).

2   The array in which we have stored all our information (the table in blue (A11:E15), but of course, this could also be a table found in a different sheet).

3   The column in which we can find the information being asked (Name is in the second column of our array as defined in argument 2).

4   The Range_lookup (see fourth field in image below) can either be false or true. If the lookup-value (first field) has to be an exact match, the argument is FALSE, otherwise it's TRUE. In most cases, you will want to look up an exact match, hence, the argument will be FALSE.
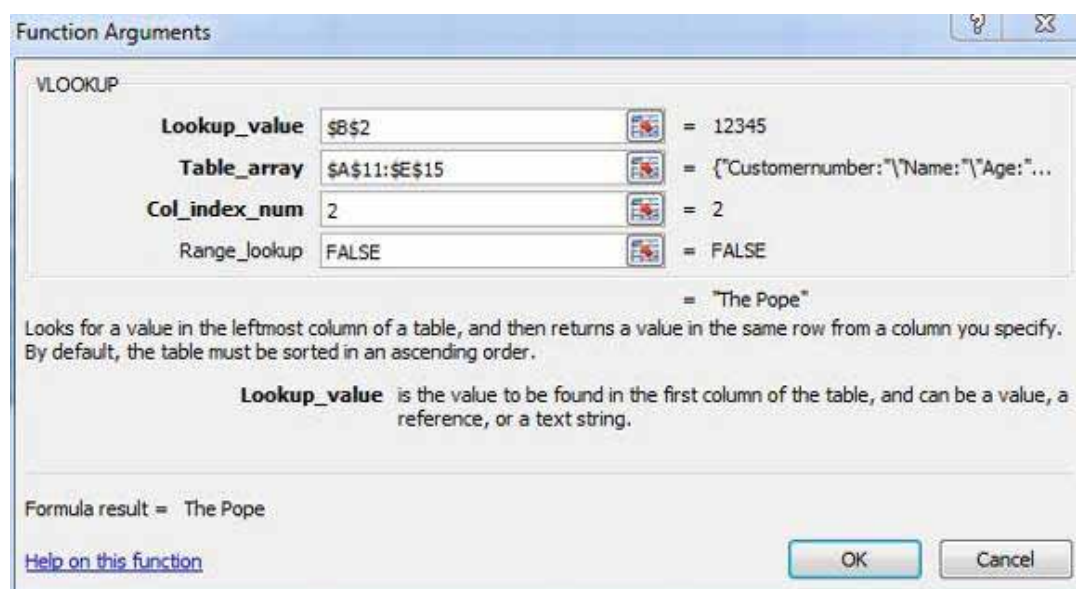
The formula: "=VLOOKUP($B$2;$A$11:$E$15;2;FALSE)" would give us the name as a result.
The formula: "=VLOOKUP($B$2;$A$11:$E$15;3;FALSE)" would give us the age as a result.
The formula: "=VLOOKUP($B$2;$A$11:$E$15;4;FALSE)" would give us the sex as a result.
The formula: "=VLOOKUP($B$2;$A$11:$E$15;5;FALSE)" would give us the country as a result.

Different type of measurement (for example kilo or KG)
During data entry always use the same type of measurement. All information that you would like to export to other software, for example, Statistical Package for the Social Sciences (SPSS) will needs to be numeric. If a measurement is found after the number, for example, 30km, Excel will read the information as text and not as a numeric data. If you will want to format the concerned cells as numeric data, right click on your mouse and select 'numeric' in the function "Format cells".

Example: do not use Gallons and Litres in the same column. Use Litres or Gallons.

3.2 Preparing data for analysis; data entry and validation

Pivot tables

The Excel function 'pivot tables' are dynamic tables, of which you can easily change the layout and change the format of the data presented. When you start to work with Pivot tables for data validation and analysis make sure that:

1   Your Excel spread sheet has column headers.

2   The column headers are not merged cells or do not have duplicated names.

3   In your range of data, there are no empty rows or columns.

Box 2   A step-by-step guide to creating the pivot table

1   Select one of the cells of your list of data.

2   Go to the insert ribbon.

3   Click on pivot table.

4   In the pop-up window, check if the range of your data is registered correctly. If not, select the right region of data.

5   Select the option "Create the pivot table in a new sheet".

Once the new sheet is visible, decide what kind of data you will want to see by:

6   Dragging from the list (top right corner) the column headers of the items you want to see in your pivot table. In your new sheet, indicate which information you would like found in a row or a column.

7   Placing the column headers in the values area; this will allow you to undertake different types of calculations, such as average, sum, count, etc.

If you will want to see how the pivot table resulted in a specific number in the data region: simply double-click on the number and all the related data found in the original sheet will appear on the new sheet.

Conditional formatting

Conditional formatting can be used to emphasise numbers or data that meet a specific condition.

Example: if a number is below 5, assign a red background colour. If the number is above 5, assign a blue background colour. Steps:

1   Select all the data on which you want to place the conditional formatting.

2   On the insert ribbon, click on the conditional formatting button.

3   Select "New rule".

4   Select a rule type: "Format only cells that contain"

5   Enter the rule description and set the format.

6   This way you can add multiple rules.
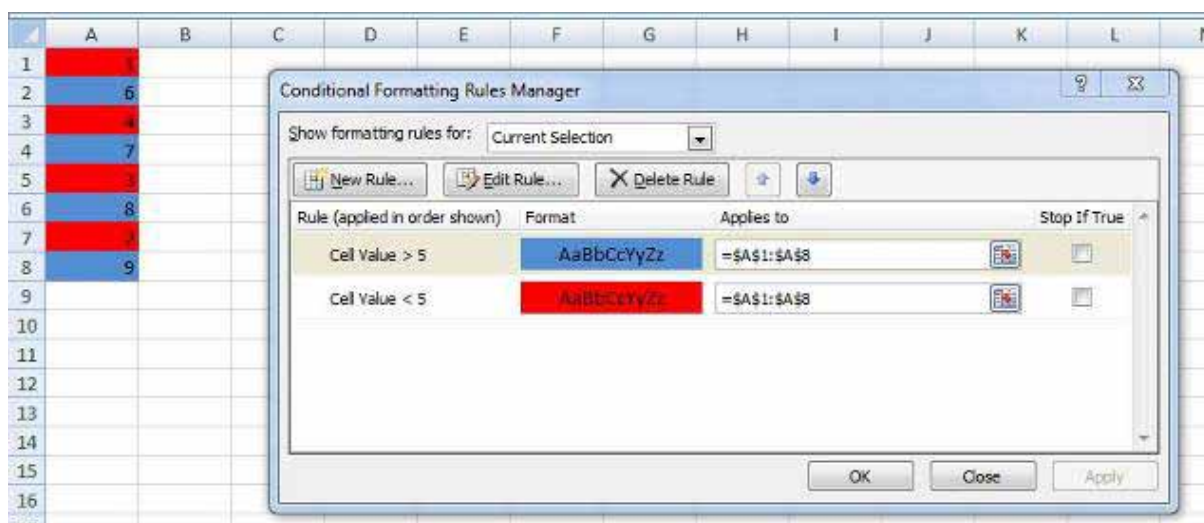
⚠️ More useful examples can be found on: http://www.contextures.com/xlCondFormat01.html

Data Validation

Data validation forces users of excel sheets to enter data strictly based on a specific format/ category inside a cell. This enables the creation of data ranges and makes data analysis easier. For instance, the content of a cell can only be a date, a number, free text, or an item out of a predefined list.

*Example* : Create a predefined list (e.g. very poor, poor, non-poor) using the Excel data validation function:

1   On the Data Ribbon, go to "Data Validation".

2   On the settings tab, choose "list" from the "allow" dropdown box.

3   Insert the source you're using:

    3a   Type the list items in the source box.

    3b   Refer to a range on your actual excel sheet.

    3c   Refer to a named range (if the list you're referring to is on a different sheet).

4   On the "Input message" tab, insert the title and message settings.

5   On the "Error Alert" tab, insert the title and message settings.

6   Click OK and select the cell.

3.2 Preparing data for analysis; data entry and validation

Picture 3a   Type the list items in the source box
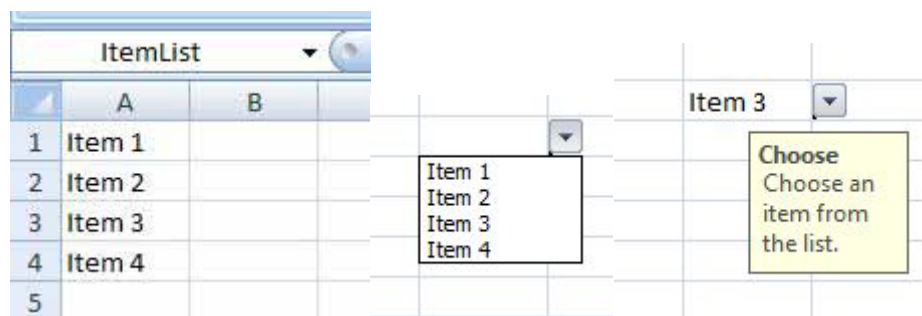

Picture 3b   Refer to a range on your actual excel sheet
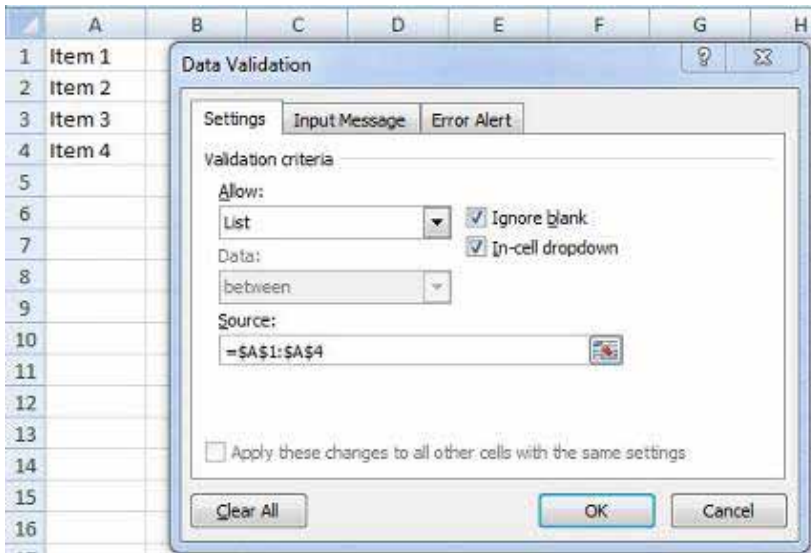
Picture 3c   Refer to a named range (if the list you are referring to is on a different sheet)

3.2 Preparing data for analysis; data entry and validation

Named ranges

In step 3c (above) of the data validation example, we entered a named range. A named range is a number of cells referred to with a name. This could be very useful in long formulae. You don't refer to a range (E.g.: sheet2!A8;H9), but to a name (E.g.: data2010). In step 3c of data validation the source was referred to as a named range "ItemsList".

Box 3   Creating a named range

1	Select all the cells within your range.	
2	Go to the cell address box and type a name (above cell a1).	
3	Then press "Enter"	

The IF() function

With this function, you can examine if a specific condition (logical test) is true or false. If the condition is true then "Value if true" appears, otherwise "Value if false" appears. For example, if the number in a cell is greater than 5 then in the cell next to it the text "Greater than 5" will appear. In case it's less than 5, the text "Less than 5" will appear.

Steps:

1   Select the "if" function.

2   In the logical test set the condition.

3   Insert the values (formulae, numbers or text) in Value if true/ Value if false

3.2 Preparing data for analysis; data entry and validation
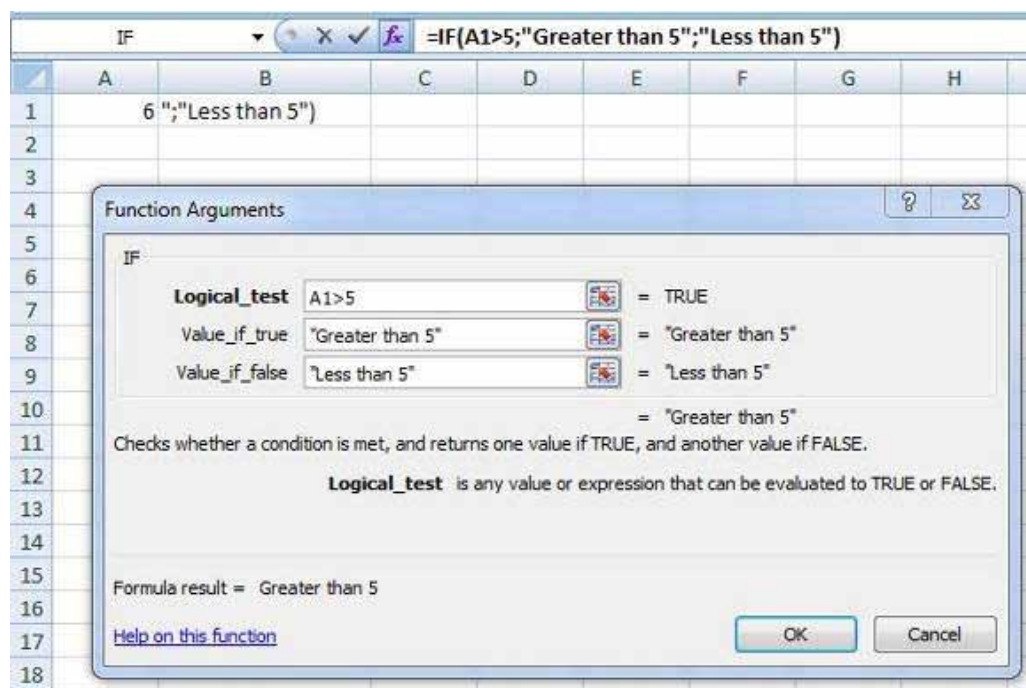
IsError()

The output of the IsError function is "True" or "False". It indicates if the cell content contains an error. As an example, see pictures below.

	A	B
1	text	ABCD
2	number	100
3	text * number	#VALUE!
4		
5	IsError	TRUE
6		
7	If - IsError	Error, please correct!
8		

In cell B3, the formula is B1*B2, which gives an error as a result. In cell B5 the IsError function determines that it has an error in the calculation. If you enter the IsError function inside an IF function, you can rewrite the "#Value!" message to something more meaningful. E.g.: "Error, please correct!"

	A	B
1	text	ABCD
2	number	100
3	text * number	=B1*B2
4		
5	IsError	=ISERROR(B3)
6		
7	If - IsError	=IF(ISERROR(B3);"Error, please correct!";B3)

Indirect

This function transforms a text string into a usable argument in a formula.

	A	B
1	Which sheet?	Sheet3
2	Which cell?	a2
3		
4	Value of the cell:	Test data of sheet 3
5		
6	Formula used:	=INDIRECT(B1&"!"&B2)
7		
8	Normal way:	=Sheet2!A2
9		

In the example above, we can type the name of the sheet in cell b1, also we can type the address of the cell of which we want to see the data of. Instead of making the formula like the content of cell b8, we can make the formula more dynamic.

Validating data

Before data analysis can start, the data collected and entered into the database will need to be cleaned by following the steps below. Search for data entry mistakes by checking the correct spelling of entries under the different variables. For instance: *Are the names of the communities or districts where data collection took place spelled the same?* If abbreviations are used, such as 'NA' for 'not applicable', *are they the same in all cells?*

Box 4   Searching data entry mistakes

> *In Excel spreadsheets you can use formatting to specify a particular 'style' in a cell. For instance, the content of a cell can be limited to a date, a number or an item from a list. Using this feature can help prevent data entry mistakes. How to use data validation in Excel 2007 is explained in the WASHCost Data Protocol.*
>
> * Are all the cells filled in? Are there any inconsistencies or gaps?
> * Scroll through all the variables and look for anomalies. Are there cells that appear to contain a lot of information? Is this correct? Check for inconsistencies.
> * Look for outliers by cross-checking different variables. For example, cross-check the numbers of users of a sanitation facility per household with the number of household members. A discrepancy here, such as 11 users for a household of five, would indicate a data entry mistake.
> * Start filtering and screening for outliers with a mixture of cross-tabulation and basic statistics by using pivot tables. For example, arrange the capital expenditure data according to average per village, then sort the same data by the minimum value and the maximum value. Are there large differences? Check any inconsistencies. How to use pivot tables in Excel 2007 is explained in the WASHCost Data Protocol.
> * Check the distribution of the data with histograms. Do the data show a normal distribution curve?

After a first round of checking for data entry mistakes, it is advisable to take some time away from the data before data analysis can start. This will sharpen and prepare your eyes for spotting data entry mistakes, gaps or inconsistencies.

3.2 Preparing data for analysis; data entry and validation

Once these basic steps have been completed, the database is ready for data analysis. During data analysis, expect to encounter more data entry mistakes and outliers. These will need to be corrected.

💡 *When analysing data, record all estimations and assumptions used, and how and why these have been made so it is clear how the results have been brought about to others.*

Further reading

Verhoeven, J. et al., 2010. *WASHCost Data Organization and Coding Protocol.* [online] WASHCost. Available at: <http://www.washcost.info/page/1029> [Accessed 22 September 2011].

3.3 Preparing data for analysis; cost conversion

In general, preparing life-cycle costs for analysis takes place in two steps[1]:

Step 1   Convert all life-cycle costs into values that can be compared for the same year, removing the effects of inflation.

Step 2   Convert all life-cycle costs into the same currency.

Converting life-cycle costs into the same year

Life-cycle costs data are often collected and reported in different years and in several currencies. These nominal costs have to be transformed into current costs so that they can be compared, with the same year, currency and unit of analysis. This is required for a financial analysis, like life-cycle costing, where all calculations are based on current (inflation-adjusted) costs. In an economic analysis, in contrast, present costs are used instead to assist in understanding the likely future costs of new projects. Box 1 explains the differences among nominal, current and present costs.

Box 1   Financial versus economic analysis

Financial analysis

▸ **Nominal costs** are the actual amount of currency on a specific date. For example, the cost to buy an apple in 2009 was US$ 1.

▸ **Current costs** bring past expenditures to today's values by removing the effects of inflation. For example, the cost of the apple bought in 2009 is US$ 1.40 in 2010 prices.

Economic analysis

▸ **Present costs** bring future costs to today's values by discounting against the time value of money (and ignoring future inflation). For example, we estimate that the present cost of buying an apple in 2020 is US$ 0.50.

To compare expenditures made in different years, all nominal costs across different years need to be transformed into a level relative to a single year (based on current costs). For example, to calculate the average operations and minor maintenance expenditure in 2011 for ventilated improved pit (VIP) latrines based on costs incurred in Ghana between 2003 and 2008, costs from those years must be converted to today's cost by using the gross domestic product (GDP) deflator.

Box 2 shows the steps for making costs comparable over time.

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[1] The Costing Sustainable Services Training Package contains a currency conversion tool for training participants. See **3.7: Currency conversion** of this training package.

Box 2   Sample exercise comparing costs over time[2]

You have collected operations and minor maintenance expenditures for a VIP latrine in Ghana cedi in 2005 (GH₵ 32) and in 2008 (GH₵ 40). What is the expected average operating expense for a VIP latrine today?

To know the expense today, convert past costs (for 2005 and 2008) to current costs (e.g., 2011) by using the GDP deflator.

1. Look up the GDP deflator for your currency in the World Bank Databank[3] or use **3.7: Currency conversion (excel)** of the Costing Sustainable Services Training package.
2. Multiply the local currency in Year X times the GDP deflator for that same year. The formula is as follows:

Cost at current prices = Cost (Year X) * GDP deflator (Year X)

2005 cost in Ghana cedi =	32
Ghana GDP deflator to convert 2005 cost to current (2011) prices =	1.13
Calculation:	**32 x 1.13**
Cost in Ghana cedi in current prices =	36.16

2008 cost in Ghana cedi =	40
Ghana GDP deflator to convert 2008 cost to current (2011) prices =	1.05
Calculation:	**40 x 1.05**
Cost in Ghana cedi in current prices =	42

Expected average operating expense in current prices for a VIP latrine in Ghana is (GH₵ 36.16 + GH₵ 42) / 2 = GH₵ 39.08.

In Box 2, the GDP deflator was used to bring all costs to their value in the year 2011. Such price indices are based on "baskets" of goods and services. Because people's consumption and investment patterns are not fixed–people respond to changing prices by buying alternatives–it may be helpful to look at expenditure patterns using the GDP deflator. The GDP deflator measures changes in both price and the changing composition of the basket: as prices and consumer preferences change, the GDP deflator adjusts accordingly. For this reason, the GDP deflator is a more accurate measure of price changes in the overall economy. GDP deflators are available for most currencies at the World Bank Databank.

Converting life-cycle costs data into the same currency

Once current costs have been calculated for the year of choice, costs can be compared across countries that use different currencies. For instance, to compare costs in capital maintenance expenditure for a borehole and handpump in 2011 in India in Indian rupees (INR 2,000) with a similar borehole installation in Burkina Faso reported in CFA francs (XOF 50,000), both currencies need to be

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[2] All calculations found in this handout are based on 2011 GDP deflator, nominal exchange rates and purchasing power parity.

[3] Available at: *www.databank.worldbank.org/ddp/home.do?Step=1&id=4*

3.3 Preparing data for analysis; cost conversion

converted to the same currency as US dollar (US$) using the nominal exchange rate or the purchasing power parity (PPP).

The WASHCost project uses the US dollar as the yardstick for comparison because it is the most commonly used currency for trading between nations.

The PPP between two countries is the exchange rate at which an amount of money in the currency of one country represents the same volume of goods and services in the other country. PPP is used because nominal exchange rates can be misleading. Exchange rates are based on short-term factors and are subject to substantial distortions from speculative movements and government interventions. Thus comparisons based on exchange rates, even when averaged over a period of time (such as a year), can yield misleading results.

Box 3 shows, step-by-step, how to make costs comparable from country to country, using both PPP and nominal exchange rates.

Box 3   Sample exercise comparing costs for different currencies

You have collected capital maintenance expenditure for a borehole and handpump in 2011 in India in Indian rupees (INR 2,000) and for a similar installation in Burkina Faso in CFA francs (XOF 50,000). Which country has a lower capital maintenance expense based on PPP (in US$)? Which country has a lower expenditure when the nominal exchange rate (in US$) is considered?

1. Look up the nominal exchange rate and the PPP exchange rate for your currency in the World Bank Databank[4] or use **3.7: Currency conversion (excel)** of the Costing Sustainable Services Training package.
2. Convert all figures into a single currency; use the nominal exchange rate or the PPP exchange rate (in US$) to compare the relative price levels of the two countries.
3. Convert all figures into US$ by dividing the local currency with the PPP or the nominal exchange rate conversion factor. The formulae for both the exchange rate or the PPP exchange rate are as follows: **US$ PPP (year x) = local currency (year x) / PPP conversion factor (year x)**

India's capital maintenance expense using US$ PPP

Cost in Indian rupees in 2011 =	INR 2,000
PPP conversion factor for India for 2011 =	19.53
Calculation	2000 / 19.53
Cost in US$ PPP =	US$ 102.40

India's capital maintenance expense using US$ market rates

Cost in Indian rupees in 2011 =	INR 2,000
Market exchange rate for India for 2011 =	46.67
Calculation	2000 / 46.67
Cost in US$ =	US$ 42.85

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[4] Available at: *www.databank.worldbank.org/ddp/home.do?Step=1&id=4*

3.3 Preparing data for analysis; cost conversion

Burkina Faso's capital maintenance expense using US$ PPP

Cost in Burkina Faso francs in 2011 =	XOF 50,000
PPP conversion factor for Mozambique for 2011 =	216.34
Calculation	50,000 / 216.34
Cost in US$ PPP =	US$ 231.12

Burkina Faso's capital maintenance expense using US$ market rates

Cost in Burkina Faso francs in 2011 =	XOF 50,000
Market exchange rate for Burkina Faso for 2011 =	471.87
Calculation	50,000 / 471.87
Cost in US$ =	US$ 105.96

The relative price, whether figured according to the market exchange rate or the PPP approach, indicates that spending on capital maintenance, in international comparison terms, is less in India (US$ 102.40 PPP and US$ 42.85) than in Burkina Faso (US$ 231.11 PPP and US$ 105.96). However, this does not necessarily mean that India is more efficient than Burkina Faso since the expenditure in Indian might not be delivering the same level of on-going services.

The imbalance in water expenditures between many African countries and India (as shown in Box 3) is partly explained by the following reasons:

▶ the likely undervaluation of the Indian rupee, perhaps by a factor of almost three (though the PPP analysis is designed to remove any such effect);
▶ the sophistication of the Asian supply chain, which reduces costs;
▶ the considerably lower wage rates in South Asia; and
▶ the dependence of the African supply chain on expensive foreign imports.

PPP is used because exchange rates can yield misleading results. The PPP conversion factors are available from the World Bank Databank or use **3.7: Currency conversion (excel)** of the Costing Sustainable Services Training package.

3.4.1 Life-cycle costs data for water

This check list describes the variables needed to determine the life-cycle costs of water services, including water treatment and transport from the source to the point of delivery. Each of the listed items is explained in the text that follows.

- Year of construction
- Currency, unit and year of expenditure
- Capital expenditure
- Cost of capital
- Indirect subsidies and discounts
- Operations and minor maintenance
- Direct support
- Indirect support
- Capital maintenance
- Description of service delivery models
- Number of users per water scheme (intended and actual)
- Number of users of water treatment system (intended and actual)
- Users per service delivery model (intended and actual)
- Total population and users in service area
- Seasonal tags for data
- Poverty level tags for users

Year of construction

The year when the water scheme or water treatment plant was constructed determines its age. The age can then be used to estimate the normative depreciation or capital maintenance expenditure per year. Actual capital maintenance expenditure, as reported in the service provider's accounts, might be significantly below this figure, either because the infrastructure is new and does not yet need renewal or because expenditure is below what is required to ensure sustainability. The year of construction can also be used to estimate the infrastructure's likely actual lifespan, compared with its normative lifespan (see Box 1 on next page).

Currency, unit and year of expenditure

Expenditure data consist of information from different years and possibly in different currencies and units[1]. To compare cost data, all information needs to be standardised using the same unit, currency

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[1] Costs data are often collected in lump-sum amounts; the unit refers to what the expenditure purchases. For example, if the expenditure covers the digging of ten boreholes, the unit is ten boreholes.

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3.4.1 Life-cycle costs data for water

and year[2]. A recommended unit for standardising analysis of life-cycle costs and service levels is per water scheme, as this unit can later be aggregated per household, service area or service delivery model.

Box 1   Definitions: actual and normative lifespans

The **actual lifespan** of a system refers to the number of years a system functions before significant maintenance is needed to maintain a given level of service. This can only be determined through field research. In WASHCost, engineering design estimates for the lifespan of a water scheme, also referred to as a **normative lifespan**, are used when appropriate. However, engineering estimates are not always accurate because system components often break down before the normative lifespan of the overall system is reached. Sometimes engineers and designers are overly optimistic about a system's lifespan under particular operating conditions. WASHCost always differentiates real capital maintenance expenditure—that is, actual spending on renewals and rehabilitation, as recorded by service providers—from what designers believe will be needed if the system operates as they hope.

Capital expenditure

Reliable cost data for capital expenditures is often difficult to find. Some cost data may be 'as budgeted' or 'as designed', perhaps in a bill of quantity or government-approved unit cost, or in the bid from the contractor that is awarded the job, or in the 'as released' funding from the service authority. 'As built' costs are what is charged by the contractor on completion, after any changes in the design; and are the final cost paid for by the commissioning authority. Recording the 'as built' costs is preferable.

If there was no overall contract for the construction, the separate costs of labour and materials must be determined.

Labour costs cover the wages of people working on the construction—drilling boreholes, digging or lining wells, excavating trenches and laying pipes, or constructing handpump aprons—but may also include community involvement, such as time spent by households to construct a water scheme.

It is possible to assign an economic value on households' labour, even where there has been no direct payment for their effort, and conduct an economic analysis that includes such unpaid inputs.

Besides the materials needed for construction, capital expenditure should also include basic expenses such as working with stakeholders and capacity building. An example is the cost of holding a meeting to explain alternative systems to users.

Indirect capital expenditure includes 'household coping costs', such as households' private expenditure on storage tanks or water filters to achieve a satisfactory level of service. This information is needed for a full economic analysis of service provision.

In a large-area network system, the cost of constructing a central treatment plant and any transmission mains needs to be added to the local expenditure on labour and materials. If this

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[2] For step-by-step guidance on how to make costs comparable, see **3.2: Preparing data for analysis; data entry and validation** of the Costing Sustainable Services Training Package.

infrastructure serves areas beyond the local system for which life-cycle costs are being analysed, its cost will need to be apportioned to the number of users in the research area.

💡 *To apportion the capital cost of a central treatment plant and transmission mains, divide the lump-sum figure by the number of users of the water scheme in the entire service area, then multiply the result times the number of users in the research area. The government agency that contracted for the construction of the treatment system should have the necessary data.*

Cost of capital

The cost of capital is the on-going expenditure for interest payments on money that was borrowed. A government may take out a loan to construct a water treatment plant, and the interest paid on the loan is the cost of obtaining access to that borrowed capital. Similarly, a small private provider may be paying interest on a loan taken out to fund construction and may also incur the cost of capital ('profit') that relates to his or her (or often the family's) personal investment in the scheme as shareholders.

In a fixed asset or regulatory accounting approach to water provision, the repayment of the principal– that is, the actual amount borrowed–is not considered a cost. The interest payment–the cost of 'renting' that principal–is included in the life-cycle costs approach under cost of capital. The amount that was borrowed is included under its related cost category. For example, if money was borrowed to construct a treatment plant, that amount is included under capital expenditure.

Information on cost of capital incurred by government borrowing is not likely to be available at the local level. Such information is best collected from the central government and any international financing agencies in the capital city.

The cost of capital incurred by small and medium enterprises can be a sensitive issue if it relates to profits. Owners may want to know how this information will be used and why it is important for ensuring the sustainability of the system.

A cost of capital not considered in this financial analysis is the economic and social benefits of investment in, say, health or education instead of water services. This 'opportunity cost' of capital may be perceived as an expenditure on indirect support (below).

Indirect subsidies and discounts

Some governments arrange special discounts on construction materials or other items. Not accounting for them will distort local costs and underestimate the future costs of building a similar facility. Information on these indirect subsidies can be found in government policy or programme documents.

⚠️ *Government-subsidised discounts should be distinguished from (1) regular government and donor funding to support construction and (2) normal discounts for bulk purchases.*

💡 *Cross-check any information found in policy documents on indirect subsidies and discounts with the local government, since there might be differences between policy and reality.*

💡 *A government may reduce or eliminate taxes on water-related items–cement slabs or buckets–to make water more affordable. Such tax transfers should be included as subsidies.*

Operations and minor maintenance

This category consists of the amount spent to operate a water scheme and undertake day-to-day maintenance. The main expense is usually wages for government or community workers who care for the system. Unpaid household or community involvement in, for example, tightening handpump bolts is not included.

Collecting several years' worth of data will help in assessing the reliability of the information. Particular incidents (droughts, floods, major breakdowns, alternative supplies) may explain certain numbers; not accounting for such events would distort the true averages.

If many gaps appear, particularly from earlier years, only the most recent data should be collected. The total operating expenditure is then divided by the number of years of available data, to determine the average per year (not over the lifespan of the facility).

Direct and indirect support

The difference between direct and indirect support is that direct support can always be attributed to a specific project or geographic area. Indirect support is not connected to a specific project or area.

Direct support is recurrent expenditures for post-construction assistance to the service provider, users or user groups, such as training and equipping local government staff to help communities manage maintenance contracts, test water quality or monitor private sector performance. The costs are usually a lump-sum figure and need to be apportioned to the number of users in the research area.

Indirect support includes recurrent expenditures for governments' macro-level planning and policy making for water service delivery, development of frameworks and institutional arrangements, overall sector-level monitoring and capacity building, and general water resources management. These expenditures may be made at the national, regional or state level and need to be apportioned to the research area's share of the country's total number of users.

Capital maintenance

Capital maintenance is the renewal and rehabilitation or replacement of a water scheme or water treatment plant. The costs are likely to be a lump-sum figure and need to be apportioned to the number of users of the local facility. WASHCost emphasises capital maintenance–that is, long-term renewals maintenance (such as replacing handpumps and rising mains), which is distinct from annual maintenance (such as tightening bolts or greasing bearings)–because the lack of major maintenance is the most common cause of failure or slippage in water service delivery.

For a handpump, capital maintenance will be intermittent–perhaps once every five to ten years–rather than annual. To get a sense of the capital maintenance expenditures for such systems, then the charges for multiple handpumps must be recorded. If no costs on existing systems have been recorded, it might be that new, replacement capital projects are being substituted for capital maintenance. Such a case indicates inefficient capital maintenance. If the new scheme represents an expansion of service or an improvement in addition to capital maintenance, accountants normally estimate what should be recorded as capital maintenance and what is new capital expenditure.

Capital maintenance expenditures for large, aging systems (e.g. large groups of handpumps more than three to five years old) are likely to be recurrent with spending every year. Such expenditures may be reported locally as part of operations and maintenance.

3.4.1 Life-cycle costs data for water

Reported capital maintenance expenditure might be low because the system is new or because maintenance is being neglected. Actual expenditures rarely reflect the actual costs of ensuring ongoing services at the desired level.

The extent to which capital maintenance is required depends on the quality of the construction and the intensity of use, as well as age. Each component of a water scheme or treatment plant has its own lifespan. Good asset management aims to replace components as and when needed, rather than replacing the entire system when it fails.

Description of service delivery models

To compare the life-cycle costs and service levels provided by different service delivery models, it is important to describe the service delivery model of each water scheme. This includes the agreed legal and institutional framework for delivering service, including commonly understood and accepted roles for those involved in the development and provision of the service, the type of technology and physical infrastructure used, and standards for the level of service to be provided[3].

Box 2   Definitions: service authorities and service providers

Service authorities are legally responsible for ensuring that service delivery takes place. Under decentralisation, this responsibility typically lies with local government. Service authorities are accountable for functions such as planning, coordination, technical assistance, regulation and oversight, but they do not provide the actual services.

Service providers are responsible for delivering water and sanitation services. Whether an organisation or an individual, the service provider is responsible for the day-to-day provision of water and for the operation, maintenance and administration of the water scheme.

Number of users per water scheme (intended and actual)

Analysing the costs per person for a water scheme requires knowing how many people the system is intended to serve and how many are actually served.

Number of users of water treatment system (intended and actual)

Analysing the costs per person for a water scheme requires knowing how many people are intended to be served by the water treatment system, and how many are actually served.

Users per service delivery model (intended and actual)

Analysing costs per person requires knowing how many people are intended to be served by each system that is part of the service delivery model and how many are actually served.

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[3] For more information, read **1.10: Service delivery models** of the Costing Sustainable Services Training Package.

3.4.1 Life-cycle costs data for water

Total population and users in service area

The service area may be a community, neighbourhood, small town, district or region. It may or may not correspond with administrative boundaries. The total population in the area and the number of users are used to determine the per person cost of service. The number of users can be determined by multiplying the number of households that have service times the average household size in a sample area and then extrapolating, or by combining coverage information and population data for a specific geographic area. These figures also help in calculating the cost per unit of infrastructure.

Seasonal tags for data

Tagging data with the season when the information was collected is important because some areas experience large differences in expenditures and service levels between the dry season and the rainy season.

Poverty level tags for users

Tagging the poverty status of each user–for example, as very poor, poor and non-poor–allows the comparison of expenditures for different socioeconomic groups.

Further reading

Fonseca, C., et al., 2011. *Life-cycle costs approach: costing sustainable services*. (WASHCost Briefing Note 1a) [online] The Hague: IRC International Water and Sanitation Centre. Available at: <http://www.washcost.info/page/1557> [Accessed 17 April 2012].

3.4.2 Calculating the life-cycle costs of water

This handout[1] contains a step by step guide on how to calculate the life-cycle costs of water, including these components:

- ► capital expenditure per water scheme;
- ► recurrent expenditure per water scheme;
- ► life-cycle costs per service delivery model; and
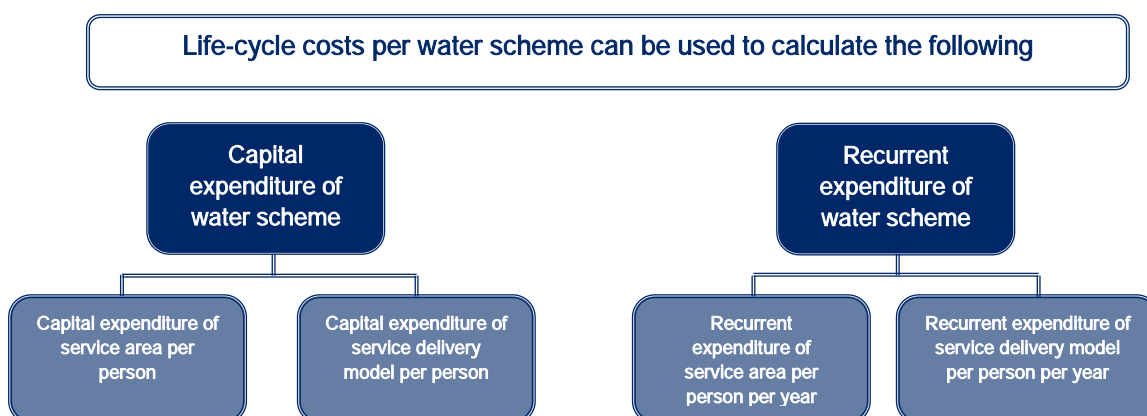- ► life-cycle costs per service area.

The results let service authorities and service providers know the costs of delivering water services and evaluate the costs against the level of the service.

The first step is to separate **capital expenditure** from **recurrent expenditure**:

Capital expenditure is the costs of providing a service where there was none before or of substantially improving or expanding the level of existing service. These are one-time expenditures. **Recurrent expenditure** is the cost of sustaining an existing service, at its intended level, through operations and maintenance, rehabilitation and replacement of systems, management, planning and monitoring of service delivery[2].

Recurrent costs are recorded per year, as they occur throughout the lifespan of a system, whereas capital expenditure is a one-time amount for implementation. However, additional capital expenditure for expansion and enhancement can take place several years into the life of a system.

The basic unit of analysis is the water scheme. The capital and recurrent expenditures per water scheme are the basis for calculating the expenditure per service area, per service delivery model and per person or household (Figure 1).

Life-cycle costs per water scheme can be used to calculate the following

Capital expenditure of water scheme
- Capital expenditure of service area per person
- Capital expenditure of service delivery model per person

Recurrent expenditure of water scheme
- Recurrent expenditure of service area per person per year
- Recurrent expenditure of service delivery model per person per year

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[1] This handout can be used in combination with **Excel file 3.4.5 Water cost analysis**.

[2] Life-cycle cost components are explained in detail in **1.3: Life-cycle cost components** of the Costing Sustainable Services Training package.

3.4.2 Calculating the life-cycle costs of water

Figure 1   Life-cycle costs per water scheme as basis for analysis

Water scheme

The **water scheme** is the unit of analysis for costs and services. A water scheme might be shallow wells with or without handpumps, boreholes with pumps or a water treatment system with piped distribution.

Service area

The **service area** is a specific geographic area, such as a community, neighbourhood, small town, district or region. Usually it corresponds to administrative boundaries.

A service area might encompass several **service delivery models** (Figure 2), each with its own legal and institutional framework, including commonly understood and accepted roles for those involved in building and providing the service, the type of technology and physical infrastructure and standards for the levels of service. The expenditure per service delivery model can be used to compare the costs of different models in a district, region or country.
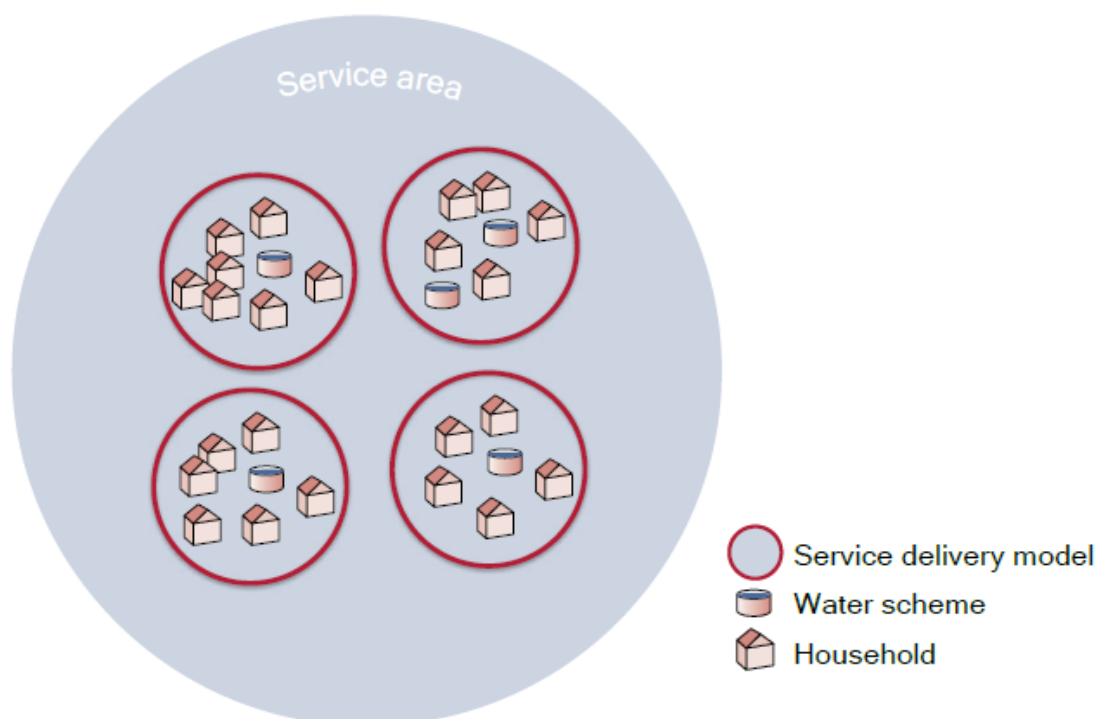

Figure 2   Service area with multiple service delivery models

Per person/ per household

The **per person or per household** costs of water service delivery can be useful when planning and budgeting for sustainable services. Service authorities and service providers (Box 1) often need to know the per person costs of services in their areas of jurisdiction. This information also helps service authorities compare the costs of different levels of service for different service delivery models.

Analysis per **service area** refers to the analysis of costs and services of water in a specific geographic area; such as a community, neighbourhood, small town, district or region. Usually a service area

3.4.2 Calculating the life-cycle costs of water

corresponds with administrative boundaries. Service authorities and service providers can use this analysis to determine the per person cost of delivering water services in their area of jurisdiction.

3.4.2 Calculating the life-cycle costs of water

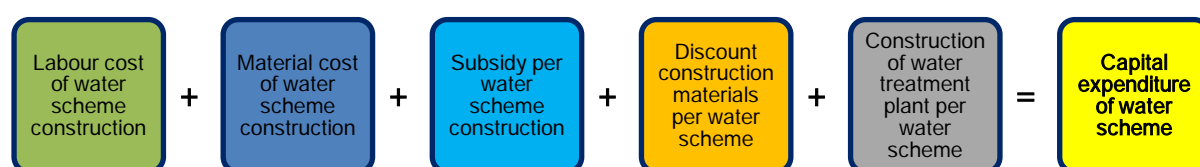**Box 1   Definitions: service authorities and service providers**

Service authorities are legally responsible for ensuring that service delivery takes place. Under decentralisation, this responsibility typically lies with local government. Service authorities are accountable for functions such as planning, coordination, technical assistance, regulation and oversight, but they do not provide the actual services.

Service providers are responsible for delivering water services. Whether an organisation or an individual, the service provider is responsible for the day-to-day provision of water and for the operation, maintenance and administration of the water scheme.

Capital expenditure of water scheme

In most cases, capital expenditure on water schemes is a single contract amount, including any treatment of water as well as abstraction, transmission and distribution. However, if water schemes are built by the community, costs for labour and materials are sometimes easier to collect separately. Include in this calculation all capital expenditure on the water scheme: initial construction, treatment, distribution of water, education of users, etc. Equation 1 shows the components of the total capital expenditure per water scheme; and Equation 2 illustrates how to determine the capital expenditure per water scheme per person.

Equation 1   Components of the total capital expenditure of water scheme

$$
\boxed{\text{Labour cost of water scheme construction}} + \boxed{\text{Material cost of water scheme construction}} + \boxed{\text{Subsidy per water scheme construction}} + \boxed{\text{Discount construction materials per water scheme}} + \boxed{\text{Construction of water treatment plant per water scheme}} = \boxed{\text{Capital expenditure of water scheme}}
$$

Equation 2   Capital expenditure of water scheme per person

$$
\boxed{\text{Capital expenditure of water scheme}} \; / \; \boxed{\text{Number of users per water scheme}} = \boxed{\text{Capital expenditure of water scheme per person}}
$$
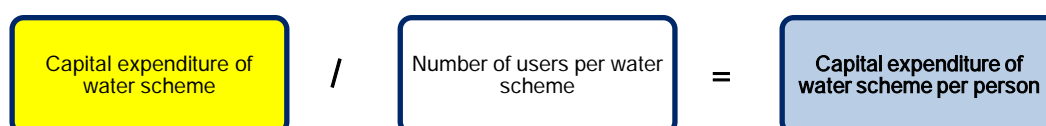
Many water schemes are designed to accommodate a future number of users–'the design population'. If that information is available, record it so that you can compare the design population with the current number of users. The results of Equation 2 let you determine the capital expenditure per water scheme per household, as shown in Equation 3.

Equation 3   Capital expenditure of water per scheme per household

$$
\boxed{\text{Capital expenditure of water scheme per person}} \; \times \; \boxed{\text{Number of household members}} = \boxed{\text{Capital expenditure of water scheme per household}}
$$

3.4.2 Calculating the life-cycle costs of water

Expenditure on the construction of a water treatment plant that serves an area larger than the research area may be a lump-sum figure. Apportion this capital expenditure to the number of users in the research area, using Equation 4.

Equation 4 Apportioned capital expenditure for large plant

| Total capital expenditure on wastewater treatment plant | / | Number of users of wastewater treatment plant | = | Capital expenditure on wastewater treatment plant per person |

If the number of users is not known, estimate the number of users by multiplying the number of household connections times the average household size, or by combining coverage-level information and population data of a specific geographic area (Equation 5).

Equation 5 Estimated number of users

| Number of household connections of treatment plant | X | Average household size | = | Number of users of treatment plant |

Recurrent expenditure of water scheme

To determine the recurrent expenditure of water scheme per year, get the total sum of the annual expenditure for each of the five life-cycle costs components other than capital expenditure, as shown in Equation 6.

Equation 6 Recurrent expenditure of water scheme per year

| Operational expenditure of water scheme per year | + | Capital maintenance expenditure of water scheme per year | + | Cost of capital of water scheme per year | + | Expenditure on direct support of water scheme per year | + | Expenditure on indirect support expenditure of water scheme per year | = | Recurrent expenditure of water scheme per year |

The calculations to determine the recurrent expenditure per water scheme per year for each cost component are shown in Equations 7 to 13. Most operational and minor maintenance expenditure is reported on an annual basis. Operational and minor maintenance expenditure (OpEx) per year is therefore most easily calculated by taking an average for the years for which data are available, as in Equation 7.

3.4.2 Calculating the life-cycle costs of water

Equation 7   Operational and minor maintenance expenditure of water scheme per year

| Operational expenditure of water scheme per year | / | Number of years of operational expenditure data | = | Operational expenditure of water scheme per year |

Equation 8   Capital maintenance expenditure of water scheme per year

| Total capital maintenance expenditure of water scheme | / | Age of water scheme | = | Capital maintenance expenditure of water scheme per year |

Capital maintenance expenditure is usually reported on an annual basis. If you cannot find capital maintenance expenditures for each year, report the average annual capital maintenance expenditure per water scheme per year for the years that data is available (Equation 9).

Equation 9   Average capital maintenance expenditure of water scheme per year

| Capital maintenance expenditure of water scheme | / | Number of years of capital maintenance expenditure data | = | Average capital maintenance expenditure of water scheme per year |

Most cost of capital data is available on an annual basis. Since interest is normally paid annually, calculate the cost of capital per water scheme per year, as shown in Equation 10.

Equation 10 Cost of capital of water scheme per year

| Total cost of capital of water scheme | / | Number of years of cost of capital data | = | Cost of capital of water scheme per year |

Direct support and indirect support are explained in **3.4.1: Life-cycle costs data for water services** of the Costing Sustainable Services Training Package. Use Equations 11 and 12 to calculate the annual costs.

3.4.2 Calculating the life-cycle costs of water

Equation 11 Direct support of water scheme per year

Expenditure on direct support of water scheme	/	Number of years of data	=	**Expenditure on direct support of water scheme per year**

Equation 12 Indirect support of water scheme per year

Expenditure on indirect support per water scheme	/	Number of years of data	=	**Expenditure on indirect support of water scheme per year**

Recurrent expenditures on water schemes are often lump-sum figures for a service area that is larger than the research area. To apportion the recurrent expenditure on direct or indirect support, use Equation 13.

Equation 13 Apportioned recurrent expenditure on direct support[3]

Lump sum figure for direct support	/	Number of users of water schemes	=	**Expenditure on direct support**

Record all your estimations and assumptions, and how and why these have been made. Doing so can help others understand how you reached your results.

Life-cycle costs of water per service delivery model per person

Capital and recurrent expenditures per water scheme are the basis for determining costs per service delivery model. Use Equation 14 to calculate the total capital expenditure for all the water schemes in each service delivery model. Recurrent expenditure per service delivery model is, as in Equation 15, calculated in the same way.

Equation 14 Capital expenditure of service delivery model

Capital expenditure of water scheme X	+	Capital expenditure of water scheme Y	+	Capital expenditure of water scheme Z	=	Capital expenditure of service delivery model

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[3] You may need to estimate the number of users of the water scheme. This can be done using equation 5.

3.4.2 Calculating the life-cycle costs of water

Equation 15 Recurrent expenditure of service delivery model

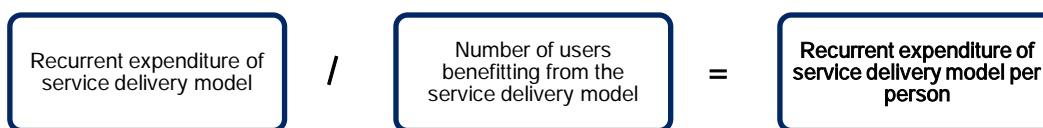| Recurrent expenditure of water scheme X | **+** | Recurrent expenditure of water scheme Y | **+** | Recurrent expenditure of water scheme Z | **=** | Recurrent expenditure of service delivery model |

Use the results of Equations 14 and 15 to determine the per person capital expenditure per service delivery model (Equation 16). Calculate per person recurrent expenditure per service delivery model in the same way.

Equation 16 Capital expenditure of service delivery model per person

| Capital expenditure ofr service delivery model | **/** | Number of users benefitting from the service delivery model | **=** | Capital expenditure of service delivery model per person |

Equation 17 Recurrent expenditure of service delivery model per person

| Recurrent expenditure of service delivery model | **/** | Number of users benefitting from the service delivery model | **=** | Recurrent expenditure of service delivery model per person |

Life-cycle costs of water per service area per person

The capital and recurrent expenditures per water scheme are the basis for determining the expenditure per service area. Use Equations 18 and 19 to determine the capital and recurrent expenditures per service area.

Equation 18 Capital expenditure of service area

| Capital expenditure of water scheme X | **+** | Capital expenditure of water scheme Y | **+** | Capital expenditure of water scheme Z | **=** | Capital expenditure of service area |

3.4.2 Calculating the life-cycle costs of water

Equation 19 Recurrent expenditure of service area

Recurrent expenditure of water scheme X	**+**	Recurrent expenditure of water scheme Y	**+**	Recurrent expenditure of water scheme Z	**=**	Recurrent expenditure of service area

To determine the capital or recurrent expenditure of service area per person, divide the total cost by the number of users in the service area (Equations 20 and 21).

Equation 20 Capital expenditure of service area per person

Capital expenditure of service area	**/**	Number of users in service area	**=**	Capital expenditure of service area per person

Equation 21 Recurrent expenditure per service area per person

Recurrent expenditure per service area	**/**	Number of users in service area	**=**	Recurrent expenditure per service area per person

References

This handout can be used in combination with Excel file 3.4.5 Water cost analysis.

3.4.3 Water service levels data

This check list describes the variables needed to determine the level of water service. Each of the listed items is explained in the text that follows.

- Water quantity measured in litres per person per day
- Water quality (perception of water quality by user, frequency of water quality testing, water quality against norm)
- Water accessibility (time per trip to collect water in minutes per person per day, number of people sharing a water scheme)
- Water reliability (days per year that the water system is not working, number of water systems that can be accessed by a user each day of the year)
- Water scheme by type of technology
- Description of service delivery model
- Population and users per service delivery model
- Name of service area, with total population and users in service area
- Name of service authority and service provider
- Seasonal tags for each of the data collected
- Poverty level tags for each of the users

Water quantity

Measure the amount of water available to users in liters per person per day. This information can be obtained through household surveys or observation at the water point or a combination of both.

Water quality

Water quality can be determined by water testing. The water quality standard may be a country norm or the standard specified by the World Health Organization (WHO). Quality testing of water can be very expensive. If no official information on water quality is available, the frequency of water quality testing is also a good indicator of quality. Next to information on quality testing, it is important to collect information from users on their perception of the quality of water. The perception of users on the water quality might influence their use of water. Collecting information from users on their perception of the quality can also be an easier and cheaper method to collect an indication of water quality.

Water accessibility

Determine how long it takes for each user to collect water and return to the home, in minutes per trip to collect water per person per day. To characterise accessibility, you can also use a number of proxies for the time criterion. These may include distance to source and number of people using the same source (crowding) or the number of hours a day the service is offered.

Water reliability

Determine the number of days per year that the water scheme is not working. This information can be collected through a combination of household surveys, village focus group discussions and interviews with the service provider.

Water scheme by type of technology

This information enables a comparison of costs and service levels provided by type of technology.

Service delivery models

This information enables a comparison of the service levels provided by different service delivery models. Describe the legal and institutional framework, including the commonly understood and accepted roles for those involved in the development and provision of the service, the type of technology and physical infrastructure used, and standards for levels of service to be provided[1].

Population and users per service delivery model

Include both the number of people the system is intended to serve and how many people are actually served by the system. This information helps to compare the design costs of a system with the actual costs per person for more accurate unit cost for planning of water services.

Name of service area, with total population and users in service area

The service area may be a community, neighbourhood, small town, district or region. It may or may not correspond with administrative boundaries. If the number of users is not available, determine the number of household connections and the average household size in a sample area, then extrapolate; or combine coverage information and population data of a specific geographic area.

Name of service authority and service provider

Service authorities and **service providers** can use information on the level of service to compare different service models and technologies against the life-cycle costs of the system.

Box 1   Definitions: service authorities and service providers

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Service authorities are legally responsible for ensuring that service delivery takes place. Under decentralisation, this responsibility typically lies with local government. Service authorities are accountable for functions such as planning, coordination, technical assistance, regulation and oversight, but they do not provide the actual services.

Service providers are responsible for delivering water services. Whether an organisation or an individual, the service provider is responsible for the day-to-day provision of water and for the operation, maintenance and administration of the water scheme.

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[1] Read **1.9: Service delivery models** of the Costing Sustainable Services Training Package for more information.

3.4.3 Water service levels data

Seasonal tags for data

Tagging data with the season when the information was collected, for instance as dry season and wet season is important because some areas experience large seasonal differences in service levels.

Poverty level tags for users

Tagging the poverty status of each user, for example, as very poor, poor, and non-poor, allows the comparison of service levels for different socioeconomic groups.

Further reading

Fonseca, C., et al., 2011. *Life-cycle costs approach: costing sustainable services*. (WASHCost Briefing Note 1a) [online] The Hague: IRC International Water and Sanitation Centre. Available at: <http://www.washcost.info/page/1557> [Accessed 17 April 2012].