IRC

Sanitation for All?

Thematic Overview Paper 20

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Thematic Overview Papers

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Edited by: Brian Appleton, UK

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1. Introduction

1.1 Sanitation "is no longer a dirty word"[1]

For decades, water and sanitation sector professionals complained that sanitation was being neglected. Politicians saw few votes in campaigning for more latrines, while funding agencies argued that they had to follow national government priorities. The results have been reflected in global statistics showing that 2.4 billion people, or 40% of the world's population, entered the new Millennium without access to hygienic sanitation facilities. Some 1.9 billion of those without facilities were in Asia, meaning that less than half of that region´s people had access to proper sanitation. The developmental disadvantages of inadequate sanitation in both urban and rural settings are described in Chapter 2.

Today, the mood is very different. Powerful arguments about the role of sanitation improvements in reducing poverty, protecting the environment, raising education standards, and spearheading human development attracted massive media attention at the World Summit on Sustainable Development in 1992. As a direct result of that Summit, a vital sanitation target was added to the Millennium Development Goals (MDGs). Target 10 of MDG7 urges governments to:

"Halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation."

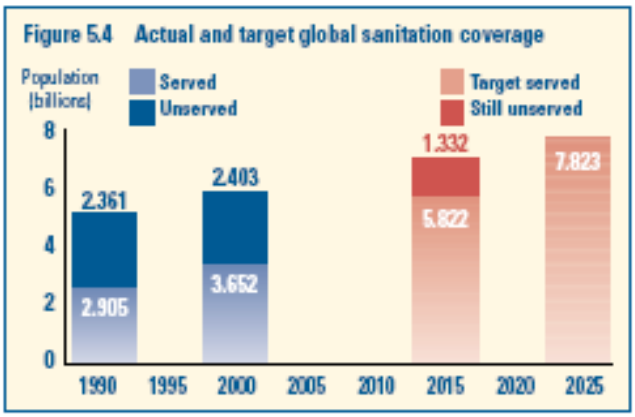
(for background details about the water and sanitation targets go to the MDG website)

Sanitation has become a high priority on the development agenda, and not just with the Water Supply and Sanitation (WSS) sector specialists. In a poll carried out for the *British Medical Journal* sanitation was voted "the greatest medical milestone of the last 150 years". (Read more at: http://www.endwaterpoverty.org/news__events/13.asp). The End Water Poverty website also includes a *Programme for Action* which says ". . must ensure that no credible country plan consistent with achieving the Millennium Development Goal (MDG) targets on water and sanitation will fail for lack of finance."

1.2 A new challenge now

So, the political commitment is there, the opportunities for financial support are better than ever, the challenge to WSS practitioners now is to deliver sustainable sanitation services to more than two billion people by 2015. In its 2004 publication, *The Sanitation Challenge: Turning Commitment into Reality* (Document 2 in the TOP ten list), WHO wrote: "Since 1990 an estimated 747 million people have gained access to sanitation facilities (equivalent to 205,000 people every day). Despite this huge achievement, a further 1,089 million rural and 1,085 million urban dwellers will need to gain access in the coming 15

[1] Gourisankar Ghosh, Executive Director, Water Supply and Sanitation Council, Global WASH Forum, Dakar, Senegal, November 2004 (http://www.wash-cc.org/pdf/publication/Dakar_Forum_Proceedings_en.pdf)



From *Global Water Supply and Sanitation Assessment 2000 Report (WHO/UNICEF)*

years if the 2015 target is to be realized." The base year for these statistics was 2000, which means that the pace of delivering new sanitation services would have to virtually double to 397,000 people per day – a formidable challenge. The coverage statistics have been updated since and are summarised in Chapter 2, but the scale of the challenge has not got any less.

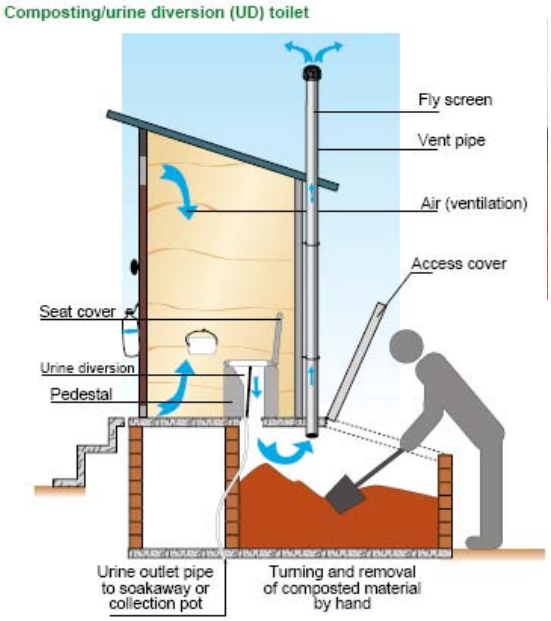
And that is not all. Many past efforts to help communities to improve their sanitation and hygiene behaviour have proved far from sustainable. Well-intentioned programmes providing subsidised toilets, latrines or sewer systems have rapidly fallen into disrepair or disuse because they did not meet the real needs of the communities they were intended to serve. Motivation to improve community hygiene is seen as a vital factor in achieving sustainability. That requires special skills among the promoters and implementers of sanitation programmes. Best practices are still evolving, and the race to reach the MDG targets is going to demand some intensive learning and information sharing alongside community-based hygiene promotion campaigns.

1.3 Evolution and innovation: Who knows what is best?

It is widely felt that the WSS sector has been a leader in developing the concepts of community participation and appropriate technologies. The "Water Decade" of the 1980s saw huge strides made in evolving community-based approaches to WSS improvements. Converting top-down, supply-driven approaches into bottom-up, demand-led methodologies changed the face of the sector. It meant changes to the training and career development of professionals and led to direct involvement of social scientists, gender specialists and community workers in the development of WSS strategies and programmes.

There is a large store of literature documenting experiences with many different sanitation technologies and the approaches used to motivate communities to implement hygiene improvements. For today's decision-makers and promoters, the choice of methodology and technology options is bewildering. Case studies illustrating successful experiences in one region are counter-balanced by equally authoritative reports of projects failing to achieve user acceptance in others. Pointers for navigating the methodological and technological minefield are included in Chapters 3, 4 and 5 along with links to authoritative web-based documentation on the many options available.

There is no ´magic bullet´ for solving any community's sanitation problems. Nor is there a universal consensus on the optimum way of involving communities in the process. Approaches are still evolving, and we look at two that have a growing support among practitioners, albeit in one case with a measurable resistance to the socio-cultural changes involved.

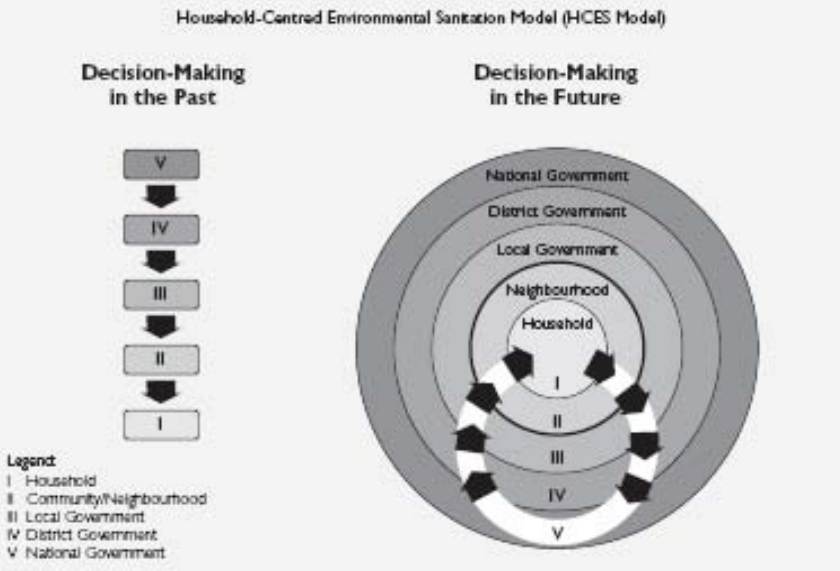


The more contentious approach is Ecological Sanitation, generally shortened to **Eco-Sanitation**. In principle, eco-sanitation seems to be very attractive solution: the concept of treating household waste as a resource and in the process obtaining a significant proportion of agriculture's increasing demand for nutrients scores high on the environmental and economic fronts. The practical application has less universal appeal: the human interventions needed in separating and handling urine, faeces and household wastewater ("greywater") give eco-sanitation's growing number of advocates a challenging promotional task and also in the case of greywater pose some, as yet unsolved, organisational dilemmas. Experiences with eco-sanitation and the case for its more widespread application are summarised in Section 2.3.4, which also includes references and links to more comprehensive literature on this fascinating option. The diagram is taken from the South African publication *Sanitation for a Healthy Nation: Sanitation Technology Options* (TOP ten publication 5)

Less controversial, but equally exciting in terms of its potential for achieving sustainable sanitation solutions, is the **Community-led Total Sanitation** (CLTS) approach, pioneered in Bangladesh in 1999 and since spread to several other countries in Asia and Africa. Quoting from the Institute of Development Studies Working Paper 257, cited more fully in Chapter 4: "Community-led total sanitation (CLTS) involves facilitating a process to inspire and empower rural communities to stop open defecation and to build and use latrines, without offering external subsidies to purchase hardware such as pans and pipes. Through the use of PRA [Participatory Rural Appraisal] methods community members analyse their own sanitation profile including the extent of open defecation and the spread of faecal-oral contamination that detrimentally affects every one of them. The CLTS approach ignites a sense of disgust and shame amongst the community. They collectively realise the terrible impact of open defecation: that they quite literally will be ingesting one another's "shit" so long [as] open defecation continues. This realisation mobilises them into initiating collective local action to improve the sanitation situation in the community." More details and more references to CLTS in practice are given in Section 4.6.

1.4 Multi-choice strategies

With so many possible ways forward, strategic planning is needed on several levels. Central governments have to match targets and processes with available resources, as well as setting and monitoring standards to safeguard health and the environment. Locally, planners need to offer enough flexibility to enable communities to determine their own best ways to satisfy their needs, while motivating rapid progress towards improvement targets.



Section 4.7 suggests approaches and further reading on planning methodologies, including the evolving *Household-Centred Environmental Sanitation* (HCES) approach with its expanding circles of responsibility based on the concept that wastes should be dealt with as close as possible to the house. Read the principles of HCES here.

2. Why sanitation matters so much

2.1 A historical perspective

Access to either natural water resources or a water supply system has always been a prerequisite for establishment of a human settlement. Water is needed for drinking, and usually for nurturing the crops that are the basis of the community's food. Protecting and/or treating the precious water though has rarely been a priority. Human and animal wastes are often seen as sources of valuable nutrients for boosting agricultural production, but the health dangers of exposure to pathogens have historically been neglected in the pursuit of developmental progress.

Present generations are paying a heavy price for this neglect. Urban squalor has become an issue of political shame and human misery in most developing countries. Slum dwellers, and even those who may be categorised as the lower middle class, live in conditions that are far worse than the rural poverty that many of them abandoned for a better life in the city. Their nutrition is worse; they live in densely populated houses or sheds, where airborne infections spread easily; and their neighbourhoods fester with their own excrement and food leftovers, attracting rats and insects that bring further health risks.

Northern countries have largely solved their contamination and pollution problems with expensive treatment technologies and legislative measures to change citizen behaviour. Similar "solutions" are rarely applicable in the South, and where they have been used it is to serve the rich at the expense of the poor.

Management of liquid and solid wastes, including excreta, has both direct and indirect impacts on the poor and on poverty in the South. Living on marginal lands without rights and services, many of the poorest men, women and children spend most of their time scavenging and literally living in the gutters and/or waste dumps of the cities. Their health and social status is directly affected by their living environment. Indirectly, the poor are affected by policy decisions that are taken concerning sanitation improvements. Sewer networks in the centres of towns serving better-off sections of society absorb a high proportion of available financial resources, leaving little for the inadequate onsite sanitation systems used in the peri-urban areas. In addition, the poor in the South are faced with rapidly growing populations and the resultant increasing quantity and complexity of their waste.

Today in the South, there are some key differences compared with Europe at the end of the 19th century: the population is poorer and has fewer perspectives; there are no abundant sources of water or land; the "trickle-down" effect of economic growth appears to be a myth; available natural sinks, such as lakes, rivers and land are close to saturation; (industrial) pollution sources are more dangerous; accumulation of wealth in the centres is outweighed by the population growth in the slum areas; and political instability and corruption complicate resource flows, governance, and accountability.

2.2 Today's needs and tomorrow's targets

The World Health Organization (WHO) and UNICEF monitor the status of drinking water supply and sanitation coverage country by country on a periodic basis. The latest statistics from the agencies' Joint Monitoring Programme were published in 2005, based on coverage recorded at the end of 2002. Worldwide, the proportion of the population deemed to have access to adequate means of sanitation had risen from 49% in 1990 (the baseline for the MDG targets) to 58% in 2002, meaning that an extra 87 million people had gained access to improved sanitation services each year over that period. To meet the MDG goal, the proportion served needs to reach 75% by 2015, which would mean serving close to 138 million people each year from 2002 onwards.

A concerted global effort in the 1990s resulted in over a billion people gaining access to safe water – 83 per cent of the world's population now use improved drinking water sources. However, a similar number of people (1.1 billion) are still forced to use unsafe water sources. The lowest drinking water coverage rates are in sub-Saharan Africa (58 per cent) and in the Pacific (52 per cent), but the largest numbers of unserved people are in Asia.

The sanitation situation is worse. Only 58 per cent of the world's population has access to improved sanitation facilities. A total of 2.6 billion people live without improved sanitation – less than half of all people living in developing countries. The lowest coverage rates are in sub-Saharan Africa (36 per cent) and South Asia (37 per cent). In some countries, such as Afghanistan and Ethiopia, less than ten per cent of the population has access to adequate sanitation facilities.[2]

The coverage statistics are summarised in the table in Annex 2. They highlight the significant regional variations in the scale of the sanitation challenge. While globally the pace of sanitation improvements has to increase by 58% (from 87 to 138 million people served per year), the situation in Sub-Saharan Africa requires almost a fourfold acceleration (7 million a year served between 1990 and 2002, compared with 26.7 million to be served each year until 2015 to meet the MDG goal).

Behind the statistics is a further dilemma: what kind of sanitation system is appropriate in the widely varying circumstances of different population groups? In the industrialised countries, the cost of renewing and expanding sewer networks is expensive and wastewater treatment costs rise continually to meet ever-stricter effluent quality standards. Wastewater treatment is also energy intensive. It is highly unlikely that high-tech sewer networks and wastewater treatment plants can deliver more than a small fraction of the sanitation services needed in the developing world. Inevitably, a wide range of options is needed, with the prime criterion being appropriateness and acceptability for a specific user group.

[2] WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, 2007

2.3 Climbing the sanitation ladder

Adequate sanitation systems include both facilities and behaviours that form a hygienic environment and reduce people's exposure to disease-causing organisms. A more comprehensive explanation of the requirements of such systems can be found in the WHO publication *Sanitation Promotion* published in 1998 (http://www.who.int/water_sanitation_health/hygiene/envsan/sanprom/en/index.html). The health-based criteria are important, but not sufficient to guarantee the effectiveness of sanitation interventions. Crucially, sanitation improvements have to meet the perceived needs of the intended users, among which health improvements are often at best secondary.

Surveys show that the main reasons people give for wanting some sort of toilet facility are:

- **Convenience** – women in particular dislike having to walk long distances to relieve themselves;
- **Comfort** – people dislike the smell of excreta and public toilets in densely populated communities are generally appalling;
- **Safety** – defecation sites are dangerous places for women and children; and
- **Status** – families are ashamed when they cannot offer guests proper toilet facilities.

Meeting these desires does not make a toilet a sanitary facility. That can only happen when the sanitation system is combined with hygienic behaviour based on an understanding of the effect of bad waste management in general and the effects of excreta on health, in particular. Personal and public hygiene and care for even the simplest sanitary facility are at the core of good sanitation.

For those who presently lack any form of hygienic sanitation facility, improvements can be made in progressive steps. The author of this TOP, the Netherlands-based NGO WASTE, has prepared a *Fact Sheet on Sanitation* that represents different categories of sanitation in the form of a *Sanitation Ladder*. The Sanitation Ladder, reproduced as Annex 3, has four steps:

- **No sanitation** – the focus here is on improved hygiene behaviours, supported by education programmes and community-based cleanliness initiatives;
- **Basic sanitation** – generally low-cost technologies that protect health in the household environment by creating barriers between pathogens and humans and ensuring hygienic disposal of excreta and wastewater;
- **Environmental sanitation** – expanding the focus to include preventing pollution of water sources, effective use and reuse of water, protecting the health of the wider community, and improving the environment; and
- **Ecological sanitation** – with a prime concern for reuse and recycling of nutrients to improve food production as well as protecting health and the environment.

No Sanitation – Improve hygiene behaviour

Among the 2 billion plus people who currently lack adequate sanitation provision, many increase the health risks through their own lack of hygiene. Avoiding contact with fresh faeces and washing hands with soap or ash after defecation are simple hygiene measures that can have a major impact on disease transmission. Household and community cleanliness also reduce exposure to risks. Millions of the world's poorest people are exposed to infection through the way they earn their living. Emptying cesspits or septic tanks or using untreated sewage for irrigation bring direct health threats, often aggravated by the workers' lack of awareness of the way that diseases are transmitted.

Hygiene education, particularly in schools, can bring behavioural improvements, but it is important that people develop the solutions to sanitation problems themselves. That is the basis of the Community-led Total Sanitation (CLTS) approach described in Section 4.6. Another extremely useful guide to simple sanitation and hygiene improvements is TOP ten Document 1: Sanitation and cleanliness for a healthy environment.

Basic Sanitation

Basic sanitation is seen as the lowest-cost technology that ensures the hygienic disposal of excreta and grey water (sullage or washwater) at household level and results in a clean and healthy living environment around the home. It provides safety and privacy, protects users from exposure to pathogens and unpleasant smells, and includes provision for storage or removal of excreta. Even the simplest toilet must be clean and not smell. User behaviour is part of the definition of basic sanitation. All household members need to have the awareness and the motivation to keep toilets clean, and to adopt hygienic handwashing practices. It follows that water, soap and basic cleaning materials are part of the basic sanitation package.

Though it is described as "basic", measuring this form of sanitation is complicated. Ideally, the definition would encompass critical components of what sanitation services should aim for: privacy, dignity, cleanliness and a healthy environment. From a monitoring point of view, however, such characteristics are difficult to measure. In compiling its coverage statistics, the WHO/UNICEF Joint Monitoring Programme classifies sanitation facilities and water supply sources as either "improved" or "unimproved" according to the type of technology used. Only "improved" facilities are counted in assessing coverage. The WHO/UNICEF classification, as listed in *Water for Life: Making it happen* (http://www.wssinfo.org/pdf/JMP_05_tables.pdf) is:

Improved technologies	Unimproved technologies
Flush/pour flush to:	Public or shared latrine
piped sewer system	Pit latrine without slab or open pit
septic tank	Hanging toilet or hanging latrine
pit (latrine)	Bucket latrine
Ventilated improved pit latrine	No facilities (so people use any area,
Pit latrine with slab	for example a field)
Composting toilet	

This pragmatic approach leaves unaddressed the question as to whether the situation of a community is “improved” when it is confronted with a proliferation of pathogens from overflowing septic tanks, or when half-naked men have to descend into sewers and cesspits to desludge these “improved” facilities.

It is important to note too that basic sanitation in a crowded urban environment demands much more of a sense of community responsibility than is the case in a rural village. The effect on neighbours of badly controlled or neglected excreta and grey water management is much more health-threatening in high density settlements and makes hygiene awareness campaigns and enforcement strategies important elements of urban sanitation programmes. The Household-Centred Environmental Sanitation (HCES) approach, described here, promotes this extension of social responsibility and institutional support as waste management problems extend out from individual households into the wider community.

Environmental sanitation

In the HCES model, environmental sanitation starts when the decisions of individual households have an effect on their neighbourhood. The WSSCC Working Group that developed the HCES model and the Bellagio Principles on which it is based took the view that environmental sanitation should contribute to improvements in the quality of life and achievement of social development. It therefore should create and maintain conditions whereby people lead healthy and productive lives and the natural environment is protected and enhanced. Beyond the health and hygiene requirements of basic sanitation, environmental sanitation is concerned with the final disposal of excreta and wastewater. Adequate treatment before disposal is what makes environmental sanitation technologies more acceptable than the “flush and forget” or “drop and store” approaches common to basic sanitation technologies. It is also what makes them significantly more expensive, though WHO argues that investment in improved sanitation has a very high payback ratio.

In the document *Evaluation of the costs and benefits of water and sanitation improvements at the global level* (Hutton & Haller, 2004 – see reference), WHO points out that every dollar invested in water and sanitation improvements gives an economic return varying between $3 and $34. Projecting the economic analyses on a region-by-region basis into costs and benefits for meeting the MDG goals, the report concludes that the $11.3 billion a year cost of halving the proportion of people without water and sanitation services would yield a benefit of $84 billion a year. The costings include planning, construction, operation

and maintenance. Sanitation improvements account for five-sixths of the total investment. Benefits take into account savings on health care, productivity gains from reduced days lost to illness and future earnings from averted deaths.

The payback figures are impressive, but they do not alter the fact that large urban sewerage schemes with sophisticated wastewater treatment plants are resource-hungry. For developing countries, with limited amounts of money, water and skilled labour, more practical ways have to be found for serving the huge numbers of people who currently lack adequate sanitation services.

Ecological Sanitation

Some scientists and practitioners have long questioned the wisdom of treating water to drinking quality at great expense, only to have a large share flushed down toilets to transport waste (including nutrients) in sewers to be cleaned again. Money, water and nutrients are wasted and misused when several hundred litres per person per day of expensively treated water are flushed down toilets, or used to wash cars, water golf courses or run air conditioning systems for the rich. In recent years more logical approaches have been developing under the label of *ecological sanitation* or *sustainable sanitation*.

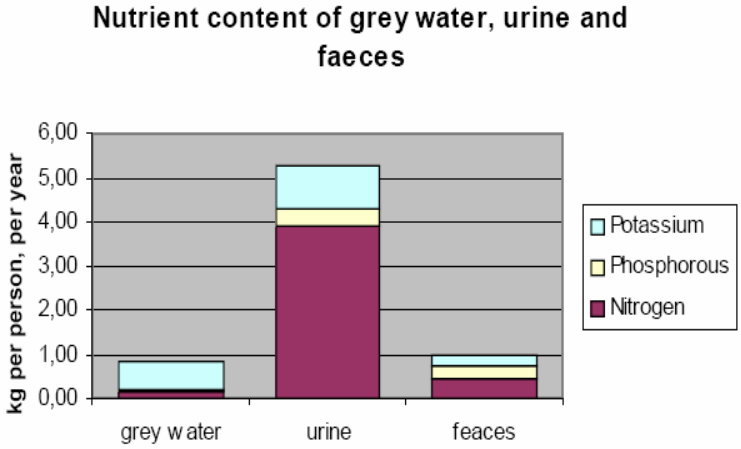
The concept is based on the idea that urine, faeces and grey (sullage) water contain resources that form part of the ecological cycle. The nutrients in human excreta and grey water are valuable and should be regarded as such. Hygienic use, instead of hygienic washing away is one of the key principles. Use of nutrients in human excreta and grey water is only possible when the complete sanitation system is taken into account, from source to final disposal. This contrasts with end-of-pipe solutions. Ecological sanitation does not just promote hygienic use of human excreta and grey water after they have been produced; one of its main objectives is to recover and reuse them as precious resources.

In some respects, daily practice is ahead of scientific progress and interest. While scientists and engineers still debate the wisdom of reusing municipal and industrial wastewater and sludge for agricultural purposes, farmers in the peri-urban areas of Africa and Asia have widely adopted this practice out of sheer necessity. As the International Water Management Institute (IWMI) says on its web page on wastewater reuse: “In rural and peri-urban areas of most developing countries, the use of sewage and wastewater for irrigation is a common practice. Wastewater is often the only source of water for irrigation in these areas. Even in areas where other water sources exist, small farmers often prefer wastewater because its high nutrient content reduces or even eliminates the need for expensive chemical fertilizers.” IWMI goes on to point out that research is needed on the impact on human health, wealth and nutrition (as well as soil-fertility) of using wastewater and excreta for agricultural production to generate practical advice for farmers and information for consumers, to limit risks and maximise benefits.

In many circumstances a sustainable sanitation approach favours dry unsewered options. It highlights the need for waste segregation at the source: Don't mix ("what God has separated", added a participant at a WATSAN conference in Addis Ababa).

An average human being produces annually 500 litres of urine and 50 litres of faeces, which contain enough nitrogen, phosphorous and potassium (NPK) to produce the equivalent of 230kg of cereal/year. This human fertiliser can partly replace the demand for artificial fertiliser. The need to conserve phosphorous, a mineral resource used to produce artificial fertilisers, is urgent. The most important causes of phosphorous depletion are inefficiencies in agricultural practices and the dispersal in sewage and solid waste of phosphorous contained in food and phosphate-based detergents. Recycling from sanitation and solid waste can be a partial solution.

Keeping urine separate opens ways for more effective treatment in both dry and existing wet systems. Urine contains the largest amount of nutrients in wastewater. Compared with faeces, urine contains about 70% of all nutrients available in excreta (urine and faeces). So, if urine is kept separate, wastewater treatment plants require less energy.



Gajurel, D.R., Li, Z. and Otterpohl, R., *Investigation of the effectiveness of source control sanitation concepts including pre-treatment with Rottebehaelter*, Water Science and Technology Vol 48 No 1 pp 111–118, IWA Publishing 2003

An additional advantage of dry urine diversion sanitation options is the optimisation of pathogen destruction. Contrary to common belief, research and practice have demonstrated that pathogens die quicker in circumstances with:

- High *pH* rate (adding sawdust, ash, etc.)
- Increased *oxygen* supply (ventilation)
- Low *moisture* (urine diversion, dehydration)
- Higher *temperature* (solar / artificial heating)
- Increased retention *time* (storage)

These conditions prevail in dry climates. Adding water to excreta creates precisely the opposite situation. Another advantage of diversion of urine (either in dry or wet sanitation systems) is the reduction of bad odour in comparison with systems such as pit latrines or composting toilets. Mixing faeces with urine creates a septic situation with the familiar unpleasant smell.

Urine diversion toilets depend on regular manual removal of urine and less frequent removal of dried faeces. In many ways this requires a shift in attitude towards sanitation for many stakeholders and a danger that the system will depend on the poor for excreta collection. This is a general problem facing the waste sector: bad image and unhealthy jobs for the poor. However, it does provide jobs and the idea that this work is badly paid is in many cases not true, as the examples cited here from the 2006 report *Economic Aspects of Informal Sector Activities in Solid Waste Management* clearly show.

Further reading on the scale of the sanitation challenge can be found in:
TOP ten Document 2: The Sanitation Challenge: Turning Commitment into Reality

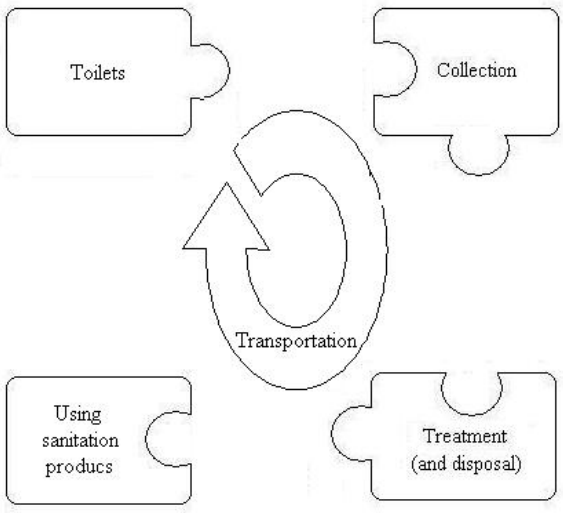
3. Sanitation system design: It's elementary

3.1 The elements of a sanitation system

The prime purpose of a sanitation system is to break the disease cycle caused by the bacteria in human excreta. To do so, the system has to combat exposure to infection through all the stages from the generation of excreta to their final disposal or reuse. It is important to emphasise again that human behaviour is crucial and fostering behavioural change is a key component of sanitation system planning. In this chapter, though, we are concerned with the functional elements of the system. While individual components will vary considerably with local circumstances and will differ from community to community, the division into elements creates flexibility and choice in developing appropriate solutions.

Five elements need to be considered separately:

- **The toilet** – there is a wide range of latrines, water closets, urine-diversion toilets, etc, that may be considered, depending on local circumstances;
- **The collection system** – septic tanks, pits, vaults, drums, may be appropriate in different environments;
- **Transportation** – large or small sewer systems, motorised, mechanical or manual haulage may need to be considered;
- **Treatment** – systems vary from sophisticated wastewater treatment plants and sludge digestion to simple composting systems and soil filtration;
- **Use of sanitation products** – urine, composted excreta and biogas are all important resources.



Elements (functional units) of a sanitation system © WASTE, 2004

Toilets

A toilet, either a pedestal or a squatting device in a bathroom or latrine, is a primary barrier between people and the pathogens present in faeces, because it allows the collection of excreta in a designated and controlled location. In addition to the toilet itself, the facility should include provision for hand-washing and give privacy, safety and comfort to the user. These features are all important for the functioning of the entire sanitation system.

Toilet designs are appropriate when hygienic safety is guaranteed and excreta can be dealt with in a socio-culturally acceptable way. Toilets must be seen by the relevant population as safe and attractive to use, while construction and maintenance costs have to be affordable.

Some examples of different kinds of toilets that can be combined into a complete system that responds to local needs and conditions are included in Figure 3.1. Others are discussed in Chapter 4 and there are more detailed descriptions of many options in the following TOP ten documents:
Document 3: Smart Sanitation Solutions
Document 5: Sanitation for a Healthy Nation: Sanitation technology Options
Document 6: On-plot sanitation for low-income urban communities: Guidelines for selection
Document 9: Ecological Sanitation – Revised and enlarged edition

Collection

A collection facility aims to prevent the uncontrolled dispersal of material containing pathogens. The collection facility, which often needs ventilation, safely contains human excreta awaiting transportation. Some collection facilities include pre-treatment of excreta. In addition, to these important functions, a collection facility should make efficient use of limited space and be able to function effectively over a long period. In double-vault latrines, for example, each chamber should be capable of holding six months or more of the users' excreta, ash, etc, to allow the requisite amount of composting time before emptying, while the second chamber is in use.

Figure 3.1 illustrates a few examples of collection systems. Others are discussed in Chapter 4 along with the toilet/latrine facilities that they may be associated with. Collection systems also feature in the TOP ten documents listed in the section ´Toilets´.

Transportation

A transportation system is needed when excreta can't be treated, deposited or used on site. Good organisation and management of transportation systems will be a determining factor in the sustainability and continuity of a sanitation system.

Transportation systems can be divided into:

- infrastructure-based systems, such as sewer networks, which require sufficient water to transport excreta effectively;

- logistic management, using regular transportation means such as trucks, vacuum tankers, carts, and tricycles.

Whether or not sewerage (i.e. the drainage system in which sewage is transported) is appropriate, depends on soil conditions, the availability of sufficient amounts of water for flushing (now and in the future), and the financial and institutional capacity of the target users. Where simple neighbourhood presettlement and collection facilities are practical, shallow “condominial” sewer systems have proved appropriate in Brazil and elsewhere (see TOP ten Document 9: Good sewers cheap).

Factors that influence the design and applicability of the transport system include the amount of waste generated, housing density, street access, haul distance, road conditions, road gradient, traffic type, and the cost of labour and fuel. A house-to-house collector may transport material directly to its destination. However, transfer becomes necessary when distances increase and direct transport is no longer economically feasible or when the destination can only be reached with a different means of transport.

Some transportation options are included in Figure 3.1 and there is more discussion in Chapter 4 and in the in the TOP ten documents listed in the section ´Toilets´.

Treatment

The purpose of treatment is to reduce the level of pathogens in excreta and wastewaters, to prevent infection of people and pollution of the environment.

The designer of a treatment system also needs to consider the recovery of resources, notably nutrients, present in excreta. Choice of appropriate treatment systems should be based on the required characteristics of the end-product for economic use, rather than prescriptive discharge standards borrowed from industrialised countries. This ‘reversed sanitation design’ approach will also have consequences for the previous elements. For example, keeping excreta separate from grey water and stormwater, or keeping urine and faeces separate provides options for more efficient recovery of resources.

Treatment facilities can be located on-site, or off-site, depending on land availability and reuse potential of excreta and grey water. If reuse of treated excreta is appropriate at the household level, on-site treatment is preferred.

To avoid health risks, handling of excreta must be limited and controlled. In most circumstances, on-site treatments meet these concerns.

Figure 3.1 illustrates a selection of on-site and off-site treatment processes.

Use of sanitation products

Development of the ecological sanitation approach has highlighted substantial gains to be made by mobilising the high nutrient and energy-producing potential of properly managed

human wastes. We saw in Section 2.3.4 what a large contribution recovery of urine and excreta could make to the demand for nutrients to improve agricultural production. This argument is amplified in Chapter 4 and expanded in great detail in TOP ten Document 9: Ecological Sanitation.

As well as urine and excreta recycling, the biogas generated when human and animal wastes undergo anaerobic digestion is a practical and economic source of energy for cooking and lighting.

These approaches contrast starkly with the conventional disposal methods that treat wastewater as an inconvenient pollutant that requires expensive cleaning and clinical disposal.

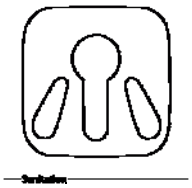
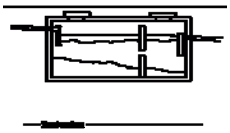
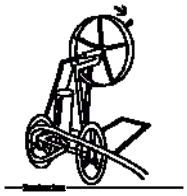
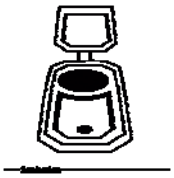
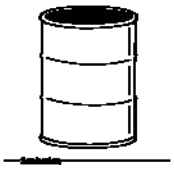
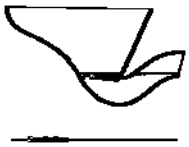
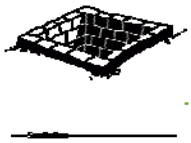
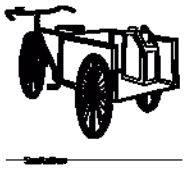
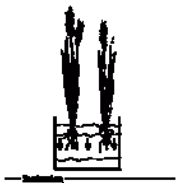
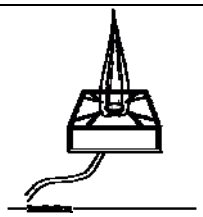
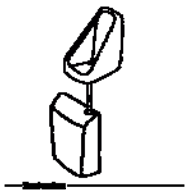
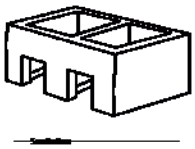
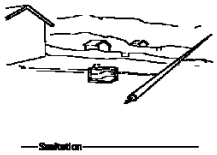
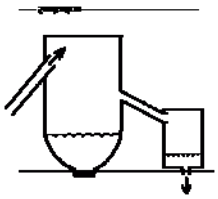
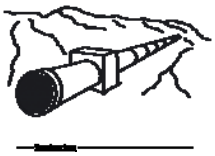
Toilets	Collection	Transportation	Treatment	Using sanitation products
 Waterless toilet	 Septic tank	 Mechanical emptying system for pits, septic tanks	 Co-composting with organic waste	 Compost as soil conditioner
 Waterless urine diversion toilet	 Oil drum	 Vacuum truck	 Dehydration	 Human urine as fertiliser
 Pour flush slab	 Shallow pit	 Tricycle	 Planted soil filter	 Biogas as source of energy
 waterless urinal	 Vault / chamber	 Settled sewerage (small diameter)	 Anaerobic digestion (biogas tank)	
		 Gravity sewerage	 Wastewater treatment plan	

Figure 3.1 Examples of sanitation elements that may be combined into a complete system (taken from TOP ten Document 3: Smart Sanitation Solutions). © WASTE

3.2 Who should be involved?

Sanitation systems work best and most sustainably when they meet the expressed desires and capacities of their users. Wherever people live, they manage their own sanitation needs – for better or worse. The kind of sanitation a household has reflects the family's priorities (in most cases those of the men). Current sanitation practices might not adhere to health, environmental or ecological standards but they have to form the basis for any improvement. City engineers, consultants, NGOs and the private sector, all of whom do have their own (honourable) interests to intervene in the lives of the poor, too often ignore the attitudes and culture of the "beneficiaries", as reflected in the existing sanitation situation.

It follows that decisions about the different elements of a sanitation improvement scheme need to be taken with the direct involvement of all sections of the community. But there are other "stakeholders" too whose involvement is crucial to the success of any sanitation project. The planning processes featured in Chapter 5 are designed to develop sanitation improvement programmes that take all stakeholders' views into account. It is helpful here to see how the attitudes and strengths of each stakeholder group may influence the choice of sanitation elements. Four distinct groups are considered:

- **Households and other toilet users**
- **The private sector**
- **National and local authorities**
- **NGOs**

Households and other toilet users

People like to defecate safely, conveniently and comfortably. The criteria may be different in each culture and people have individual preferences, but nobody is willing to pay a high price in terms of money, time and effort for a toilet. Richer people are willing and able to buy convenience. The poor – particularly poor women – compensate for the lack of money to acquire a sophisticated toilet facility with a readiness to spend time, to clean it, to reach it and to maintain it. (See for instance case study 5, CBO management of slum neighbourhood sanitation services: the Aynal's Bastee Case, Dhaka, Bangladesh in IRC Occasional Paper *The Value of Environmental Sanitation*: http://www.irc.nl/page/31975).

In sanitation projects, we emphasise continually the need for participation to construct and maintain the system. Many systems designers for the poor imply a voluntary role of households. However, like everyone else, if the poor can avoid this role they will do so, unless the incentives are high enough to make the toilet a priority. In many peri-urban communities the problems can not be avoided, and that creates an incentive not to wait for the local government. Without organisations to plan and work on a communal scale, toilet systems will be household-based constructed by the users and local private entrepreneurs. And, unless there is sufficient awareness and motivation, individual systems are less likely to serve the common good in terms of protecting health and the environment.

The private sector

International organisations and experts increasingly promote decentralised, small-scale systems and operations to achieve sanitation targets. In this approach, the small private sector plays a key role. Local masons, artisans, small-scale manufacturers, local entrepreneurs and small private operators deliver products and services. They provide building materials, construct the sanitation systems, empty the pits, and manage the collection, transport, composting and use of the sanitation products. And they market these locally, often on the basis of a direct client-contact approach. In most cases, each local business provides only a part of entire sanitation systems. Their interest is profit-driven and their planning and organisation is usually poor. The performance of their service is highly influenced by the bad image of the sector in general. Work conditions are bad and payment is low, often resulting in poor professional standards. Nevertheless, these people provide an essential service to the community. Without them the situation in the peri-urban areas would be unbearable.

Supporting local private businesses allows authorities and NGOs to concentrate on their main role of promotion, marketing and regulation of sanitation instead of its direct provision. In this way they can avoid unnecessary direct investment and make their scarce resources work to better effect. It is tempting to believe that the free-market mechanism will provide sanitation that people need and ensure realistic prices. However, reality usually looks different. In many parts of cities, such as in informal housing areas with absence of regulations, planning and sanitation programmes, the private sector is not able to deliver adequate sanitation. In addition, people's individual sanitation choices affect the livelihood of the entire community. It is instructive to bear in mind that, even in the relatively rich cities of 19th century Europe, market forces were insufficient on their own to provide safe sanitation for all inhabitants.

National and local authorities

Historically, the local authority has been seen as the responsible provider of sanitation and waste services. It provided all the elements of the waste management system: the physical and intellectual infrastructure; the institutional framework and the daily operation of services. This ideal functions imperfectly in the South, where the local authority often can only provide sanitation and waste services to a relatively small section of the central business and residential area, while lower and middle class neighbourhoods and areas outside the centre have few or no services. In the South, structural adjustment and fiscal discipline are imposing strict limits on government expenditure, which restricts the expansion of conventional services to these areas. At the same time that the expanding urban population is demanding traditional and new services, local authorities are less and less able to provide them.

Local authorities are generally aware of the health risks and environmental problems caused by inadequate waste management. At the same time they are looking for new ways to share their responsibilities with neighbourhood communities, small enterprises, large private entrepreneurs and industries, hospitals, schools and other stakeholders. Increasingly, the local

authority seeks to mobilise the human and financial resources of these actors in order to develop an adequate system of waste services.

Recognising the need for a more efficient role for the public sector, public funds and resources are better used to support product development, market research, training, promotion, hygiene awareness campaigns and other forms of facilitation.

In a field note based on research in Africa, the Water and Sanitation Program (WSP) suggests that the role of the public sector is to:

- Understand existing demand for sanitation, and what limits it;
- Overcome those limits, and promote additional demand;
- Stimulate development of right products to meet that demand;
- Facilitate the development of a thriving sanitation industry; and
- Regulate and coordinate the transport and final disposal of wastes.

Public subsides for toilet construction should be avoided if possible, or limited when necessary. Subsidies should never be given in a way that could disturb the existing private initiatives. A more promising use of subsidies and credit is to support small businesses that provide sanitation facilities and services to the public.[3]

NGOs

Based on their work in and with communities, NGOs and non-profit organisations often assume a role as representative of the poor and are positioned as such in stakeholder platforms. In addition, NGOs step into a vacuum created by the absence of political will by the city administration to deliver service to low-income neighbourhoods. This results in a complex role for NGOs as financier, technical adviser and representative of the poor in sanitation projects. International NGOs such as WaterAid, CARE, Oxfam and others have a considerable pool of specialist expertise and a positive track record in carrying out community-based sanitation programmes, including building the capacity of other partners to perform their roles.

In the multi-stakeholder partnerships that we are discussing here, NGOs can use their skills to help in a monitoring and information sharing role that may assist with:

- transparency of financial operations and flow of materials
- quality of construction
- understanding of health and hygiene aspects
- performance of maintenance and operation
- own contribution of beneficiaries
- cost recovery potentials
- public satisfaction with facilities and services

[3] WSP field note: The Case for Marketing Sanitation, 2004

- efficiency of planned solutions to respond to problems
- gaps in the private service provision and skills of private and public sector

Further reading on the type pf multi-stakeholder partnerships that can bring successful sanitation improvements includes:
TOP ten Document 10: Scaling up rural sanitation in South Asia: Lessons learnt from Bangladesh, India and Pakistan and
The Household-Centred Environmental Sanitation Approach

4. Approaches to technology choice

4.1 A multiple-choice examination

Even seasoned sanitation sector professionals find themselves faced with a wide variety of possible solutions to any particular sanitation problem. For well-meaning non-specialists hoping to help communities to find a sustainable solution, the array of possible technologies is bewildering. The incremental approach, building on existing sanitation provision – good or bad – is a way forward, but even then, decisions about appropriate latrines, sewer systems, treatment requirements and behavioural implications require careful consideration by all those involved.

The TOP format does not permit detailed analysis of individual sanitation technologies. The TOP ten documents do include such analyses and the aim of this TOP is to help readers to locate pertinent documents for their own particular situation. In this chapter we try to offer general guidance on the pros and cons of different types of technology, with pointers to supplementary information. First though, we look at the background issues that influence the choices to be made.

4.2 Social, economic and environmental issues

Socio-cultural aspects of sanitation include the influence of gender, religion and culture on individuals' attitudes to waste generation and management. As we have already noted, the reasons that people may want to improve their sanitation have little to do with the concerns of those who determine the international development agenda. The incentive for an individual person to demand improved sanitation is a sense of danger and disgust for bad odour and dirt, and not an awareness of public health, environmental degradation and the need to recycle natural resources. In a WSP paper, *Who buys latrines, where and why?* (Jenkins, Marion, 2004), the author points out that well-being was the main incentive for villagers in Benin to require latrines, and prestige was also important. South Africa's Minister of Water Affairs and Forestry, Ronnie Kasrills expressed it succinctly in 2002, when he said "Water is Life, but Sanitation is Dignity".

Sanitation choice is also a big gender issue. There are many reasons why women need to be included in the decision-making process: not just because they are regarded as those most responsible for hygiene in the household, but because their sanitation needs are greater and different from men's. For many men, urinating in public is neither shameful nor unacceptable. Men also have more ready access to public places to use toilets (pubs, mosques, etc). In contrast, public toilets are associated with violence against women, rape, lack of privacy and often appalling hygiene situations. Women often prefer to walk before sunrise or after sunset several kilometres to defecate in open places rather than to visit public toilets closer to home. During menstruation women need to visit sanitation facilities more frequently and are therefore more in need of a nearby and clean toilet than men.

The young, the elderly and the disabled, all too have special needs that need to be taken into consideration when designing a community sanitation scheme.

Religion, through its relation with ethno-cultural and gender aspects can be the motivation for a request for a particular form of sanitation. For example, the distinction between anal cleansing with paper (or other materials) and water, the 'wipers and washers' can be explained by religious morals and norms. However, very often habits change over time because of the need to adapt to changing circumstances. Hindus and Muslims are considered washers, though nowadays many are not. Many Christians in the Philippines have no religious motivation to use water for anal cleansing, but they do.

Cultural values are expressed through religion just as often as the other way around. However, what both have in common in many communities is that excreta, and particular faeces, are considered as not pure, as dangerous and dirty. Contact should be avoided. Based on experience with infectious diseases this might make sense to many, but not for those in East Asia whose food security was highly dependent on the use of human and animal fertilisers. Today, understanding the pathogenic cycles better than hundred years ago, we may consider the lack of hygiene awareness in for example China difficult to accept. However, the use of human excreta has been a crucial reason why agriculture in East Asia was able to feed large numbers of people continuously over centuries.

4.3 Economic and financial aspects

As discussed in section 2.3.3, WHO has demonstrated a substantial cost/benefit advantage from investment in improved water and sanitation services. According to Hutton & Haller (reference), the $11.3 billion a year cost of meeting the MDG goal for water and sanitation coverage would yield $84 billion in health care savings and productivity gains. Impressive as these numbers may be, they depend on a substantial increase in current levels of investment in sanitation, and on the right kind of programmes being developed and financed.

Too often in the past, sanitation provision has been dependent on decisions by promoters about *affordability* of particular technologies rather than the *willingness* of users to pay for particular levels of service. Ironically, this approach often leads to too low a level of service, whereas the users would be prepared to invest more of their own resources in greater convenience provided by more expensive solutions. More important is that users should be able to select for themselves the technology that best fits their needs, and to make the behavioural changes necessary to obtain optimum benefits. In TOP ten Document 10, WSP cites the example of a successful programme in Bangladesh with a range of ingenious toilet designs costing from $0.30 to $500.

The use of subsidies to help promote sanitation improvements is a controversial issue. In TOP ten Document 10 it is argued that subsidies for low-cost latrine slabs and other sanitation options have been counter-productive, because they can meet only a small part of the demand and may deter others who can afford to pay.

Social marketing of sanitation has to include all groups and to promote behavioural change as well as “selling” sanitation hardware. In the Community-led Total Sanitation (CLTS) approach the social marketing stimulates community members to address their sanitation situation, and mobilises the disgust engendered by discussion of open defecation as a driver for incremental improvements and awareness-raising.

4.4 Environmental concerns

Some household-based sanitation solutions simply transfer the problem to other places. Piped sewerage is the obvious example. Transporting human waste in large volumes away from residential areas, only to discharge it untreated into rivers and streams that could be valuable freshwater resources, does not make economic or environmental sense. On a more local level, badly managed septic tanks that release poorly treated effluent into the surrounding ground, contaminate both soil and groundwater.

The Household-Centred Environmental Sanitation (HCES) approach addresses these issues through its expanding circles of responsibility and strict environmental principles (reference).

In contrast to the environmentally damaging effects of some sanitation “solutions”, ecological sanitation is by definition an environment-enhancing approach. By converting human waste into reusable nutrients and soil conditioners, eco-sanitation systems reduce the need for damaging artificial fertilisers and increase crop production, particularly, but not exclusively, at household and neighbourhood levels. The nutrient content of one human’s excreta over one year is approximately equal to the nutrients required to produce the biomass for that person to eat in a year.

4.5 Technology pros and cons

Five of the TOP ten documents deal specifically with sanitation technologies:

Document 3: Smart Sanitation Solutions describes toilets, collection systems, transportation, treatment and ways of using sanitation products. Brief descriptions of each system are followed by guidance on where they are considered applicable, comparative costs, and the advantages and disadvantages of each option. In all, five different toilets (Arborloo, dry toilet, dry urine diversion toilet, pour flush slab, and waterless urinal), three collection systems (Fossa Alterna, oil drum/container, and vault/chamber), three transportation systems (cartage, MAPET/Vacutug, and settled sewerage), four methods of treatment (co-composting, dehydration, planted soil filter, and anaerobic digestion) and three examples of product use (compost as a soil conditioner, human urine as fertiliser, and biogas energy) are compared and contrasted. The choice of options is very much focused on low-cost solutions appropriate for small communities.

Document 5: Sanitation for a Healthy Nation: Sanitation Technology Options was prepared by the South African Department of Water Affairs and Forestry to counteract the perceived

problem that: “communities and local governments are currently {2002} choosing technical options that, in the long term, are unaffordable and unsustainable”. It begins with four “options not recommended”: Unimproved pit toilet; chemical toilet; bucket toilet; and communal toilets. It goes on to describe and appraise three dry on-plot systems (Ventilated Improved Pit (VIP) toilet, Ventilated Improved Double Pit (VIDP) toilet, Composting/urine diversion toilet) and seven wet systems (Pour-flush toilet, Aqua-privy with soakaway, Conservancy tank, No Water Consumption System (NOWAC), Full-bore water-borne sewerage, Septic tank with soakaway or small-bore solid-free sewer, and Shallow sewerage). Illustrations of each technology are accompanied by text describing the principles, operational and institutional requirements, costs and, critically, experiences and comments, which include both positive and negative remarks.

Document 6: On-plot sanitation in low-income communities: Guidelines for selection dates from 1998 but contains important survey data on user reactions to seven different on-site sanitation systems in urban areas:

- Unimproved pit latrines
- Lid-covered pit latrines
- Ventilated improved pit (VIP) latrines
- Double-pit pour-flush latrines
- Pour-flush toilet to septic tank
- Bucket/pan latrines

Among the key conclusions (Section 1E of the report) is this one: “High degrees of satisfaction were expressed for all latrine types (except bucket/pan latrines); simple pit latrines recorded higher levels of satisfaction than latrines assumed to be of higher technical specification. Satisfaction levels are most significantly affected by smell, insects and emptying problems, although the actual proportion of households recording these points as problems was low.”

Document 8: Good sewers cheap describes the highly positive experiences with installation of condominial sewerage systems in Brazil. Published in 1995, after more than a decade of experience with the shallow small-bore systems that link neighbouring houses through their gardens, the document records high satisfaction rates and a massive switch in urban sewer planning away from large sewers towards condominial sewers, in both poor and middle class areas. It notes the intensive consultation needed between residents and implementing agencies, to sort out the interventions needed to build and maintain the sewer networks and has a highly instructive cartoon-style user manual that explains both the operation of the system and its maintenance demands.

Document 9: Ecological Sanitation – Revised and enlarged edition is the “bible” for an ever-growing number of enthusiastic proponents of eco-sanitation. As well as making the case for the approach on the grounds of sustainability and resource recovery, the 145-page document contains examples of eco-sanitation toilets, collection approaches and ways of recovering and reusing nutrients.

The book contains answers to many of the questions that arise in the minds of people introduced to the idea for the first time, including toilet designs for separation and measures to deal separately with urine, faeces and the materials (including water) used for anal cleansing. It also has suggestions for dealing with grey (sullage) water, while acknowledging that this is an area requiring further research.

4.6 CLTS: Power to the people

Water and sanitation practitioners have long recognised that community involvement/participation is crucial to the sustainability of their development projects and that decisions about the type of technology used and its upkeep have to be based on the views of the men, women and children involved. The newest form of this concept has been labelled ***Community-led Total Sanitation*** (CLTS) and its successes are driving donors and governments to review policies based on subsidies for sanitation hardware. Pioneered in Bangladesh in 1999, CLTS uses people's shame and disgust at their open defecation practices as the driving force for self-help improvements to completely eliminate the practice.

Facilitators stimulate community members to talk openly about open defecation, and the discussions rapidly lead to a shared determination both to change behaviour and to build the facilities necessary to achieve a cleaner, healthier lifestyle for all. Subsidies disrupt the community approach, because they are divisive and counteract the critical sense of common purpose.

Following the successes in Bangladesh, CLTS approaches have spread to other countries in South and Southeast Asia and are also being adopted in some African countries. DFID is funding a research project: *Going to Scale: The Potential of Community-led Total Sanitation*, managed by the Institute for Development Studies (IDS). The web page http://www.livelihoods.org/hot_topics/CLTS.html has a growing list of publications describing the principles of CLTS and experiences of its application in Bangladesh, Cambodia, China, India, Indonesia, Nepal, Pakistan and West Africa (with Bolivia and Ethiopia said to be "coming soon"). There is also a link to enable interested parties to contribute to the research project.

In their 2005 paper *Subsidy or Self-respect? Community-led Total Sanitation: An Update on Recent Developments*, authors Kamal Kar and Katherine Pasteur say: "As CLTS is a low-cost approach and it strengthens social solidarity, there is great potential for scaling-up. But there is still much to be learnt about what aspects of CLTS work well, and in what conditions. The key challenge for NGOs and donors is to learn from communities that have already implemented CLTS, to share experiences, and to use what they learn to adapt and change. It is not a question of committing more funds; in fact, fewer may be needed. The key is to train more facilitators in the principles of CLTS, as it is their skills in mobilising communities to change people's attitudes and behaviour that are essential to the success of the approach." On a "Post-it Board" (http://www.livelihoods.org/post/CLTS_postit.htm), readers are invited to contribute comments and feedback on a regularly updated paper

assessing favourable and unfavourable conditions for CLTS. Read the latest version of the paper here.

More information on CLTS in practice can be found in TOP ten Publication 10.

4.7 Strategic planning for community-based action

The CLTS approach and the Household-centred Environmental Sanitation (HCES) concept make users the focal point for decisions about local sanitation improvements. Other stakeholders also have important parts to play, as discussed in Section 3.2. For governments and donors committed to the multi-stakeholder, community-led concept, there remains the challenge of developing an overall plan that enables resources to be allocated and assures the support necessary to achieve and sustain targeted progress.

TOP ten Document 7: Effective strategic planning for urban sanitation services: Fundamentals of good practice is a detailed discussion of strategic planning techniques that will lead to an overall plan taking into account national targets and the concerns of all stakeholders. The main principles of the planning process are set out as:

"Plans should be household-centred. They should start from consideration of the needs and demands of individual households and explore deal with wastes as close as is possible and appropriate to those households. This will does not mean that planners should assume that sanitation problems should always be dealt with locally. Investigation of 'where we are now' may well reveal that purely local solutions are not desirable or even possible. It does mean that the option for developing decentralised systems should always be examined**.**

The plan should, where necessary, include measures to establish and inform demand for improved sanitation. Demand implies willingness to pay, either directly or indirectly, at least part of the cost of sanitation improvements. Even when people are convinced of the need for improved sanitation, they may need guidance on the costs and benefits of different sanitation options. This is likely to be particularly true for ecological options, which may well be new to people.

The plan should be financially viable, taking realistic account of ability and willingness to pay for activities, facilities and services. Whenever possible, householders should take direct responsibility for financing and providing in-house and on-plot facilities. To make such facilities affordable, a range of designs to suit the needs of different income groups should be produced. Householders should also contribute to the cost of public facilities and services that benefit them directly. Ideally, they should pay the full capital cost of such services and they should certainly pay the operational costs. Government may have to cover the cost of services whose benefits accrue to society as a whole and/or are not fully recognized by their intended beneficiaries.

Different sanitation options may be appropriate in different areas. For instance, sewerage may be appropriate where population densities are high but completely inappropriate for low density areas with standpost water supplies. This is an important

consideration when plans incorporate an ecological dimension. In general, initial efforts to introduce ecological sanitation should normally focus on those areas in which conditions favour its use.

Plans should include appropriate incentives, including rewards for positive actions and practices and sanctions against negative actions and practices. Incentives are often assumed to be about money but they can also involve non-monetary factors such as the approval or disapproval of neighbours. They can apply to individuals but may also apply to the wider community (for instance the Total Sanitation approach developed in South Asia often rewards villages that reach specified sanitation coverage targets)."

4.8 Summary remarks

In many ways, sanitation is still regarded as the Cinderella of the drinking water sector: the poor relative in a German fairy tale who comes in second place and must remain out of sight. Yet, as has been made clear in this TOP, better sanitation has large environmental, socio-economic and health benefits. The coming year will be the International Year for Sanitation, which is strongly supported by the donor community. However, if, as as in the past, sanitation is again the poor relative, it will be up to all stakeholders, ranging from donors to implementers, to take concerted action to create sustainable sanitation.

5. TOP books, articles, papers

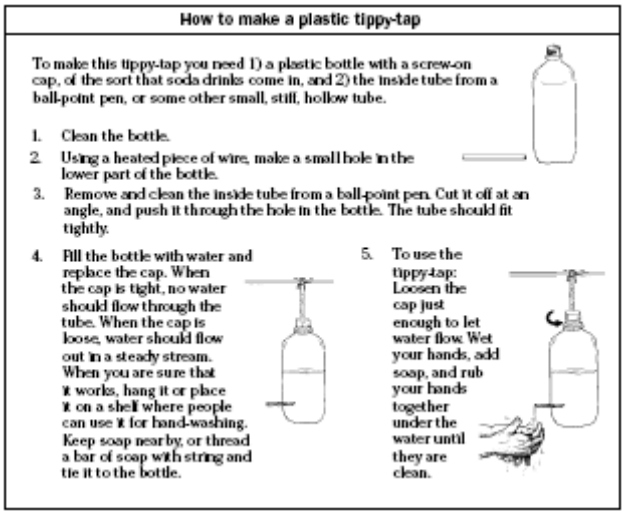
5.1 The TOP ten documents

The publications in the table, each of which is available free of charge and in downloadable form from the cited sources, add amplification and detail to the summary text in the TOP. Together, they give readers a comprehensive background to the complexities of the sanitation issue and offer practical ways of finding solutions to the many challenges ahead. Following the table are brief abstracts/examples from each publication, along with the contact details for obtaining hard copies or downloading the documents from the internet.

No.	***Title***	***Produced by***
1	*Sanitation and Cleanliness for a Healthy Environment*	Hesperian Foundation
2	*The Sanitation Challenge – Turning Commitment into Reality*	WHO (Author Barbara Evans)
3	*Smart Sanitation Solutions*	NWP, IRC, PRACTICA, SIMAVI and WASTE
4	*Sanitation and hygiene promotion: Programming guidance*	WHO/WSSCC
5	*Sanitation for a Healthy Nation: Sanitation Technology Options,*	Water Affairs and Forestry Department, South Africa
6	*On-plot sanitation in low-income urban communities: Guidelines for selection*	Andrew Cotton and Darren Saywell, WEDC
7	*Effective strategic planning for urban sanitation services: Fundamentals of good practice'*	GHK Research and Training
8	*Good Sewers Cheap*	Gabrielle Watson for WSP
9	*Ecological Sanitation – Revised and enlarged edition*	Stockholm Environmental Institute
10	*Scaling up Rural Sanitation in South Asia: Lessons learnt from Bangladesh, India and Pakistan'*	Andrew Robinson for WSP

Document 1. Sanitation and cleanliness for a healthy environment (Hesperian)

A simple well written guide for practitioners and non-specialists, this 48-page publication includes lots of practical tips, like the one illustrated here, for making a simple water dispenser for use in latrines or other situations where handwashing is crucial. Published in 2005 by Hesperian Foundation, Berkeley, California, in cooperation with UNDP and SIDA, the booklet can be


How to make a plastic tippy-tap

To make this tippy-tap you need 1) a plastic bottle with a screw-on cap, of the sort that soda drinks come in, and 2) the inside tube from a ball-point pen, or some other small, stiff, hollow tube.

1. Clean the bottle.
2. Using a heated piece of wire, make a small hole in the lower part of the bottle.
3. Remove and clean the inside tube from a ball-point pen. Cut it off at an angle, and push it through the hole in the bottle. The tube should fit tightly.
4. Fill the bottle with water and replace the cap. When the cap is tight, no water should flow through the tube. When the cap is loose, water should flow out in a steady stream. When you are sure that it works, hang it or place it on a shelf where people can use it for hand-washing. Keep soap nearby, or thread a bar of soap with string and tie it to the bottle.
5. To use the tippy-tap: Loosen the cap just enough to let water flow. Wet your hands, add soap, and rub your hands together under the water until they are clean.

downloaded from the Hesperian website, using this link:
http://www.hesperian.info/assets/environmental/EHB_Sanitation_EN_lowres.pdf.

Document 2. The Sanitation Challenge: Turning Commitment into Reality (WHO)

This 32-page document contains a lot of information on the political background to the sanitation challenge, together with summary global statistics to help define the challenge. It also seeks to identify the roles that can be played by national and local governments, communities and civil society, households, entrepreneurs and international agencies, in implementing strategies to meet the challenge. Lots of examples ("We are inspired by ..") illustrate how these different stakeholders have met the challenge in their own scenarios.

Two examples:

Abstract 1 (page 13)
… civil society and community efforts in Bangladesh
The Government of Bangladesh has long been committed to improving sanitation, but recent research by WaterAID showed that, while subsidies (the core of government sanitation policy) gave people the "opportunity" to construct latrines, the generation of the "capacity" to do so lagged behind. The Bangladesh nongovernmental organisation (NGO) Village Education and Resource Centre (VERC) demonstrated that communities acting together can take steps to significantly improve their sanitation situation. Working with VERC, villages developed a range of new approaches to solving sanitation problems, including the design of more than 20 new models for low-cost latrines. VERC's approach unlocks communities' ability to solve problems by themselves.

Abstract 2 (page 25)
... ecological sanitation in San Luis Beltrán in Mexico
In this periurban barrio in Oaxaca, Mexico, dry toilets with urine diversion have become a universal sight; whereas in the late 1980s, when the idea was first introduced, the population was keener to have a waterborne sewerage system. The local committee was convinced that the system would work after they saw 35 demonstration units working well. Technical inputs from a national NGO and support from the Ministry of Public Works was instrumental in getting the programme off the ground. While some health concerns persist around the safety of "ecological" toilets, they clearly represent an important avenue for continued monitoring and research.

The booklet can be downloaded from:
http://www.who.int/water_sanitation_health/hygiene/sanchallengecomp.pdf

Document 3. Smart Sanitation Solutions (Netherlands Water Partnership)

A good general introduction to the topic, this 68-page publication was produced by five Dutch organisations as a contribution to the Fourth World Water Forum in Mexico in March

2006. It makes the important point that a sanitation system is a set of linked components, which includes but is not restricted to toilets. A sanitation system is deemed to be "smart" when it is "adapted to local conditions and adaptable to a changing environment". To develop a smart sanitation solution in a local context, the following guidelines are said to be crucial:

- Involving families and the private sector in design and planning (developing ownership);
- Responding to actual needs (demand responsive);
- Building on existing practice, experience and infrastructure (don't re-invent the wheel);
- Taking account of values, attitudes and behaviour of the users (culturally sensitive);
- Making choices based on affordability and willingness to pay;
- Considering existing institutional settings (develop institutional support).

The "smart" sanitation technologies described include a range of toilets/latrines designed to recycle the human waste products, and also the collection, transport and reuse options for the wastes. A case study (page 56) describes a project in two Philippine *barangays* which involves waterless urine diversion toilets. The success of the project for individual "ecological sanitation co-operators" has led to surplus urine, partly composted faeces and anal cleansing water being processed in a "Materials Recovery Facility" where researchers are investigating co-composting for agricultural reuse.

The booklet can be downloaded from the IRC website, using the link:
http://www.irc.nl/content/download/24282/273405/file/SSS_2006.pdf

Document 4. Sanitation and hygiene promotion: Programming guidance (WSSCC/WHO)

Published in 2005, this 96-page document recognises that many of the people involved in planning and promoting sanitation improvements will not have sanitation as their only area of interest. It therefore sets out to link the sanitation agenda to poverty alleviation and other developmental issues, while emphasising the key role that sanitation improvements have in the lives of individuals. While stressing that decisions at household level are going to be critical in the achievement of sustainable sanitation systems, the document also sets out five basic principles concerning the role of governments in ensuring equity and replicable progress. Those principles are:

Principle One: The role of government is to balance public and private benefits of sanitation to ensure increased access at the household level while safeguarding society's wider interests.
Principle Two: Many groups are excluded from the benefits of traditional 'sanitation' programmes. The role of government is to balance the interests of different groups in society and redirect resources to those who are systematically excluded.
Principle Three: It is no good selling (or even giving) people something that they don't want. The role of government is to identify and support what already exists.

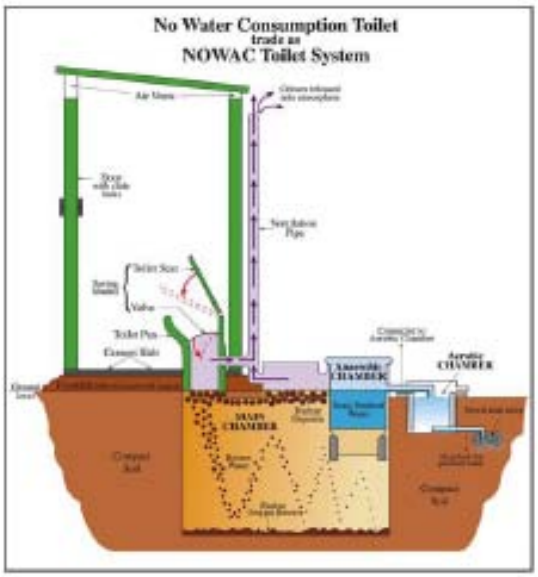
Principle Four: Many actors may have knowledge and experience which can inform a sanitation and hygiene promotion programme. The role of government is to identify and forge partnerships with any organisation or individual who can be part of the solution.
Principle Five: New approaches may result in a shift of power and resources. It is the role of government to promote and support this shift including finding resources to build capacity and support institutional change.

The publication can be downloaded from the WHO website, using the link:
http://www.who.int/water_sanitation_health/hygiene/sanhygpromo.pdf

Document 5. Sanitation for a Healthy Nation: Sanitation Technology Options (DWAF)

Published in 2002 by the National Sanitation Task Team of the South African Department of Water Affairs and Forestry, this 14-page illustrated leaflet contains diagrams and descriptions of alternative simple sanitation technologies. The descriptions include comments on application of the different technologies in the South African situation. The analyses are forthright and include realistic assessments of what can go wrong. Though published in 2002, the document includes reviews of technologies such as urine diversion and the NOWAC (no water consumption) toilet system (see diagram and description below) as well as small-bore sewer systems.

No Water Consumption System (NOWAC)



Principles of operation	Operation and Institution	Costs	Experience and Comment
Fill main chamber with water to activate the system. No additional water will be required in future. Waste drops into the water in the main chamber where the organic material decomposes. This process is natural and executed by organisms. The waste moves around in the main chamber for a period of approximately 100 days. The brown water moves into the second chamber. This chamber is filled with an anaerobic filter and is situated in the main chamber. It destroys approximately 95% of all dangerous pathogens before it flows over into an anaerobic filter where the remains of the pathogens are destroyed by organisms and oxygen. The volume of the overflow equals the volume of the waste per person. This overflow of uncontaminated water flows into a soak away, which can be seen as an additional filter.	Operates: + Without additional water + With only the seat as mechanical part + Without any chemicals No maintenance required for 15 – 20 years. After 15 – 20 years the sand layer at the bottom of main chamber is removed with a pump after which the system will work for another 15 – 20 years. Note: Only sand and not the water will be pumped out.	Capital: 5000 – 6000 per unit which includes: + The complete system + The concrete top structure + The transport + The installation + The training of each household Note: Installation costs can increase in rocky areas and aslant steep slopes. Operating: No costs up to 15 – 20 years.	Similar systems are accepted internationally in echo sensitive areas and where water is scarce.

The leaflet can be downloaded from the DWAF website, using the link:
http://www.dwaf.gov.za/dir_ws/content/lids/PDF/Technical.pdf

Document 6. On-plot sanitation in low-income urban communities: Guidelines for selection (WEDC)

This document presents the findings from Phase 2 (August 1994 - March 1997) of a Department for International Development (DFID) project (R4857) covering On-Plot Sanitation in Low Income Urban Communities. The project concerns the performance of on-plot sanitation systems in urban India, Ghana and Mozambique, and aims to investigate how satisfactory on-plot sanitation is in the urban context, and to develop guidance on its use for policy makers and professional staff of urban governments, development agencies and non-government organisations. It contains detailed analyses of user reactions to a variety of simple latrine technologies and records a high level of user satisfaction for all except bucket/pan latrines.
The report and guidance can be downloaded in three sections from the WEDC website, using the link: http://www.lboro.ac.uk/departments/cv/wedc/publications/opsg.htm

Document 7. Effective strategic planning for urban sanitation services: Fundamentals of good practice (DFID)

This 24-page document (the basis for Chapter 6 of this TOP) focuses on urban sanitation, and on the need for an overall strategic plan to lead to beneficial changes for the city as a whole, rather than on "isolated pockets of good practice". It sets out six principles for effective strategic planning:

Principle 1 Respond to informed demand
"Recent thinking on service provision stresses that infrastructure schemes must respond to user demand by providing what potential users want and are willing to pay for . . ."

Principle 2 Focus on sound finances
"Expansion of sanitation systems will not be possible unless an institution or group of individuals, preferably the intended users, is willing to pay for the new facilities required . . "

Principle 3 Develop incentives for good practice
"Incentives help to ensure that individuals and organisations act in a way that ensures the ongoing availability of functioning sanitation services . . ."

Principle 4 Involve stakeholders in appropriate ways
"Stakeholders are people, groups and organisations with an interest in some particular subject, in this case sanitation. They include both primary stakeholders, those who will either benefit directly from or be adversely affected by any proposed sanitation improvements, and secondary stakeholders, all others who may be involved in developing the policy context for sanitation provision, delivering services and acting as intermediaries between service users and service providers . . ."

Principle 5 Take a wide view of sanitation
"Sanitation strategies should look beyond local solutions to narrowly defined problems to recognise the links between different sanitation services. Excreta disposal, solid waste management and drainage are inter-related and the impact of improvements in one will be reduced if they are carried out without regard to the others . . ."

Principle 6 Take manageable steps towards intermediate objectives
"This last principle is derived directly from the incremental approach to the development and implementation of strategies identified when we considered the options for 'getting from here to there' . . ."

The booklet can be downloaded from the GHK website, using the link:
http://www.ghkint.com/products/downloads/Publications/Strategic%20planning%20for%20urban%20sanitation.pdf

Document 8. Good sewers cheap (WSP)

The 70-page publication dates from 1995 and explains the origins of the Brazilian condominial sewer programme. Shallow small-bore sewers serving blocks of houses and apartments cost only a quarter as much as conventional sewerage to serve the same neighbourhoods.

Annex 2, starting on page 63 of the document, is a cartoon-style "User's Manual" for condominial sewers which also serves as a helpful introduction to the system. The page reproduced on the right is a sample from the manual.

The publication can be downloaded from the WSP website, using the link:
http://www.wsp.org/filez/pubs/global_goodsewerscheap.pdf

Document 9. Ecological sanitation (Stockholm Environmental Institute)

This 145-page document published in 2004 has comprehensive information about ecological sanitation, including, but not restricted to urine-diversion toilet systems in both rural and urban situations. The following abstract from page 72 of the document, makes a powerful case for the eco-sanitation approach:
". . . about 1.5 litres of undiluted urine can be used to fertilize 1 square metre of soil. 1.5 litres is the amount produced by one adult in one day. Even without an eco-toilet, people could collect their own urine and use it on backyard gardens to increase yields. However, the fertilizing effect of urine works best in soil with a high organic matter content and this

can be increased by adding the humus from eco-toilets and garden composts. . . . vegetable and fruit crops grown using urine fertilization produce 2–10 times the amount of crop by weight as those grown in unfertilized, poor soil. If people use urine to grow vegetables and fruits, the increased production results in greater food security at virtually no cost. Soil enriched with humus from eco-toilets holds water longer than soils not enriched with compost. Research has shown that plants grown in soils enriched with large amounts of humus require less watering and survive droughts better than plants grown in ordinary soils without this humus. In times of drought, when whole fields of grain may die, backyard crops grown on humus may well survive and produce enough vegetables to help a family through a difficult period. If, over time, families can collect enough humus from their eco-toilet, they may be able to enrich larger and larger areas, leading to increasing food security."

The publication, together with a number of fact sheets and other literature, can be downloaded from the Eco-Sanitation website, using the link:
http://www.ecosanres.org/pdf_files/Ecological_Sanitation_2004.pdf

Document 10. Scaling up rural sanitation in South Asia: Lessons learnt from Bangladesh, India and Pakistan (WSP)

This 136-page book, published in May 2005, reports on a regional study commissioned by the Water and Sanitation Program-South Asia (WSP-SA) to address issues surrounding the huge sanitation challenge in South Asia. Seven of the eight case studies featured in the report use the "Total Sanitation" approach, defined as "A community-wide approach whose main aim is universal toilet use (total sanitation) in each community covered by the program. The total sanitation approach focuses on stopping open defecation on a community-by-community basis by highlighting the problems caused to all by open defecation within and around the community, and by ensuring that every household either builds and uses their own low-cost toilet, or has access to a shared toilet."

The following text is abstracted from the Executive Summary of the report:
"The main objectives of the study were:

- To develop case studies of innovative approaches to rural sanitation in South Asia;
- To analyze the factors of success (and constraints) found in these case studies;
- To assess potential strategies (and constraints) to scaling-up the approaches used in case studies; and
- To draw up policy recommendations for large-scale rural sanitation programs in the region.

Seven of the eight case study programs use a 'total sanitation' approach to promote behavior change, including low-cost toilets in India and Bangladesh. The eighth case study program implements simplified rural sewerage schemes in Pakistan using a 'component-sharing' approach. The sanitation programs studied range in size from a small-scale NGO program covering 12 villages in one district to a large-scale government program that provided more than 1.5 million toilets in Andhra Pradesh [last year].

Based on the case study findings, 10 performance indicators were used to rate the overall performance of each case study program. A detailed analysis was then carried out, which identified the following key 'factors of success':

- Focus on stopping open defecation (rather than building sanitation facilities);
- Investment in hygiene promotion and social intermediation (at household level); and
- Provision of affordable sanitation options to the poor.

The more successful programs provided high access to sanitation, and ensured high toilet usage through a combination of participatory processes, hygiene promotion, and institutional incentives (financial rewards for achieving universal toilet coverage, community bans on open defecation, fines for open defecation, and so on).

The case study analysis also identified a number of 'common constraints':

- Widespread failure to monitor local outcomes (for example, open defecation, toilet usage, handwashing);
- High hardware subsidies (including the provision of free toilets);
- Ineffective social intermediation (notably by government bodies); and
- Unsustainable supply chains.

That completes the "TOP ten" publications, which together form a helpful library of supporting documentation for anyone seeking to contribute to sanitation improvement efforts around the world. Several more documents are cited in the main text of this TOP, and they are listed below, with summary descriptions and details on how to obtain copies.

5.2 Other supporting documents

The Household-Centred Environmental Sanitation (HCES) approach

The HCES approach was developed by a Working Group of the Water Supply and Sanitation Council. It was later synthesised into the *Bellagio Principles*. The approach and the principles are amplified in a 2005 document: *Household-Centred Environmental Sanitation: Implementing the Bellagio Principles in Urban Environmental Sanitation – Provisional Guideline for Decision-Makers* (http://www.wsscc.org/pdf/publication/hces.pdf). The following description of HCES is abstracted from that guideline:

"The HCES approach recommends that:

- People and their quality of life should be at the centre of any environmental sanitation system
- All environmental sanitation systems must be designed in such a way as to balance economic and environmental goods
- Solutions of environmental sanitation problems should take place as close as possible to the place where they occur
- 'Wastes', whether solid or liquid, should be regarded as resources
- Environmental sanitation systems should be 'circular' – designed in such a way as to minimise inputs and reduce outputs

- Problems relating to environmental sanitation should be handled within an integrated framework, and this framework should itself be part of a wider system of integrated water resources, waste management and food production

Objectives of HCES:
The goal of applying the HCES approach to urban environmental sanitation services (UESS) is to provide stakeholders at every level, but particularly at the household and neighbourhood level, with the opportunity to participate in the planning, implementation and operation of UESS. By doing so, it aims to create sustainable systems of UESS delivery that will help ensure that:

- People lead healthy and productive lives;
- The natural environment is protected and restored; and
- The conservation and reuse of resources is encouraged, contributing to local-level economic activities.

Implementation of the HCES approach will contribute significantly to the universal goal of UESS, which is to provide sustainable services to everyone, within a framework which balances the needs of people with those of the environment, in order to support healthy life on earth.

Achievement of this goal in turn contributes to a range of international goals and targets, including ensuring environmental sustainability (MDG Goal #7), improving the lives of slum dwellers (MDG target #11) and improving access to basic sanitation (the WSSD sanitation target)."

Evaluation of the costs and benefits of water and sanitation improvements at the global level

http://www.who.int/water_sanitation_health/wsh0404.pdf

Economic Aspects of Informal Sector Activities in Solid Waste Management

Final report, November 2006, Chapter 4. Prepared by WASTE and Skat under contract to GTZ (German Agency for Technical Co-operation) and the CWG (Collaborative Working Group on Solid Waste in Low- and Middle-Income Countries)

Abstracts illustrating the earning potential of workers in waste recycling:

"In Lima the average earnings in the informal sector are € 5.70 /day for adults and €1.35 /day for children (24% of adult's earnings). The average daily earning for adults is slightly more than the legal minimum wage of 5.10 euros/day, and consists primarily of earnings from buying and selling recylables.(…) In Lusaka an informal sector waste worker has average earnings, at €1,877.76 per year, are almost 3 times higher than the legal minimum wage of € 612,00. The majority of these informal sector workers are involved in unregistered collection, but also have earnings from selling recylables. (…)

Pickford, J. 1995. Low-cost sanitation: A survey of practical experience. ITP.

This book addresses itself squarely to the enormous problem of lack of adequate sanitation. It is a guide to what has been learned about providing sanitation coverage for both rural and urban low-income communities and outlines what is appropriate, practical and acceptable.

The author, who has very extensive experience in many parts of the world, sets out to define “appropriate” sanitation and what constitutes “adequate” coverage, before undertaking a thorough examination of the health, social and cultural aspects and preferences in diverse regions of the world. Evidence is also given of the diseases which occur through lack of adequate sanitation provision, and the health benefits which result from its installation or upgrading. Sanitation alternatives are presented in terms of “technical” efficiency but also, always, in the light of cultural acceptability. The final part of the book deals with the practical, financial and organisational consideration of obtaining or upgrading sanitation provision, the emphasis being firmly on the community and its needs and preferences. Throughout, the text is supported by extensive references, illustrations and statistics making this book vital for anyone involved in this field of endeavour, directly as a worker or a planner, and also those studying the subject who require a thorough yet concise survey of the experience to date.

6. TOP Websites

The Water Supply and Sanitation Collaborative Council
www.wsscc.org
An international organisation that 'enhances collaboration in the water supply and sanitation sector to accelerate the achievement of sustainable water, sanitation and waste management services to all people, with special attention to the unserved poor, by enhancing collaboration among developing countries and external support agencies and through concerted action programmes'.

UNICEF Sanitation
http://www.childinfo.org/areas/sanitation/
www.unicef.org/wes/
General information about sanitation situation in the world, including the challenge, current status and trends, map, country data.

WHO Water, Sanitation and Health
http://www.who.int/water_sanitation_health/en/
Policies, guidelines, regulations, research, databases and statistics related to sanitation.

The Joint Monitoring Programme (JMP) for water supply and sanitation
http://www.wssinfo.org/en/welcome.html
Data on the sanitation situation in global level, region level, developing country, developed country.

International Water Association
http://www.ecosan.org/
Specialist Group on Ecological Sanitation

International Water Association
http://www.iwapublishing.com/template.cfm?name=iwaphome
IWA publication information

Vital Water Graphics
http://www.unep.org/vitalwater/orginsts.htm
Links to water and sanitation institutions

Worldbank Water and Sanitation
http://www.worldbank.org/html/fpd/water/
http://info.worldbank.org/etools/BSPAN/VideoListing_Topic.asp?Topic=Water%20Supply%20and%20Sanitation
Some videos, documents on water supply and sanitation from de Worldbank.

International Ecological Engineering Society (IEES)
http://www.iees.ch
IEES provides a common forum for diverse persons and groups involved in ecological engineering projects.

Ecological Sanitation in South Asia
www.eco-solutions.org
Background on EcoSan: Design, demonstrations and promotion on the Indian subcontinent.

SUDEA Society for Urban Development in East Africa
http://user.tninet.se/~gyt516c/
SUDEA works since 1996 in EcoSan and Ethiopia and offers information on their experiences.

Aquamor, Zimbabwe
aquamor.tripod.com
Information on rural water supply and sanitation sector, extracts of books and manuals.

ReSource Institute for Low Entropy System
http://www.riles.org
An independent, nonprofit organization that works in partnership with communities in English and Spanish speaking countries to protect public health and the environment. Gives several examples of ecological sanitation.

World of composting toilets
http://www.compostingtoilet.org/index.cfm
WOCT provides information on composting toilets and grey water treatment

The Water Page
http;//ww.thewaterpage.com
The Water Page gives information about sustainable water resources management and use, among which is ecosan. A particular emphasis is placed on the development, utilisation and protection of water in Africa and other developing regions

Sanitation Connection
http://www.sanicon.net
Sanitation Connection is an Internet-based resource that gives you access to accurate, reliable and up-to-date information on technologies, institutions and financing of sanitation systems around the world. Institutions of international standing contribute to the information base by providing and maintaining a topic of their specialization. Sanitation Connection is a partnership between Water and Sanitation Programme, International Water Association, United Nations Environment Programme, WSSCC and World Health Organization.

Source News

http://www.irc.nl/source

Source News is a joint endeavour between IRC International Water and Sanitation Centre and WSSCC. It aims to provide regular digests of current news in the sector under a series of common headings including: international news; news from the regions; and resources. It is accompanied by a bi-monthly special features edition. Source is available both as an electronic newsletter, via the web, and as hard copy.

RedSeco Forum

http://www.laneta.apc.org/sarar/indexeng.htm#

Periodic electronic conferences to stimulate discussion and to create a virtual space for exchanging ecosan experiences in Latin America and the Caribbean.

Garnet

www.lboro.ac.uk/departments/cv/wedc/garnet/grnttnc.html

Independent initiative of the Water Supply and Sanitation Collaborative Council, promoting networking between researchers, academics and field workers on several fields in the water and sanitation sector.

Aqua for all foundation

www.aquaforall.nl

This foundation intends to create a link between Third World water and sanitation projects, sponsoring and socially responsible entrepreneurship. WASTE is one of their advisers in the committee

Supraregional sector project 'ecosan'

www.gtz.de/ecosan/english/

The German Society for Technical Cooperation (GTZ) acting on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), carries out a sector project on ecosan in which they investigate ecosan-systems, establish them in national and international guidelines and prepare them for dissemination

Ecological Sanitation Research, Sweden

www.ecosanres.org

EcoSanRes is an international environment and development programme on ecological sanitation managed by the Stockholm Environmental Institute (SEI) and funded by the SIDA (www.sida.org). They carry out promotion, capacity building and pilot projects world-wide.

Source separation and local treatment of domestic wastewater

http://www.ftns.wau.nl/lettinga-associates/index.htm

This project is carried out by the working group Decentralised Treatment And Reuse in the Lettinga associates foundation for Environmental Protection & Resource Conservation. This is a private firm of world-renowned scientists within the university of Wageningen, the

Netherlands. Within this 4-year investigation a description and analysis of European projects with source separation is made.

Water and sanitation programme

www.wsp.org

The WSP is administered by the World Bank. This international partnership of development agencies is concerned with water and sanitation services for the poor

Supporting entrepreneurs for environment & development

http://seedinit.org

The Seed Initiative aims to inspire, support and build the capacity of locally-driven entrepreneurial partnerships to contribute to the delivery of the Millennium Development Goals and the Johannesburg Plan of Implementation.

Integrated Experts Programme for experienced specialists and managers

http://www.cimffm.de/english/bew_if.htm

CIM tops up the local salary with a market-oriented Euro payment, and also pays subsidies towards the costs of health, nursing and retirement insurance.

7. TOP Contacts

In alphabetical order:

Ecological Sanitation Research, Sweden
www.ecosanres.org
EcoSanRes is an international environment and development programme on ecological sanitation managed by the Stockholm Environmental Institute (SEI) and funded by the SIDA (www.sida.org). They carry out promotion, capacity building and pilot projects world-wide.

German Society for Technical Co-operation (GTZ)
www.gtz.de/ecosan
A wide variety of information and links could be found here, thematic sorted. Also links to international- and regional organisations working in the field of ecosan are listed (mainly from a development co-operation point of view).

Gothenburg University
http://www.gu.se/English/default.html
Algae growth, conc. (struvite, ion ex, freezing, etc

IRC International water and sanitation centre
www.irc.nl
News and information, advice, research and training, on low-cost water supply and sanitation in developing countries. Here you can find InterWATER which offers information about organisations and networks in the water supply and sanitation sector, related to developing countries

Luleå Technical University
http://www.luth.se/index2.en.htm
Exergy analysis, storage, drying, nitrification

SANDEC - Department of Water and Sanitation in Developing Countries, Switzerland
http://www.sandec.ch/
SANDEC is the Department of Water and Sanitation in Developing Countries at the Swiss Federal Institute for Environmental Science and Technology (EAWAG) in Duebendorf, Switzerland. Its activities centre on problems of sustainable development in economically less developed countries. Its mandate is to assist in developing appropriate and sustainable water and sanitation concepts and technologies adapted to the different physical and socio-economic conditions prevailing in developing countries.

Sanitary Engineering, department of Delft university of technology
http://www.gezondheidstechniek.tudelft.nl/index.htm
Research is focussing on reclaiming of nutrients from source separated wastewater from point of view of the limited phosphor resource in the world

Sanitation Connection
http: //www.sanicon.net
Sanitation Connection is an Internet-based resource that gives you access to accurate, reliable and up-to-date information on technologies, institutions and financing of sanitation systems around the world. Institutions of international standing contribute to the information base by providing and maintaining a topic of their specialization. Sanitation Connection is a partnership between Water and Sanitation Programme, International Water Association, United Nations Environment Programme, WSSCC and World Health Organisation.

SKAT
http://www.skat.ch
Skat consulting and Skat foundation are sister organisations who contribute to poverty reduction and sustainable development through knowledge sharing and the provision of advisory services in the developing world.

Swedish Institute for land use techniques
http://www.lt.slu.se/ecosan/
Swedish research on hygiene, function, i.e. degree of separation, functional problems, fertilising effects, resource usage, emissions, developing countries.

Technical University of Hamburg
http://www.tu-harburg.de/aww/publications/)
Institute of Municipal and Industrial Wastewater Management in which one of the working fields is the development of new sanitary concepts. Publications could be downloaded.

Water and sanitation programme
www.wsp.org
The WSP is administered by the World Bank. This international partnership of development agencies is concerned with water and sanitation services for the poor.

WASTE
http://www.waste.nl
WASTE is a non-profit consultancy group specialised in sustainable sanitation and solid waste project advise, facilitation and knowledge sharing.

Water, Engineering and Development Centre
http://www.wedc.ac.uk
The Water, Engineering and Development Centre (WEDC) is one of the world's leading institutions concerned with education, training, research, and consultancy relating to the

planning, provision, and management of infrastructure for development in low- and middle-income countries.

WSSCC – Water Supply and Sanitation Collaborative Council

www.wsscc.org

The WSSCC is a leading international organisation that enhances collaboration in the water supply and sanitation sector to accelerate the achievement of sustainable water, sanitation and waste management services to all people, with special attention to the unserved poor, by enhancing collaboration among developing countries and external support agencies and through concerted action programmes.

Annex 1. Past and future trends in environmental sanitation

What have we learnt about environmental sanitation based on past trends and future needs? Past experiences with environmental sanitation teach us a number of lessons about the routes to success. The lessons divide conveniently into four key areas:

- Time frame
- Demand
- Technology selection
- Cost

Time frame in sanitation programmes

The timeline for sanitation efforts can be rather long, with physical and financial implementation developing along an exponential curve. Specifically, a long time may be needed to stimulate demand and organise inputs before full-scale construction takes place. One implication of this is that donors (national or external) should be committed to supporting programmes over a long period. Simple three or four-year project cycles are unlikely to succeed except on a small scale. Short project cycles without strong institutional anchors are probably also insufficient to create conditions for the sustained behavioural change needed to ensure health benefits.

Expenditure on water facilities tends to be distributed comparatively evenly over time, while that on sanitation is not. Demand for sanitation needs to be stimulated and many individual units (the households) need to collect money and materials. Thus the project cycles for water and sanitation can be out of synchronisation, for instance when the implementation of water services is 'winding up' and shifting to a new location, but the sanitation component is not yet completed.

Another observation from project experience is that the gap after water facilities are planned but before they are constructed is an 'opportunity time' for sanitation and hygiene mobilisation and promotion. This is not to suggest that water should be conditional on sanitation, or that households should be required to construct latrines before water facilities are provided (questionable ethically and does not contribute to effective use and maintenance of latrines as experienced in Bangladesh's UNICEF programmes (UNICEF, 2000)). But it is important to take advantage of the fact that, in the period before water facilities are constructed, communities are receptive and their institutions are often willing to be involved in mobilisation around sanitation.

Each of these lessons has implications for design of strategies and deployment of programme resources that need further detailed investigation. More documented experience is needed to identify strategies to improve planning of timelines for sanitation projects and deployment of resources for them.

Demand

There are examples of successful sanitation programmes that concentrated on so-called software and left construction activities totally in the hands of the private sector. However, there are more examples of unsuccessful programmes that have only concentrated on construction. The key is that s*anitation is, to a large extent, a social phenomenon, rather than a technical one* (Wegelin, 2000). Demand, and its cognates—mobilisation, marketing, education and participation—are crucial issues.

Demand is somewhat complicated because it is may not be fully expressed by the target users, may be latent or only partially informed. For example, there may be a real demand for latrines, but if they are not affordable there will be little construction. As a more subtle expression of demand: women may be willing (or even want) to develop new hygiene practices which often imply some re-organisation of domestic habits. However, these practices may not be realised if the men in the household are uninformed or unsupportive.

We may define the *entering level* as the expressed demand that is shown by the proportion of those who already have a facility, or practice a particular behaviour, at the beginning of a planned intervention. Different entering levels imply different timelines, expenditures and strategies. For example, where less than a certain percentage – say about 40% -- of the households practice defecation in some type of latrine at the beginning of a project intervention, then more emphasis is needed on *demand creation, social marketing or technology development*, as indicated in the following table.

Example of possible differences in latrines programmes with different entering levels

< 40% of the population uses of any kind of latrine	**> 40% use of any kind of latrine**
Demand creation (social marketing, promotion) for a considerable time before construction	Emphasis on hygiene promotion and behaviours, in addition to expanding the demand
New projects may tend to be more supply-oriented**	Tends to be more demand-oriented, for example technology choice greater and some households invest in upgrading technologies
Capacity building partners and stakeholders: Stimulate private providers in areas of high coverage. NGOs, public or government-subsidised in rural areas. Possible staff incentives.	Subsidies are reduced, eliminated or targeted towards vulnerable families
Identify and deal with technology issues, for example, low-cost facilities that operate throughout the year.	Bye-laws, institutionalisation
	Stimulate private provision in less accessible areas

** “The experience of large-scale programmes such as the PNSBC (Mozambique) suggests that initially a supply-driven approach may be necessary to establish a platform from which more demand-responsive approaches can be implemented.” (Saywell, 1999, p. 46).

Inevitably, the level and expression of demand can change over time. How to increase the expressed demand has become of subject of heated debate, between those favouring social marketing approaches and proponents of community development or health promotion approaches. In practice, most interventions use several channels and approaches. They try to determine the effective mix for a particular situation, of marketing, promotion and education strategies, including interpersonal communication[4].

Finally, experience has suggested that education and hygiene promotion should continue beyond the construction period. This is sometimes overlooked, thereby diminishing the initial investment through poor maintenance and use, or inconsistent behaviours. Ideally, in the post-construction period, continuous and sustained institutional solutions should gradually develop. Examples of one element of this gradual institutionalisation and upgrading are the School Sanitation and Hygiene Education (SSHE) programmes being given more prominence around the world by UNICEF and partner governments and organisations.

Technology selection

There are many technologies for low-cost sanitation, such as simple pit latrines, sanplat with pit, Ventilated Improved Pits (VIP), double-pit, pour-flush, composting latrine, small bore systems, ecological toilets, mechanical flush and septic tanks. In general, however, current so-called low-cost technologies appear to be too costly for poor households (Year 2000 *Global Assessment: WHO and UNICEF* Joint Water Supply and Sanitation Monitoring Programme).

Unfortunately, the level of latrine technology is far behind low-cost water supply options. Specific gaps include:

- There is no truly low-cost sanitation technology that operates throughout the year in high water table areas. This particularly affects coastal populations, including those in dense urban populations in the many coastal cities around the world;
- Where population density is high, on-site solutions such as mechanical pit emptying and small-bore systems need further refining and dissemination as they do not work optimally;
- Studies need to be collected and validated on leaching and cross pollution from latrine pits to drinking water sources, and identified gaps need to be filled; and

Costs

Cost control, subsidies and incentives are three important financial aspects of sanitation programmes. Cost control relates to the provision of adequate product at the lowest price.

[4] Three important references are:
McKee, N. (1992) Social mobilisation and social marketing in developing communities: lessons for communicators. Penang, Malaysia : Southbound 208 p.
Hubley, J. (1993) Communicating health : an action guide to health education and health promotion. London, UK, MacMillan Press
Murre, T., C. van Wijk-Sijbesma and S. Esrey. (1995) Motivating better hygiene behaviour: importance of public health mechanisms of change. UNICEF. 46 p.

This is particularly important where the public pays all or part of the costs. In the few cases where implementers such as NGOs or government groups have worked to control costs, this has involved competitive bidding, use of local materials for construction, leaving part of the construction to the household, strong financial monitoring and auditing. The following table shows the all-in costs for the same technology/model implemented by different groups. It demonstrates that strong cost control (attempted only by the last group in the table) does indeed result in cost reductions.

Costs of latrines, Kerala India 1989-95 (Indian Rupees)	
Programme of …	**Average unit cost**
World Bank	Rs. 3500
Various government agencies	Rs. 3000 to Rs. 3500
(NGO) project with local government	Rs. 2000

Source: Kurup, p. 45

In situations where construction is done by the private sector, prices are theoretically held down through competition among small providers and by the free flow of information to clients about prices. In practice however, information does not always flow freely and small providers can create small cartels. Some projects in Bangladesh and India, for example, approach this problem by insuring that clear information about costs and prices (for materials, construction wages and piecework costs) are readily available to the public.

Over the years, a heated debate has developed about household subsidies for low-cost latrine programmes. The tendency is to reduce or eliminate subsidies for household latrines. One argument has been that such subsidies are insupportably expensive on a large scale and have not created conditions for mass acceptance of latrines. Indeed, subsidies do not seem to have had the desired results in terms of mass provision for vulnerable families. The evidence on other issues seems to be mixed. The following chart shows, for example, that per capita subsidies for water were more than for latrines in one fairly large area.

Subsidies for implementation of water and sanitation per person, Kerala, India 1994		
Location	**Piped water supply schemes: avg. per capita subsidy (Rupees, 1994)**	**on-site sanitation: avg. per capita subsidy (Rupees, 1994)**
Nattika scheme	1,270	375
Edapal	979	400
Anjengo	778	375

Source: SEUF, 2000

The main point regarding subsidies is that reducing the cost may be effective. However, deciding on subsidies on basis of real affordability is more realistic. This also entails that changes do not take place too quickly.

Annex 2. Sanitation Coverage

SANITATION

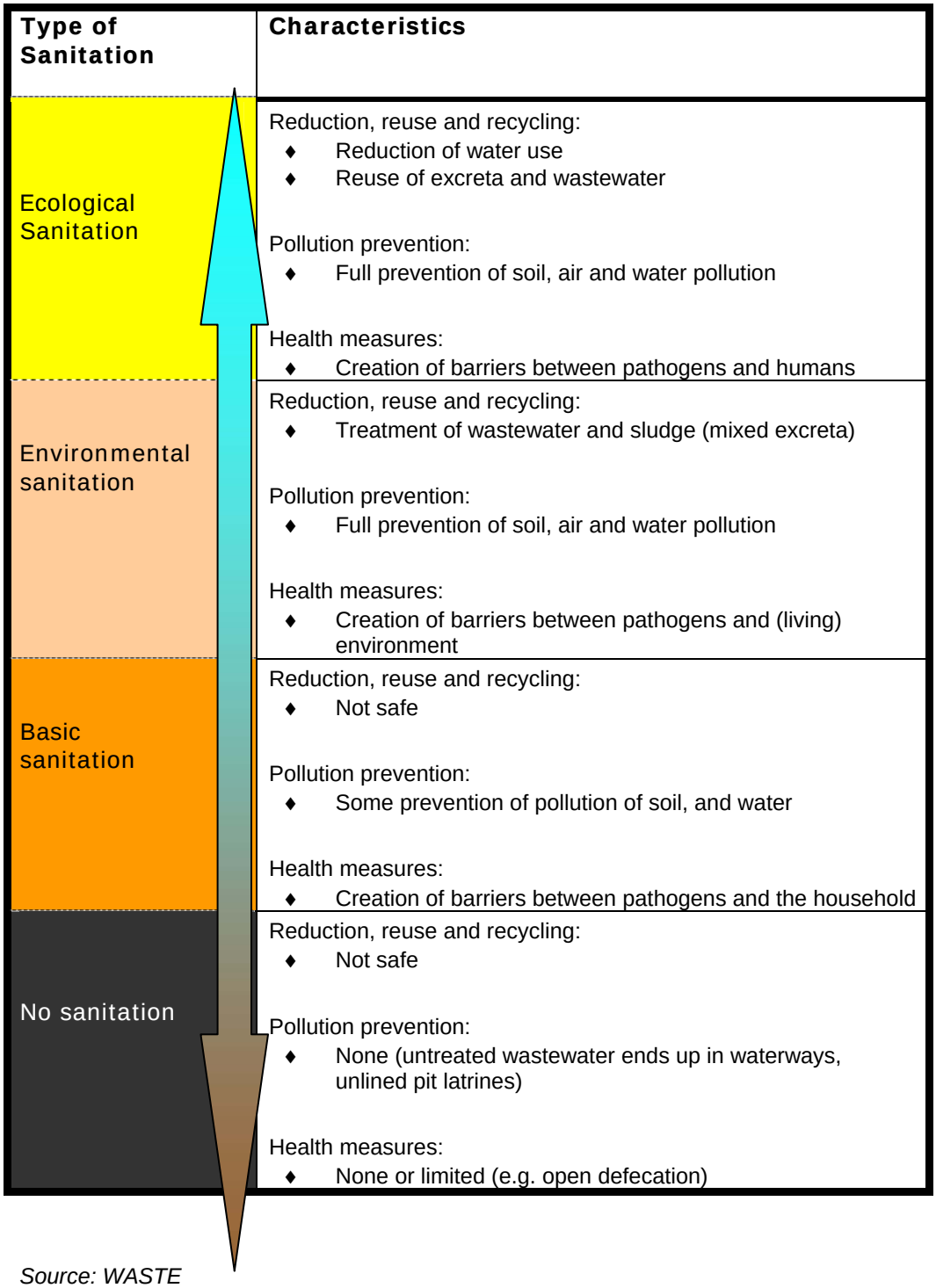
Region	Coverage in 1990 (%)	Coverage in 2002 (%)	Projected coverage in 2015 (%)	MDG attained target (%)	Population served and unserved in 2002 (thousands)		Projected population served and unserved in 2015 (thousands)		Annual increase in people served 1990–2002 (thousands)	Annual increase needed in people served 2002–2015 to reach the MDG sanitation target (thousands)
					Served	*Unserved*	*Served*	*Unserved*		
World	**49**	**58**	**68**	**75**	**3 606 595**	**2 618 280**	**4 918 571**	**2 278 680**	**87 164**	**137 796**
Developed countries	**100**	**98**	**96**	**100**	**973 194**	**19 861**	**997 505**	**41 563**	**ID**	**ID**
Eurasia	**84**	**83**	**82**	**92**	**231 182**	**49 788**	**224 381**	**49 254**	**ID**	**ID**
Developing regions	**34**	**49**	**63**	**67**	**2 402 219**	**2 548 631**	**3 696 685**	**2 187 863**	**84 193**	**118 494**
Developing regions										
Northern Africa	65	73	82	83	108 485	38 834	150 091	32 947	2 632	3 341
Sub-Saharan Africa	32	36	40	66	247 544	437 224	360 601	540 902	7 011	26 727
Latin America and the Caribbean	69	75	82	85	398 506	137 120	515 174	113 087	8 053	10 424
Eastern Asia	24	45	68	62	626 926	747 912	1 011 252	475 883	27 613	22 700
South Asia	20	37	55	60	541 785	938 502	992 904	812 376	25 875	41 645
South-eastern Asia	48	61	75	74	328 330	207 281	471 257	157 085	9 778	10 511
Western Asia	79	79	79	90	145 991	37 970	189 868	50 471	3 151	5 409
Oceania	58	55	52	79	4 652	3 788	5 538	5 112	80	289

ID, Insufficient data.
The regional figures in the last column do not add up to the global figures because of rounding.

Source: http://www.who.int/water_sanitation_health/monitoring/jmp2005annexes.pdf

Annex 3. Sanitation Ladder

Sustainable sanitation hierarchy



Source: WASTE

About IRC

IRC facilitates the sharing, promotion and use of knowledge so that governments, professionals and organisations can better support poor men, women and children in developing countries to obtain water and sanitation services they will use and maintain. It does this by improving the information and knowledge base of the sector and by strengthening sector resource centres in the South.

As a gateway to quality information, the IRC maintains a Documentation Unit and a web site with a weekly news service, and produces publications in English, French, Spanish and Portuguese both in print and electronically. It also offers training and experience-based learning activities, advisory and evaluation services, applied research and learning projects in Asia, Africa and Latin America; and conducts advocacy activities for the sector as a whole. Topics include community management, gender and equity, institutional development, integrated water resources management, school sanitation, and hygiene promotion.

IRC staff work as facilitators in helping people make their own decisions; are equal partners with sector professionals from the South; stimulate dialogue among all parties to create trust and promote change; and create a learning environment to develop better alternatives.

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