POLICY GUIDANCE MANUAL ON WASTEWATER MANAGEMENT

WITH A SPECIAL EMPHASIS ON DECENTRALIZED WASTEWATER TREATMENT SYSTEMS

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FOR A BETTER URBAN FUTURE

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Editorial Supervision: Mr. Bajinder Pal Singh

Text Editing: Ms. Manraj Grewal, Mr. Robert Steele

Photo/Graphic: ESCAP and UN-Habitat

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FOREWORD

Poor sanitation and wastewater management in developing countries leads to the contamination of fresh water sources and is a major cause of disease and death and affects also the health of eco-systems. 80-90 percent of all wastewater generated in developing countries is discharged directly into surface water bodies without any treatment.

On the MDG target of halving the proportion of people without access to basic sanitation by 2015, the Asia-Pacific region is still further behind schedule. The percentage of people in the region without access in 1990 was estimated to be 64 per cent; the figure dropped to 41 per cent by 2012, which means that a further reduction of 9 percentage points is still needed if the target is to be attained. Moreover, one hundred million people in South-East Asia alone continue to practice open defecation.

Decentralized wastewater treatment systems (DEWATS) can provide an appropriate solution to this problem in many situations. DEWATS also makes it possible to expand sanitation coverage. However, a number of challenges exist for wider application of DEWATS in many developing countries, such as lack of policies, and awareness, incentives and institutional mechanisms.

In this context, ESCAP and UN-Habitat are jointly implementing a project on "Strengthening capacity of policymakers in South-East Asia to promote policies and developing plans for improved wastewater treatment and reuse in urban and peri-urban areas," to address wastewater and sanitation issues through promotion of DEWATS. Cambodia, Lao People's Democratic Republic, Viet Nam have been selected to conduct national activities including policy studies, national workshops for capacity building and a pilot project.

The main objective of the project is to support capacity building of policy makers and planners for better wastewater management through different activities at regional and national level. It also expected to establish or strengthen existing institutions which can function as resource center(s) or referral points with expertise on all aspects of DEWATS.

This publication has been developed based on experience of the policy makers of South-East Asia and consultations with relevant stakeholders at country and regional level. It is presenting a set of policy recommendations developed during the implementation of the project.

This manual provides a step-by-step guide on development and implementation DEWATS in developing countries of the region with a set of financial schemes, market opportunities, investment and potential impacts. It has emphasized the importance of the leading role of Governments in development of norms and policy frameworks and in operationalization of the practical tools to enable business cases. It also addressed the active roles of the communities and private sector in wastewater management and sanitation, with a special emphasis to promote DEWATS.

2015 is a critical year for sustainable development as the post-2015 development agenda will be developed along with the proposed Sustainable Development Goals (SDGs). Water must, therefore, feature prominently in the post-2015 development agenda. Currently, there is broad agreement on the critically important role that water has played in trying to achieve the MDGs and will play in the future SDGs. One proposed SDG focuses explicitly on "Ensure availability and sustainable management of water and sanitation for all". The availability and productive use of good quality water is essential to achieving many other proposed SDGs. We also know that, in the context of worsening global climate change, the achievement of water-related SDGs will be even more challenging than the work we have already done on the MDG targets.

It is our sincere expectation that the manual will contribute to the scale up of DEWATS in developing countries and to contribute to the development and implementation of SDGs.

Mr. Raekwon Chung
Director, Environment and
Development Division
United Nations
Economic and Social Commission
for Asia and the Pacific

Mr.Alioune Badiane
Director of Project and
Program Division
United Nations Human
Settlements Programme

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ACKNOWLEDGEMENT

The Policy Guidance Manual on Wastewater Management and Sanitation, with a Special Emphasis to Decentralised Wastewater Treatment Systems (DEWATS) in South-East Asia is prepared under the overall guidance of Mr. Raekwon Chung, Director of Environment and Development Division (EDD) of Economic and Social Commission for Asia and the Pacific (ESCAP) with substantial inputs from Energy Security and Water Resources Section of EDD, ESCAP. The ESWRS core team of authors and consultants included Ms. Aida Karazhanova, Mr. Gabriel Regallet and Mr. Christoffer Larsson.

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This publication is an outcome of a joint ESCAP and UN-Habitat project on "Strengthening capacity of policymakers in South-East Asia to promote policies and developing plans for improved wastewater treatment and reuse in urban and peri-urban areas", to address the fast-growing problem of untreated wastewater through promotion of the Decentralized Wastewater Treatment Systems (DEWATS) in 2013-2015 (ref: DA 8th Tranche).

ABBREVIATIONS AND ACRONYMS

3S	Sustainable Sanitation Services
BCR	Benefit-Cost Ratio
BOD	Biochemical Oxygen Demand
CBS	Community Based Sanitation
CBA	Cost-Benefit Analysis
CDM	Clean Development Mechanism
CLTS	Community Led Total Sanitation
COD	Chemical Oxygen Demand
DEWATS	Decentralised Wastewater Treatment System, includes technology and follow respective norms and institutional support
DEWATS Facility	Decentralised wastewater treatment technological module and the Whole visible infrastructure
EAC	Equivalent Annual Cost
GHG	Greenhouse Gas
GPOBA	Global Partnership on Output-Based Aid
IBNET	International Benchmarking Network for Water and Sanitation Utilities
LDC	Least Developed Countries
MDG	Millennium Development Goals
OBA	Outcome Based Assessment
PLF	Progress-Linked Finance

PPSP	Program Percepatan Pembangunan Sanitasi Perkotaan (Road Map for Acceleration of Urban Sanitation Development)
SCES	Household Centered Environment Sanitation
SD	Sustainable Development
SDG	Sustainable Development Goals
SEA	South-East Asia
SFPTF	Sanitation Financing Partnership Trust Fund
SIA	Social Impact Assessment
STBM	Sanitasi Total Berbasis Masyarakat (National Strategy for Community Based Total Sanitation)
TSC	Total Sanitation Campaign
TSS	Total Sanitation Services
U3SAP	Unified Sanitation Sector Strategy and Action Plan

INTRODUCTION

Sanitation is central to human and environmental health and it is essential for sustainable development, dignity and opportunity. During the last three decades the countries of South-East Asia (SEA) have experienced rapid economic growth, with a high proportion of this growth originating from their cities. At the same time the sanitation-related component of MDGs 7 (10) is less likely to be achieved within the targeted timeframe (2015). However, the policymakers in the SEA region are more aware than ever of the economic, social, health and environmental benefits of adequate sanitation. According to WHO-UNICEF, in 2010, 10.3 million people in Cambodia, 2.9 million in Lao People's Democratic Republic and nearly 21.8 million people in Viet Nam did not have access to improved sanitation. In addition, studies conducted by the World Bank Water and Sanitation Program show that Cambodia, Lao People's Democratic Republic and Viet Nam suffer an annual economic loss of USD 450 million, USD 193 million and USD 780 million, respectively, due to inadequate sanitation. These losses are accounted for by direct health impacts, along with costs for accessing clean drinking water, additional time to access unimproved sanitation, and tourism losses due to sanitation-related issues.

Various global efforts have been made to raise the political profile of sanitation, such as through a United Nations General Assembly resolution (No. 61/192) that declared 2008 the International Year of Sanitation. In 2013, the United Nations General Assembly (No.67/291) designated 19 November to be celebrated as a UN World Toilet Day. Regional high-level sanitation conferences (SACOSAN and EASAN), the Fifth Ministerial Conference on Environment and Development in Asia and the Pacific (MCED-5) and close monitoring of the related Millennium Development Goals (MDGs), including initiatives towards implementation of the post-2015 development agenda, are related to sanitation and post Rio+20 processes for Sustainable Development (SD), and highlight the sanitation issues of the region. The Low Carbon Green Growth Roadmap (ESCAP and KOICA, 2012) for Asia and the Pacific by ESCAP, launched at the Rio+20 Summit on SD, also highlights the importance of an eco-efficient water infrastructure and changing the way water resources are managed by developing an integrated and decentralized system, along with a set of an actionable options for shifting their countries to green growth. These are shown as fact sheets and case studies with innovative approaches and experiences, presented for review by policymakers.

ESCAP has also developed a methodology for the calculation of Household Water Security Index (ADB, 2013a), as an integral element of a Composite Water Security Index, which takes into account three parameters of access to water, access to sanitation, and diarrhea (DALYs). The Commission Resolution 69/8 on enhancing knowledge-sharing and cooperation in integrated water resources management in Asia and the Pacific invites member States to consider allocating the necessary resources to improve household water management and sanitation services to meet the needs of the people, as well as secure water for ecosystems, human health and human well-being. ESCAP has also made significant efforts and exhibited leadership among policymakers of the SEA in promoting pro-poor urban and peri-urban sanitation (Dupont, 2007), besides identifying innovative practices in low-cost decentralised solutions for water and sanitation. It has collected case studies from different countries, covering a broad spectrum of water and sanitation issues, such as piped water distribution, city-wide strategies, water conservation, wastewater management and public toilets. ESCAP disseminates these studies to assist local governments and their civil society partners in developing integrated and participatory strategies for water and wastewater management through workshops.

The on-going joint ESCAP and UN-Habitat project (ESCAP, 2014) continues ESCAP's previous regional efforts towards enhancing awareness, encouraging governments to review policies and strategies on sanitation, and mobilising communities to change sanitation and hygiene practices. Two such documents: *The Background Policy Study on Wastewater Managementand Sanitation in Cambodia, Lao People's Democratic Republic and Viet Nam and the Policy Guidance Manual on Wastewater Management with an emphasis to Decentralised Wastewater Treatment Systems (DEWATS)* are facilitating decisions to address the critical problem of discharge of untreated wastewater to the environment in rapidly growing urban and peri-urban areas of SEA.

OBJECTIVES OF THE POLICY GUIDANCE MANUAL

The Policy Guidance Manual on Wastewater Management with a special emphasis on Decentralised Wastewater Treatment Systems (DEWATS) highlights adequate policy and sustainable practices from the South-East Asia (SEA) region and worldwide. The primary objectives of the Policy Guidance Manual on DEWATS for SEA are three-fold:

(a) to guide national and local policy-makers and experts of SEA in enabling pro-poor policies, strategies, legal, institutional, social, environmental and financial frameworks for sustainable sanitation services;

(b) to advocate DEWATS to accelerate sustainable sanitation services in peri-urban areas and secondary towns along the Mekong corridor; and

(c) to suggest solutions and options for reforms aimed at sustainable delivery of sanitation services towards the achievement of the country's Millennium Development Goals (MDGs) for sanitation, and to contribute to the post-2015 development agenda and SDG6 on Water and Sanitation.

WHO WILL BENEFIT FROM THIS POLICY GUIDANCE MANUAL?

Policymakers and decision-makers on sanitation, other relevant policymaking authority in finance, public infrastructure or education related roles will generally benefit from this Manual. Researchers, who seek a brief overview of recent changes in sanitation policies in the Asia-Pacific region, along with international organisations that engage in capacity building or infrastructure development in order to accelerate decentralised solutions for sustainable sanitation services in the region, will also find this Manual useful.

THE WAY FORWARD

The following approaches for implementation need to be pursued in the three target countries of South-East Asia (Cambodia, Lao People's Democratic Republic and Viet Nam):

- Learning from past DEWATS experiences and assessing ways to scale up DEWATS;
- Ensuring sustainability of service delivery through inclusive and Pro-Poor Public-Private Partnerships for Sustainable Sanitation Services (5P for 3S), resource recovery and enabling a sanitation value chain with capacity building of supply chain interveners;
- Creating demand, including from the poor, for sustainable sanitation services facilitating the integration of DEWATS into centralised systems;
- Strengthening the capacities of all interveners and enabling the creation of regional platforms for dialogue, knowledge management, and innovation among the three countries;

- Enhancing innovative financing and financial viability of sanitation facilities by improving affordability, smoothing and subsidising sanitation expenditures, and through the use of OBA, outcome-based financing models and other financing mechanisms (microcredit, revolving funds, social impact bonds, etc.;
- Enhancing regional cooperation among policymakers and experts on decentralised sanitation solutions through a Regional Resource Centre.

STRUCTURE OF THE POLICY GUIDANCE MANUAL

The Manual consists of three distinct parts, namely:

Part 1: The Policy Guidance Manual on Wastewater Management with a special emphasis on DEWATS for SEA presents, three broad time-bound steps, each enabling the 10 important interrelated Focus Areas for the attention of policymakers, namely:

Step 1: Planning and Designing;

Step 2: Implementation and Operationalization;

Step 3: Evaluation and Replication.

Each of the ten proposed Focus Area has its own systematic step-wise approach, depending on the technological system chosen and the country's particular circumstances;

Part 2: Case studies and principles of different policy frameworks.

In addition, The Background Policy Study on DEWATS in Cambodia, Lao People's Democratic Republic and Viet Nam was prepared to support this Policy Guidance Manual, and is available at the ESCAP website.

The on-line e-learning facility for policymakers, which is being developed and is available for all government officials and local communities and leaders, to assist in policymaking, is thus an integral component of the present Policy Guidance Manual in June 2015, onwards. The different modules and courses would be available at the e-learning facility, to provide an overview of several water management technologies and management systems, policy tools and norms. Upon the successful completion of on-line tests, the joint ESCAP-UN-Habitat-AIT certificate would be delivered at the end of the courses to the participants.

PART 1:
POLICY GUIDANCE MANUAL

This is the Policy Guidance Manual (ESCAP, 2014)[1] on Wastewater Management, which is based on experiences worldwide, is targeted at policy makers of South-East Asia. It reflects three broad steps of planning and designing, implementation, as well as evaluation and replication of various business cases, with a special emphasis on and promotion of Decentralised Wastewater Treatment Systems (DEWATS).

Ten Focus Areas (Figure5) are elaborated with a step-by-step approach provided for each that should be considered, where relevant, simultaneously and in parallel at both designing and operationalising phase of the technological choice of DEWATS. Depending on the technological system chosen, different smaller steps within planning and implementation phases have to be taken to achieve tangible progress with DEWATS. DEWATS is based on identified priorities for the benefit and self-sufficiency of target communities, with an overarching goal to further improve impacts on health and long-term surface water quality that would be defined by the whole-system choices and approaches taken.

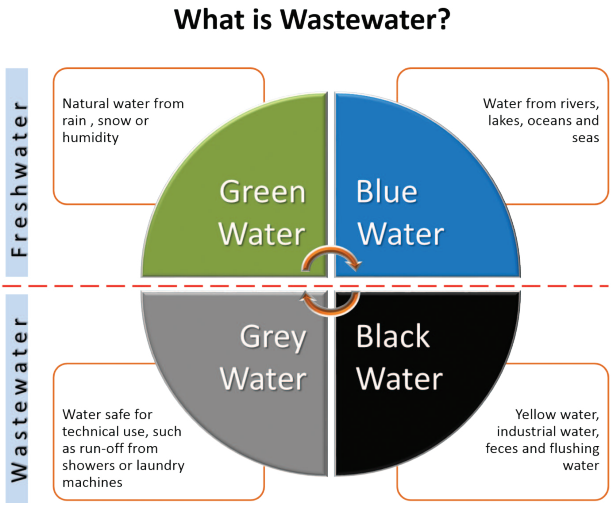
WHAT IS WASTEWATER?

Wastewater can have a number of definitions (UN-Water 2015). The approach taken in this report is a very broad definition following that outlined in the UNEP/UN-Habitat document 'Sick Water?'. Thus, wastewater is defined as "a combination of one or more of:

- domestic effluent consisting of blackwater (excreta, urine and faecal sludge) and grey-water (kitchen and bathing wastewater);
- water from commercial establishments and institutions, including hospitals;
- industrial effluent, storm water and other urban run-off;
- agricultural, horticultural and aquaculture effluent, either dissolved or as suspended matter" (Corconan et al., 2010).

[1] *The first draft of the Synopsis of the Policy Guidance Manual was prepared prior to the Regional Policy Workshop of Stakeholders on DEWATS in March 2014, and was further developed and peer-reviewed by participants of three national workshops and regional workshops, organised by UN-Habitat with substantial support from ESCAP and AIT in September-December 2014 and the Regional Workshop on Wastewater and Sanitation of April 2015, organised by ESCAP in collaboration with AIT and UN-Habitat.*

Figure 1: Basic colour code for wastewater



Although, using this definition, the term 'wastewater' clearly encompasses domestic, commercial, industrial, agricultural components and also faecal sludge, these are sometimes covered separately in order to clarify or highlight the importance of the individual components or wastewater streams. (UN-Water, 2015)

Leaders of the second Asia Pacific Water Summit have strongly highlighted that we the must distinguish between green, blue & grey water resources, and do more to manage the wastewater of increasingly urban populations. Grey water reuse, along with simple water conservation technologies, and river rehabilitation makes water efficient practices affordable, and contributes towards a more sustainable economy.

WHAT IS WASTEWATER MANAGEMENT?

Wastewater management is the process of taking wastewater and treating/managing it in order to reduce the contaminants to acceptable levels so as to be safe for discharge into the environment. There are effectively two basic types of wastewater treatment:

centralised and decentralised. Centralized systems are large-scale systems that gather wastewater from many users for treatment at one or a number of sites, whereas decentralized systems are dealing with wastewater from individual users, or small clusters of users, at the neighborhood or small community level.

The choice between centralized or decentralized wastewater management systems will depend upon a number of different factors, but it is important that full consideration be given to both the options rather than the situation that has existed in the past where sewerage was often considered to be the only 'proper' form of urban sanitation (UN-Water, 2015).

WHY CHOOSE A DECENTRALIZED WASTEWATER MANAGEMENT SYSTEM?

The decentralised wastewater management concept is best suited to translate the following Bellagio Principles into practice:

- Does not require large and capital intensive sewer trunks;
- Broadens the variation of technological options;
- Reduces the water requirements for waste transportation;
- Adaptable to different discharge requirements;
- Reduces the risk of system failure;
- Increases wastewater reuse opportunities;
- Allows incremental development and investment to the system (here: technical operational modules)

There is a place and situation for both centralised and decentralised approaches in every city. It is at the citywide sanitation planning stage that areas with centralised and decentralised systems should be designated using basic criteria along with the incremental sanitation ladder shown in Figure 2. Subsequently, feasibility studies can be conducted to complete the economic and financial analyses required to establish the technology that will be implemented. The decentralised wastewater management approach is an appropriate choice for areas of a city that cannot be economically covered by a conventional centralised system and for more type-specific community-based

sanitation needs, such as hospitals, health centres, education facilities, public markets, slaughte rhouses, and prisons.

WHAT IS DECENTRALIZED WASTEWATER TREATMENT SYSTEM (DEWATS)?

The term Decentralised Wastewater Treatment Systems (DEWATS) was developed by an international network of organisations and experts. In this Policy Guidance Manual, the term DEWATS is applied in singular or plural form, referring to a chosen specific technological module, linked up with management and operations that is part of a whole-system approach, enabled by the relevant holistic policy framework. The technical modular, "systems approach" (Compass Education, 2014) includes a whole range of different integral elements, and is part of the value chain within sustainable sanitation services, specifically targeted at urban and peri-urban areas of the region. This approach incorporates lessons learned from the limitations of conventional centralised and decentralised wastewater treatment technical systems, thereby helping to meet the rapidly growing demand for on-site-wastewater solutions, supported by a specific policy framework. DEWATS is characterised by the following: (BORDA and WEDC, 2009)

- encompasses an approach, not just a technical hardware package, i.e. besides technical and engineering aspects, the specific local economic and social situation is also taken into consideration;
- provides treatment for wastewater flows with close COD/BOD ratios from 1 m^3 to 1000m^3 per day and unit;
- can treat wastewater from domestic or industrial sources. It can provide primary, secondary and tertiary treatment for wastewater from sanitation facilities, housing colonies, public entities like hospitals, or from businesses, especially those involved in food production and processing;
- can be an integral part of comprehensive wastewater and sanitation strategies. The technological systems should be perceived as being complementary to other centralised and decentralised wastewater treatment options;
- can provide a renewable energy source depending on the technical layout (e.g. biogas supplies energy for cooking, lighting or power generation);
- based on a set of design and layout principles.

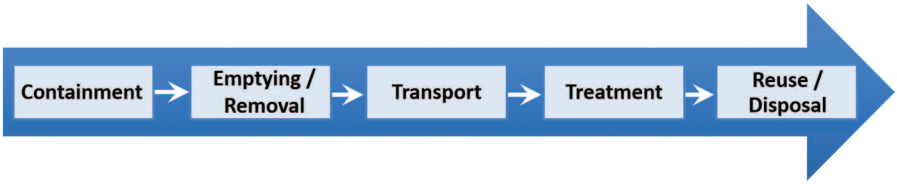
Figure 2: Sanitation ladder

A Part of the Sanitation Ladder and the Service Chain

Decentralised wastewater management exists at different levels along the sanitation ladder (Figure 2) and geographically from household to city district level. However, the case study of sanitation development in Indonesia found that DEWATS is a step-wise approach towards the city-wide centralised facilities (ESCAP, 2014).

Although improved sanitation facilities are considered to be "likely to ensure hygienic separation of human excreta from human contact," the sanitation ladder only considers the far left hand side (containment), which is effectively the user interface, of the sanitation service chain (Figure 3), and focuses on selected technologies rather than on the overall function of a sanitation system. Many of the current problems relating to domestic wastewater come from a lack of consideration of the other components of the service chain.

Figure 3: Sanitation service chain

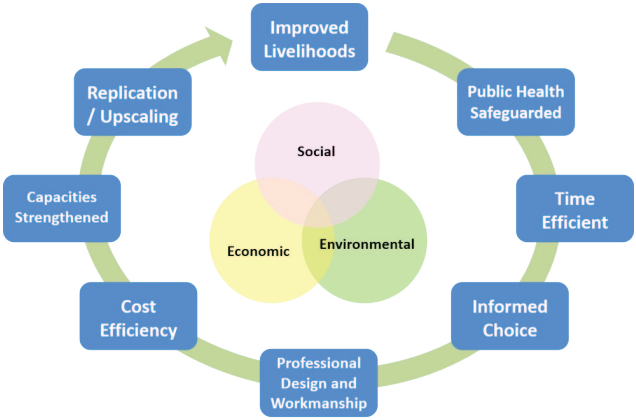


WHAT ARE THE BENEFITS OF DEWATS?

The primary benefits of DEWATS are listed and schematized in Figure 4 below.

- Improved livelihoods: DEWATS will improve the quality of livelihoods in poor urban settlements, especially for women and children;
- Public health safeguarded: By protecting drinking water sources, DEWATS treatment options will reduce the pollution load of groundwater and surface water sources such as rivers;
- Time efficient: Less than 12 months are required for planning and implementing DEWATS;
- Sustainability through informed choice: Communities choose DEWATS system and components they prefer;
- Professional design and workmanship: Technical options promoted are tested and subjected to rigid quality control;
- Cost efficiency: The investment as well as operation & maintenance costs of technical CBS options are low;
- Strengthened capacities through training and capacity building: Stakeholders are trained and assisted to plan, implement and manage DEWATS independently or in co-management;
- Replication: Trained local facilitators and urban planners ensure future DEWATS replications and scaling up within the target cities.

Figure 4: Visual presentation of the benefits of DEWATS



STEP 1 AND STEP 2

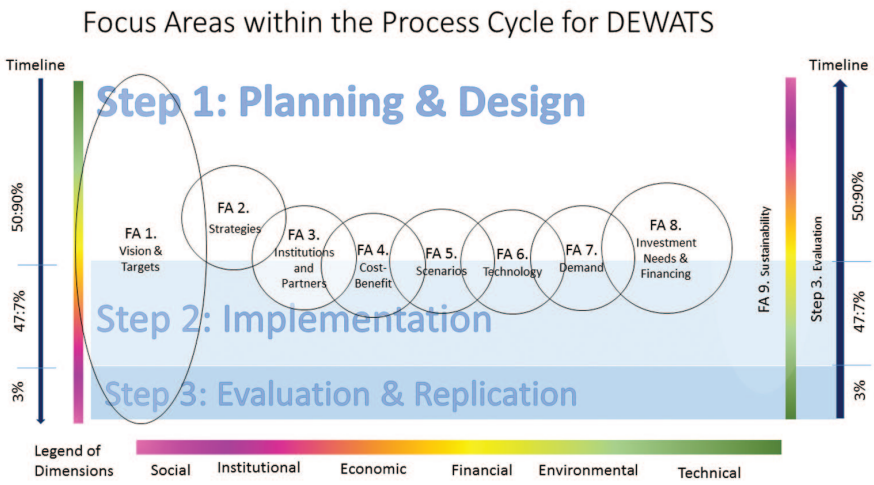
Step 1 and Step 2 cover both planning, designing and implementation phases. The visioning of different scenarios within Focus Areas 1 should be followed by assessment scenarios of Focus Areas 2 to 5, complemented by selection of technology, enabling financial and demand climate of the Focus Areas 6-8, which should be undertaken simultaneously and are very much fundamental to direct the whole implementation phase of the Step 2. Policy makers may wish to spend more time within Step 1 (from 50 percent to 90 percent of the whole time), enabling conditions, which includes policies, norms, standards of technologies, creating demand among population, arranging financial schemes, etc. (ref titles of Focus Areas), prior to a shift towards practical engineering work of implementation phase, including management of the operations and involving partners, private sector and communities. Step 2 might rather be implemented much quicker than Step 1 (from the remaining 50 percent to 7 percent of total time) and maintained through the whole process, following sustainability scenarios of the Focus Area 9.

TEN FOCUS AREAS OF COUNTRY-WIDE STEP-BY-STEP IMPLEMENTATION OF DEWATS

Sustainable solutions to ensure water security, in particular, when organizing decentralised wastewater treatment systems, must address several issues simultaneously, before the implementation starts and practices show that the more time we invest in planning, the better results we achieve as an outcome and in watching the performance process through evaluation.This section outlines the various steps that Governments should undertake in planning, design and implementation of a decentralised approach to wastewater treatment and sanitation using the 10 focus areas (10 FA) presented (Figure 5).

It starts from the Focus Area 1 with visioning and setting of measurable targets to achieve within a specified timeframe. It is important to remember that DEWATS planning should be an inclusive stakeholder participatory process, leading to sustainable development, integrating environmental, economic and social impacts of DEWATS.

Figure 5: Visual presentation of FOCUS AREAS ofstep-by-step DEWATS Implementation for inclusive and sustainable development



It should also lead to policy and strategy development at the national and local level (FA 2-5), followed by programmatic implementation (FA 5-9), which also has elements of FA 2-5, followed by monitoring and evaluation, and strategies for replication of self-sufficient business cases on DEWATS (FA10 or Step 3).

The DEWATS Focus Area process is systemic and interactive, meaning that results of M&E are analysed and looped back to inform and revise Focus Area 1 (FA1) and so on (FA 2-10).

FOCUS AREA 1

Vision and Setup Targets

While maintaining short-run stability, countries should be guided by the goals of long-term economic development, poverty reduction and the overall vision of the well-being. Vision is a statement that describes a desired future state. It should be as realistic as possible so that it may be used as guidance for orienting stakeholders in developing a strategy, particularly if a mission statement is formulated. Ideally, inputs and positions from involved stakeholders should be included to align and orient stakeholders towards a common goal. (ESCAP, 2004)

Visioning of a proper wastewater treatment system and sustainable sanitation services (3S) is an integral part of a national vision statement of mid-term or long-term strategic plans in building a "visible" and "invisible" infrastructure of the economy. In this context, a vision is the projection of an ideal future sanitation condition desired by all stakeholders, which practically establishes a commitment to an action plan or programme in achieving the stated Vision. It usually represents what stakeholders envision accomplishing within a specified time frame (e.g. 10 to 20 years in the future).

For instance: **A clean and healthy country: A country in which every person has safe and adequate sanitation and lives in a hygienic environment.**

The Vision entails the components that determine the national VISION approach (See box 1). This vision then will guide the planning process that will be conducted by those stakeholders at the national and city level.

As with other strategic plans, a citywide sanitation strategy needs a vision statement that is shared and futuristic. The vision should depict a healthy and hygienic city resulting from the availability of comprehensive and sustainable sanitation services, or in other words, one that meets the principles of total sanitation. Many internal and external factors of government affect the formulation of a city's sanitation vision (see Figure 6). Besides having to precisely portray the desired condition, the vision statement must also be:

- easy to envisage (i.e. picture in people's minds),
- easy to communicate,
- sufficiently broad but achievable,
- adaptable to the city's dynamic condition and overall city development plan,
- formulated in a concise, clear and concrete way,
- easy to be monitored through indicators and data on socio-economic impacts

The national and city vision is most successful when it integrates various approaches to sustainable sanitation services. These include the following:

- The Household Centred Environmental Sanitation (HCES) approach, which is an integrated approach in which the households and neighbourhoods decide on the services they need, and these needs are then addressed by the local and higher levels of government. HCES not only puts household and neighbourhood priorities and means at the centre of the planning and implementation process, but also involves a wide range of stakeholders from the government, private sector and civil society.

Box 1: Decisive components of the national VISION

- Building on people's energy and creativity at all levels, requiring empowerment and building the capacity of local governments and people in households and communities to take action by applying sanitation technologies that respond to actual needs.
- Taking a holistic and integrative approach, acknowledging hygiene and sanitation as a human right, and relating it to human development, the elimination of poverty, integrated management of water resources, and environmental sustainability.
- Committed leadership and good governance, changing long-accustomed roles, leading to new responsibilities of authorities and institutions to support households and communities in the management of their hygiene, water and sanitation, and in being accountable to users as clients.
- Building synergy among all partners, encouraging shared commitment among users, politicians and professionals; requiring professionals within the sanitation sector to combine technical expertise with an ability to work with users and politicians and with the sectors of health, education, environment, energy, and food.

Figure 6: Links between national and city visions

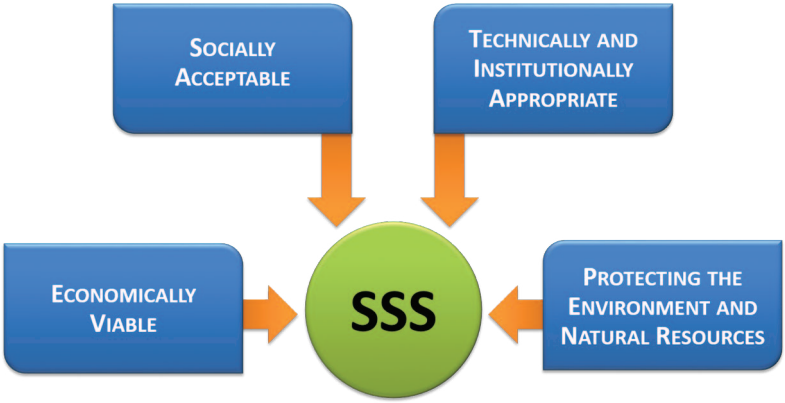
- The sanitation marketing approach that aims to increase demand for sanitation and to strengthen private sector capacity to supply sanitation products and services.
- The total sanitation services approach that fosters an enabling environment for progress, with special attention to planning, capacity building and institutional arrangements at the city, and provincial level; policy and strategy at the national level; plus advocacy and awareness-raising at all levels.
- A sustainable sanitation service (3S) delivery approach that focuses on the service itself, understood in terms of quantity, quality, reliability and accessibility as the main objectives of sanitation (and hygiene) interventions,which is shown as follows in Figure 7.

Furthermore, to achieve more sustainable sanitation services, key stakeholders should focus on the following underlying principles of an effective and cost-effective program:

- Financial analysis and long-term financial planning
- Demand-responsive approach
- Comprehensive assessment of local and community needs
- Service orientation
- Multi-stakeholder involvement and multi-task planning

A clear DEWATS vision should also accompany with a setting measurable objectives,

Figure 7: Criteria for Sustainable Sanitation Services (3S)



outcomes and targets, which are the check points on the state of the business and infrastructure case. Focus Area 5 and 10 of the Policy Guidance Manual elaborates how to set SMART objectives (See box 4) and how to keep evaluation of DEWATS on track with the reference points. The outcome(s) should include a goal, performance measure, baseline, and a target. The outcome(s) must define an event or condition that is external to the project and that is of direct importance to the intended beneficiaries and/or the public.

The following three steps should provide guidance on how to develop Expected Measureable Outcomes:

1. Determine what the project will accomplish, i.e. the intended results of the project, generally expressed as a Goal or Objective.
2. Figure out how to measure the results and select the performance measure.
3. Determine the baseline for each measure and set Target goals for future performance.

Use the Baseline Data to set Targets for the quantity of change expected. Targets may be framed in terms of: 1. Absolute level of achievement (ex: 500 households connected to decentralized wastewater system); 2. Change in level of achievement (ex: connect additional households to the wastewater systems, 20% more than last year); or 3. Change in relation to the scale of the problem (ex: connect peri-urban households in the district to DEWATS, approximately 35% of the total households.

More details on relevant policy frameworks and case studies are provided in PART 2 and are listed as follows.

Policy Framework 1.1: Targets of SDG Goal 6. Ensure availability and sustainable management of water and sanitation for all as of March 2015

Policy Framework 1.2: Successful Wastewater Management Policy

Case Study 1.1: Cycle of Sanitation Development in Indonesia

Case Study 1.2: Organic Wastewater Treatment and Biogas Utilisation in China

Case Study 1.3: Community-based Project Addresses Wastewater Treatment Challenges in Cambodia

Case Study 1.4: Marching Together with a Citywide Sanitation Strategy

FOCUS AREA 2

Assess Sanitation Strategies and Socio-Economic Impacts of DEWATS

Although we take it for granted, sanitation is a physical measure that has probably done more to increase human life span than any kind of modern medical services (drug or surgery). In order to strategically plan an expected performance, it is necessary to first be aware of the current state one finds oneself in. There are different means of accurately comprehending the specific context of sanitation endeavors, which should then lead to the development of quantitative short-term (aligned with the fiscal/budget year) and mid-term (e.g. 3-5 years) performance expectations. Depending on the subject matter, there may be value in quantifying long-term expected outcomes as well (e.g. 10 years). (ESCAP, 2004)

Governments can use different costing and assessment methodologies on sanitation strategies, besides making strategic assessments of policy impacts on socio-economic development as listed below. Focus Area 2 considers the future scenario mapping points, elaborated in more detail in Focus Area 5 on scenario assessment methodologies. These include:

- Conducting a **quantitative assessment** of current policies and strategies in terms of the costs of poor sanitation and the returns of improved sanitation on health, water resources, environment, tourism and other welfare indicators.The World Bank's Water and Sanitation Program has conducted such an economic assessment of sanitation in six South-East Asian countries, including Cambodia, Laos and Viet Nam (World Bank, 2015).
- Assessing the **cost-efficiency and cost-effectiveness** of current policies, strategies and economic decisions on investments and operations in the sanitation sector, particularly in terms of collection, transport, treatment, reuse and disposal of waste water and cost recovery of waste water treatment facilities.
- Conducting a **cost-benefit analysis** of current DEWATS projects in the country in terms of planning, construction, financing and operation costs, revenues (user fees, sale of energy/ biogas, reuse of water for irrigation, tourism and recreation, implementation of new businesses), social benefits (improved health, reduced pollution and water use, minimal operational/ maintenance tasks & costs, minimal land requirements, overall amenities for the city).
- Conducting **Social Impact Assessment (SIA)**. SIA can be defined in terms of efforts to

assess, in advance, the social consequences that are likely to follow specific policy and government actions in the area of water and sanitation services. Typical SIA processes include: i) Defining baseline conditions (i.e. population characteristics, community and institutional structures, political and social resources, individual and family changes and community resources), ii) Public involvement:This requires identifying and working with all potentially affected stakeholder groups, including those who live in proximity to the site; those who will be affected by the development intervention; those who are forced to relocate because of a project; and those who have interest in policy change but may not live in proximity, iii) Project description and Identification of alternatives, iv) Screening and scoping, v) Predicting responses to impacts (social impacts refer to the consequences of any public/private actions on human populations), and vi) Management and monitoring. On this basis, in the context of DEWATS, all sewage, sanitation and drainage projects should be developed in collaboration with households, communities and city councils.

- Using **Environmental Benefit Assessments**. Such a tool allows the examination of the positive outcomes for society that might result from the adoption of improved sanitation and wastewater management targets, and the implementation of environmental actions to meet these targets. By appraising and, where possible, estimating the economic value of such benefits, these assessments can raise the importance of improved sanitation in the political agenda, and alsocontribute to 'levelling the playing field' within environmental policy, especially where there is currently a clearer perception of and focus on costs rather than benefits. They can offer evidence to policymakers and stakeholders to support arguments for environmental investments and policy integration, by demonstrating the benefits of enhanced environmental protection.

Such studies will inform the decision making process on future strategies and programming in the sanitation sector of the country. Special attention is paid to the assessment of economic incentives and cost-recovery. Various strategies are described below:

- **Fee and tariff-based measures, subsidies, and other mechanisms** to facilitate access to DEWATS by the poorest consumers; putting value on de-sludging services and the basic operations and maintenance (O&M) of the facility.
- **Economic instruments**, such as wastewater tariffs or pollution charges, are an important complement to technical, regulatory, and institutional tools to achieve a sustainable and efficient management of decentralised wastewater. A basic principle of economic instruments used in environmental management is the "polluter pays principle". Economic instruments use market-based, mostly monetary, measures with the objective of raising revenue to help finance wastewater services. These instruments provide incentives to use water efficiently and carefully, and provide disincentives for the release of polluted wastewater, to make the polluter pay for the environmental damage done, and to raise awareness on the environmental and societal costs of water use and

wastewater discharge. The most common economic instruments used in wastewater management are the pricing of wastewater services, and the levying of charges for wastewater discharge into the environment.

- **Various cost recovery mechanisms** are being applied in wastewater management with the aim of pursuing one or more of the above-mentioned objectives. The following strategies have a greater bearing on decentralised systems:
  - *Pollution charges*: Charges are imposed for the discharge of treated and untreated wastewater into the environment. These charges are mostly levied upon the discharge of effluents from treatment plants and industry.
  - *Fees for wastewater services/user charges*: Fees or user charges are directly charged to users of wastewater services upon connection to and discharge of wastewater into the sewerage system. These include putting a value on de-sludging services. There are different types of user charges that can be divided into fixed charges, volumetric charges, and combinations. For households, the volume of discharged wastewater and sludge is directly related to the consumption of potable water. Consequently, the fee is usually collected as a surcharge on the water consumption bill and/or as a separate bill for de-sludging services. Different regulations canbe considered if large volumes of potable water are used for other purposes such as irrigating land plots or gardens.
  - *Discharge permits*: Discharge permits and licenses may also be a tool for controlling pollution and raising revenue. In this approach, the authority responsible sets maximum limits on the total allowable emissions of a pollutant into a sewer system, or into the surface water if the discharge is direct. Discharge permits are then issued according to this limit. In the discharge permit, the charges or levies can be incorporated for cost recovery purposes. Tradable discharge permits can give polluters more flexibility in investment and operation of wastewater management systems.

A list of related Case Studies is provided in Part 2. It includes the following:

Case Study 2.1: Pros and cons of DEWATS

Case Study 2.2: Major Lessons Learnt from Some DEWATS Projects in Peri-urban Areas in Viet Nam

FOCUS AREA 3

Analyze Institutions and Partners

It may be assumed that intelligence and knowhow are distributed throughout society, and therefore the government should not be viewed as the lone actor in the societal governance systems as a whole. For some activities, such as regional planning, however, it is advisable to encourage stakeholders to form a collaborative, diverse and trans-disciplinary body of knowledge and expertise. This way, decisions may be more inclusive and mediation-based, and thus the outcome more satisfying for all the parties involved. (ESCAP, 2004)

There are many actors influencing the decision-making process with respect to the management of wastewater, excreta and grey water (Figure 8). It is important for governments to map stakeholders, analyse the current systemic causal relationships in terms of barriers and drivers for collaboration, and to propose options for more integrated partnerships (5P), leadership, and social entrepreneurship. Important stakeholders include those who have been involved in a) developing and providing sanitation services, b) community awareness and empowerment, c) developing sanitation technology, and d) in national and city development planning and planning approval.

There are a number of steps that governments can take to build and manage collaborative inputs to the sanitation planning process.

Firstly, it is important to prepare an inventory of intersectoral mechanisms that already exist at the national level as a way towards the creation of intersectoral collaboration on sanitation and wastewater management.

At the national level, ministries and other public sector agencies responsible for water management, waste management, agriculture and fisheries, construction, transportation, public health, the environment, trade and industry and local government all have the potential to influence the planning, design, and operations of wastewater activities and to address the adverse consequences these may have. Some of the decision-making may be delegated to lower administrative levels, including provincial, municipal or district

authorities. Small-scale wastewater, excreta and grey water projects may be completely informal, initiated by local communities with or without the help of local governmental or non-governmental organisations.

It is challenging to bring key interest groups together, as they may span all spheres of society, ranging from different technical sectors to single investors and households, and could have conflicting interests or means of communication. Therefore, it is crucial that a central mediator is appointed and acknowledged. At an international level, this role usually falls upon an international body; at the national and local level it may be a government agency, an NGO, or an interest group, which will lead the process.

Secondly, it is important to identify a suitable mechanism for collaboration.

A number of options exist:

- Establishment of an intersectoral committee or technical working group: In many countries, this has repeatedly been the standard approach to tackling problems of an

Figure 8: Stakeholders involved in sustainable sanitation services

Box 2: Roles of the private sector in DEWATS

There are many opportunities for the private sector in the DEWATS business, including in these areas:

- Design and construction of DEWATS facilities, from household latrines and septic tanks to sewerage systems and treatment plants.
- Service providers, including sludge removal services, operation of public toilets and drainage cleaning services
- Operation and maintenance, such as road sweeping and drain cleaning services, removal of garbage to final disposal sites, management of final disposal sites, and operation of wastewater treatment plants
- Producers and retailers of products and equipment, such as refuse trucks, septic tank units, compost processors, sludge pumps, incinerators, cleaning chemicals, toilet and latrine components
- Waste management and processing, such as wastewater recycling, reuse, and sludge management.

intersectoral nature. Intersectoral committees should be led by a leading agency, be well resourced, and mandated to make binding recommendations.

- Establishment of a Memorandum of Understanding: This is a project-oriented rather than a strategic solution, but in the project context it has proved to be a valuable and effective way to achieve intersectoral collaborative action. By spelling out the nature of the tasks at hand, as well as defining responsibilities and determining resource flows, a MoU provides a clear framework for intersectoral collaboration that can be easily monitored for compliance.
- Targeted capacity building and informal networking: A more informal approach to achieving intersectoral action is to implement a capacity-building programme for intersectoral negotiation and decision-making. It is problem-based learning set in a realistic context. For example, in working to achieve an integrated wastewater, excreta and grey water system in urban and peri-urban areas, it could be necessary to bring professionals from different relevant sectors together to go through a systematic programme of critical decision-making.

Thirdly: find ways to involve private sector (see Box 2), particularly in relatively short-term flexible arrangements, and in facilitating consortia that can bring improvements in efficiency, especially in labour productivity, bill collection, and management of waste water services, at affordable costs. Given later is an overview of the ESCAP concept

of pro-poor public-private partnership (5P) for sustainable sanitation services (3S) with a step-by-step guide for its setting and implementation.

Fourthly: encourage communities deprived of adequate sanitation services to participate in planning, developing, operating and paying for improved sanitation services. This may be done though a step-wise process approach, with clear intermediate objectives, and a communication framework.

The community participation strategy should describe, at least, the following:

- Purpose of the strategy,
- Target groups (primary, secondary, others),
- Links to other sanitation development activities,
- Timeframe,
- Key theme or message,
- Methods for building community awareness, participation, and ownership,
- Media to be used,
- Actors involved, particularly those responsible for implementation; and
- Methods of monitoring and evaluation.

Moreover, in order to strengthen the regional network and capacities of DEWATS and overall sanitation services, the process of sharing R&D findings and disseminating the experiences and outcomes with key stakeholders and others outside the process, including those with similar responsibilities elsewhere in the region is systematically important.

Step-by-step guide for organizing a successful PPP (3P) framework for 3S in selected countries of South-East Asia

The role of Government, in addition to other stakeholders, is to ensure andprovide stability, financing credibility, and uphold laws and regulations. Pro-poor elements of Public Private Partnership (5P) can only be ensured by the Government and the Donors/Philanthropists or development agencies through respective policies and norms. The five-step approach described below is necessary to ensure 5P for 3S implementation process. Development of business cases on 3S, based on studies of market opportunities and diversification of revenue income, could sbe a strategic area of intervention that could ensure return on investment from state and private sector sources in the long run.

The role of Service Providers, who could be selected from the pool of social entrepreneurs, is important in this regard, as they could serve a significant number of households and industries (Figures 11 and 12). They can be periodically trained and evaluated, subsidised and empowered, and they can also be oriented to develop innovative partnerships to provide an increased access to capital, with the promise of its return to the state budget in future (in both direct and indirect forms).

To guarantee the sustainability of the sanitation system, policies, technologies and financial schemes should be widely discussed in local and regional meetings and consultations through a participatory approach. After the discussion on the most efficient framework and the engagement of the stakeholders, a partnership agreement should be signed by all to ensure the construction of the wastewater treatment and sludge handling system, and to formalise the role of each player. Here is a summary of the detailed 5-step approach.

Step 1: Development of a National Programme (NP) to implement the strategy on 3S in the LDCs in a participatory process, including:

a. Assessments of policies and partners.

b. Inventory of technical facilities and infrastructure, baseline to be continuously assessed and reviewed.

c. Target setting and ensuring benchmarks for Monitoring and Evaluation, Quality Assurance.

d. Stakeholder analysis and framing research.

e. Engagement of potential PPP investors to tap the market opportunities.

Step 2: Ensure Government commitment towards enabling policy on PPP for 3S:

a. Financial commitment through appropriate budget allocation in the form of a Trust Fund to be enabled as part of the National Programme (NP, based on vision and strategy)

b. Political commitment in the form of policy, regulation and subsidy

c. Selection of financial scenario, using multi-philanthropic platform and inputs to the NP

Step 3: Outreach/negotiate with philanthropists and convince them of the need to create the PPP environment in order to encourage SMEs to participate, in addition to empowering local communities using the service and value chain in sanitation towards water security.

Step 4: Encourage SMEs and private sector to act as Service Providers and to follow one of the financial mechanisms proposed below, whereby Government input is ensured. For example, through the financial contribution ratio:

30 percent (Government, in kind, cash): 60 percent (Philanthropist, cash): 10 percent (RoI) that would be gradually changed into 30 percent: 40 percent: 30 percent.

Step 5: Develop detailed tripartite (multi-stakeholder, multi-philanthropist) MoUs, contracts, agreements for PPP, accompanied by continuous:

- Assessment of the implementation of the Government strategy along with capacity building (workshops and study tours), M&E, Quality Assurance.
- Establishing of political framework to encourage and support DEWATS suppliers.
- Research and assessment of potential PPP investors.
- Training on Operations and Management (O&M), Monitoring and Evaluation (M&E), Quality Assurance.
- Coordination of PPP implementation, joint ventures or joint investment.
- Actual implementation of 5P for 3S with Monitoring & Evaluation

Step 6: Facilitate an e-learning platform targeting mainly government officers and local community leaders dealing with water management issues and solutions, with a special emphasis on decentralized wastewater management systems that can be immediately applied and/or influence policies. Expand the platform among the initiative partners and involve more knowledge and higher education partners.

Related Policy Framework and Case Studies of Part 2 are listed below:

Policy Framework 3.1: Pro-poor public Private Partnership for Sustainable Sanitation Services

Case Study 3.1: BAPPENAS and the Sector Working Group in Indonesia

Case Study 3.2: Individual, Community and Institution-based Sanitation Approaches in Indonesia

Case Study 3.3: What Communities can Expect to Manage in Indonesia

Case Study 3.4: SANIMAS ("Sanitation by Communities") in Indonesia

FOCUS AREA 4

Analyse Costs and Benefits

Since 2007, the Water and Sanitation Program (WSP) of the World Bank has been conducting in-depth country studies of the economic impact of inadequate sanitation in six South-East Asian countries. The study indicates that poor sanitation was costing the economies of these countries an equivalent of between 0.5% and 7.2% of their annual GDP. In South-East Asian countries, the average is 2percent of the GDP, whereas in South Asian countries, it is 6 percent of the GDP. For Viet Nam, Lao People's Democratic Republic and Cambodia, the costs are 0.5 percent, 5.6 percent, and 7.2 percent of the GDP, respectively.

The purpose of doing a Cost-Benefit Analysis (CBA) is to estimate benefits and costs of different options, and then compare these options for better decision-making. In our case the options are different kinds of sanitation solutions.

The Benefit-Cost Ratio (BCR) presents the relationship between the benefits of the action compared to the cost of implementation. A ratio above 1 means that the return is higher than the investment, i.e. for every one dollar invested, the return is more than one dollar. It is important to understand what the benefit-cost ratio actually means. If the government invests in a wastewater treatment plant system with a benefit-cost ratio of four, it does not mean that the government will receive a four dollar return on every one dollar invested. It is rather the entire society that will gain four dollars on the investment. You could say that GDP as a whole will increase by four dollars for every one dollar invested.

Examples of the Benefit-Cost Ratios' Comparisons for South-East Asia

The comparison of Benefit-Cost Ratios (BCRs) between different countries will provide governments an indication of how cost-effective their interventions have been as compared to the others.

The following table shows comparisons of BCRs from urban and rural sites of six countries; Viet Nam, Philippines, Indonesia, Cambodia, Lao People's Democratic Republic, and China (Yunnan). In general, dry and wet pits return the highest benefits on investments.

Table 1: Benefit-Cost Ratio comparison for six countries

Country	Rural			Urban		
	Dry pit	Wet pit	Septic tank	Wet pit	Sewerage with treatment	Septic tank with treatment
Viet Nam	8.0	N/A	4.0	8.1	3.0	3.8
Philippines	5.0	8.0	2.5	4.8	4.5	4.5
Indonesia	8.1	7.0	4.0	3.3	1.8	1.9
Cambodia	2.0	3.0	N/A	1.7	0.1	N/A
Lao People's Democratic Republic	8.3	10.0	3.8	6.0	N/A	N/A
China,Yunnan Province	5.8	N/A	3.8	5.0	2.0	2.8

Centralized wastewater treatment systems have a positive return in all countries except for Cambodia, indicating that there is a need for them to review their current strategy.

It is also important to understand that the payback period of an investment can be more than one year. If a wastewater treatment plant system has a lifespan of 20 years, the BCR will reflect the benefits (and the costs) over this entire period. Typically, the payback period for a pit latrine in rural areas (moving up from open defecation) is around one year. For a centralized system, it is considerably longer.

For example, a person who used to practice open defecation, but now has access to a latrine, will have more time for productive work, and is likely to get sick less frequently. The increased free time and improvement in health means that he or she will have more time to do something productive, and this can be translated into increased monetary income, which will be included in the return on the investment.

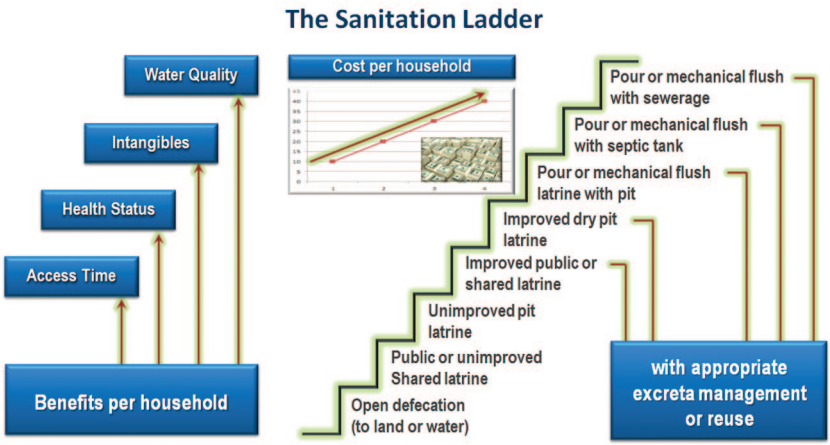
The BCR may vary according to the setting. For example, the benefit-cost ratio of a specific solution may be greater in a rural setting than in an urban setting or vice versa,

depending on the location. For example, the BCR of installing wet pit latrines in rural Laos is 7.8, but 6.2 in an urban area.

Figure 9 presents a generalized picture of the sanitation "ladder". The higher up in the ladder, the more advanced and costly the sanitation system. At the bottom of the ladder is open defecation with no access to sanitation, and at the top of the ladder are flush toilets connected to sewerage. The BCR is typically higher in the lower parts of the ladder. This is because populations using improved sanitation have already seen some benefits, so moving them up the ladder leads to fewer marginal benefits.

Figure 10 shows how benefits from improved wastewater treatment and sanitation are estimated in monetary terms. There are also intangible benefits that can not be expressed in monetary terms. These include improved quality of life, gender impacts, convenience, comfort, privacy, status, security, etc. These should not be underestimated. Even though the greatest benefit for households are saved time and improved health, their greatest motivator may be dignity, comfort and privacy as presented in a study by (Jenkins and Sugden, 2006). However, there is limited research on how these benefits can be monetised, i.e. how they translate into revenues for governments or for households themselves (Trémolet, 2012).

Figure 9: The sanitation "ladder" (WSP, 2012a)



Other important benefits include wider-scale external benefits that result from improved sanitation at a national level. These benefits can include increased productivity of water quality that will improve the situation for fisheries, lead to an increase in tourist numbers, and make the country more attractive to foreign direct investment. Box 3 presents the categories included in the Cost-Benefit Analysis study carried out by the World Bank within WSP.

The World Bank study found that sanitation interventions have very favorable socio-economic returns to households and society as a whole, contributing to improved health, clean environment, dignity and quality of life, among many other benefits. Key findings from Cambodia, Laos, and Viet Nam are presented below. (World Bank, 2015)

Cambodia

- Poor sanitation leads to economic losses of USD 448 million per year, which translates into per capita loss of approximately USD 32.
- The economic losses are equivalent to 7.2 percent of Cambodia's GDP in 2005.
- This amount is roughly equivalent to the contribution of the fishery sector to the GDP, or twice the forestry's contribution.

Figure 10: Categories and methods to estimate improved sanitation (WSP, 2012a)

Benefit Category	Population with Unimproved Sanitation	Population with Improved Sanitation	Benefit Estimated
HEALTH	Data on health risk per person, by age category and socioeconomic status	Generic risk reduction, using international literature	Averted health care cost, reduced productivity loss, reduced deaths
WATER	Data on water source and treatment practices	Observe changes in practices in populations with improved sanitation	Reduced water sourcing and water treatment cost
ACCESS TIME	Data on water source and treatment practices	Observed reductions in time to access toilet	Opportunity cost of time applied to time gains
INTANGIBLE BENEFITS	Attitudes and preferences of householders to sanitation	Benefits cited of improved sanitation	Strength of preferences for different sanitation aspects and willingness to pay
REUSE		Practices related to excreta reuse	Value gained, based on sales or own use

Box 3: Categories for Benefit-Cost Analysis of Wastewater Treatment (extracted from WSP)

Health benefits include reduction in diseases caused by improved sanitation. The economic savings used to measure this are; 1) the averted healthcare cost 2) the economic cost of time lost due to illness; and 3) the cost of premature deaths avoided.

Water benefits include economic savings, such as paying less for water, or walking lesser distance to access clean water. It also takes into account the reduced cost of treating water due to concerns about safety and appearance.

Access time is the time saved due to access to improved sanitation, such as access time to a private toilet compared to finding a place for open defecation. The economic value of time is based on the same values as health related time savings.

Intangibles include comfort, privacy, convenience, safety, status and prestige. These are difficult to measure in monetary terms, but they often play an important role in the demand for improved sanitation, and the willingness to pay for it.

Reuse includes benefits from recycling of materials such as compost fertilizers and biogas. This is a good opportunity, especially, in rural areas where households have access to excreta from livestock.

Tourism is an industry sensitive to poor sanitation. Tourists who fall prey to food poisoning or can not find a clean toilet are less likely to return.

- Economic returns are potentially high—in excess of USD2 returned per dollar invested—especially in rural areas where low-cost on-site solutions are feasible.
- Poor sanitation is causing 9.5 million hygiene-related disease episodes per year (97% diarrheal).

Indonesia

- In 2006, Indonesia lost an estimated USD 6.3 billion due to poor sanitation and hygiene, equivalent to approximately 2.3 percent of its GDP.
- Of the impacts evaluated, health and water resources contribute most to the overall economic losses estimated in the study.
- Poor sanitation, including hygiene, causes at least 120 million disease episodes and 50,000 premature deaths annually. The resulting economic impact is more than USD 3.3 billion per year.
- The associated economic costs of polluted water attributed to poor sanitation exceed USD 1.5 billion per year.

Lao People's Democratic Republic

- Poor sanitation leads to economic losses of USD 193 million per year, which translates into per capita loss of approximately USD 28.
- The economic losses are equivalent to 5.66 percent of Lao People's Democratic Republic's GDP in 2005.
- Poor sanitation is causing 3 million hygiene-related disease episodes per year.
- Economic returns are potentially high—in excess of USD ten dollars returned per dollar invested—especially in rural areas where low-cost on-site solutions are feasible.

Philippines

- Overall, the study estimated that poor sanitation led to economic costs to the order of USD 1.4 billion, equivalent to about 1.5 percent of its GDP in 2005 and translated to per capita losses of USD 16.8 per year.
- The health impacts represent the largest source of quantified economic costs at about USD 1 billion or about 72 percent of the total economic costs.
- The second most important economic impact was on water resources, which accounted for about 23 percent of the total costs.
- The remainder was divided between impacts on other wellbeing and livelihood factors, including impacts on tourism.

Viet Nam

- Economic losses: overall population welfare losses are equal to 1.3 percent of the GDP.
- Financial losses, reflecting expenditure or income losses resulting from poor sanitation, are equal to roughly 0.5 percent of the annual Gross Domestic Product (GDP).
- The majority of economic losses are shared between health (34 percent), water resources (37 percent), and the environment (15 percent).
- The annual losses per capita equal USD 9.4 per year.

Yunnan Province, People's Republic of China

- Pit latrines in rural areas have an economic return of at least six times the cost, and off-site treatment options in urban areas have an economic return of at least two times the cost.
- Economic efficiency of the improved sanitation can be optimized by making programs

more demand-sensitive, which leads to sustained behavior change. More efforts are needed to stimulate demand from populations and deliver sanitation solutions that they wish for. Users should be involved in all the stages of sanitation projects.

- The higher investments needed for the appropriate transport, treatment, and disposal of human excreta and wastewater can be justified by the higher income levels and willingness to pay for improved quality of life, especially in urban centers. Monitoring is needed to ensure that the environmental benefits are being captured (World Bank, 2015).

Detailed reports on these studies can be found at http://www.wsp.org/content/east-asia-economic-impacts-sanitation

The results from Benefit-Cost Analysis greatly enhance the ability of policy makers to make informed decisions and set a sensible policy. But it needs to be kept in mind that high cost-benefit ratios for DEWATS in other countries do not always translate into the same scenario in another. The local situation in each country is usually different, and this may lead to different results.

It should also be kept in mind that economic returns from interventions are for the economy as a whole. And some of these returns could come from avoiding costs due to, for instance, environmental degradation. It does not come as cash to the coffers of governments, although a part of it will, as a healthy economy benefits all sections of society.

Below is a list of the related Policy Frameworks and Case Studies from Part 2:

Policy Framework 4.1: Co-benefits of Sustainable Wastewater Management Options

Policy Framework 4.2: Assessing Cost-Effectiveness of Decentralised Wastewater Treatment

Policy Framework 4.3: Indicators for monitoring; Guidelines on Strategic Planning and Management of Water Resources

Policy Framework 4.4: Spread Sheet for Economic Calculation of DEWATS (based on annual costs)

Case Study 4.1: Affordability Assessment for DEWATS in Khe Tre town, Viet Nam

Case study 4.2: Cost-effectiveness Analysis of 4 Wastewater Management Options in South Can Tho

Case Study 4.3: Results of the Cost Analysis of Sanitation Options

FOCUS AREA 5

Assess the Strategic Future of DEWATS

In order to secure and maximise best outcomes for the future of DEWATS, it is important to identify future appropriate strategies. The formulation of strategies should be undertaken within the context of resource parameters, including the financial, human, and technical resources that are likely to be available. Strategy formulation involves maximising outcomes and minimising risks. (ESCAP, 2004)

Strategic and long-term future of DEWATS depends on the system selected (i.e. financial, technological, treatment, etc.), coupled with planning tools that are able to integrate a number of fundamental dimensions of the development, and should be considerate to the following five important components in planning and implementation:

(i) Sanitation mapping

Sanitation mapping indicates the sanitation status of urban, semi-urban and rural areas of the country generating general recommendations for sanitation improvement initiatives. It is most realistic and economical to prioritise the improvement of existing services rather than creating an entirely new set of services. Regional services of the ministry in charge of sanitation along with municipal services will provide a description of:

- The state of urban sanitation (including peri-urban areas and small towns along the Mekong Corridor), highlighting the existence, performance and quality of sanitation services (centralised systems and DEWATS) and non-technical aspects, as well as the problems. For certain aspects, specific indicators should be used to provide a better picture of the sanitation conditions.
- Sanitation development trends, needs, and opportunities, including what each areaneeds to improve the accessibility, performance and quality of its sanitation services. This description should also address the potential for expansion or enhancement of existing sanitation facilities such as DEWATS and other resources.

Box 4: SMART Objectives (cross-reference to FA1)

SMART is a concept formulated by Peter Drucker more than 50 years ago. This strategy focuses on managing teams based on their ability to complete individual and team goals and objectives. There are several key factors that should be present in the objectives for them to be effective.

Specific: To make objectives specific, they must tell a team exactly what is expected, why it's important, who's involved, where it's going to happen and which attributes are important. In other words, objectives should describe specifically the result that is desired.

Measurable: This stresses the need for concrete criteria for measuring progress toward the attainment of the objective. The thought behind this is that if a goal is not measurable it is not possible to know whether you are making progress towards its successful completion. In order to be able to use the objectives as a part of a review process, it should be very clear whether the person has met the objective or not.

Achievable: The next important factor in setting objectives is that they should be achievable. The objectives should neither be out of reach nor below standard performance, since these may be considered meaningless.

Realistic: Realistic objectives are objectives that recognize factors, which cannot be controlled.

Time-based: Time based stresses the importance of grounding objectives within a time-frame, giving them a target date. A commitment to a deadline helps a team focus its efforts on completion of the goal on or before the due date (Bogue, 2005).

- Final analysis of the sanitation mapping assesses all the data collected, both secondary and primary. The results should a) determine the need and priorities for sanitation services and opportunities for DEWATS development, and b) recommend appropriate interventions for the development of DEWATS, taking into account areas that pose environmental health risk.

(ii) Scenarios for DEWATS

The ministry in charge of sanitation, in collaboration with de-concentrated and decentralised services, will prepare DEWATS development scenarios based on the recommendations derived from sanitation mapping. These scenarios are formulated with different objectives and targets for urban sanitation development based on the results of the sanitation mapping, including community demands. Statements of objectives and targets should be based on **S**pecific **M**easurable **A**chievable **R**elevant **T**ime-bound (SMART) objectives (see Box 4).

(iii) Cost-Benefit of Scenarios

It is important for political decision-makers to evaluate and assess the various DEWATS scenarios with a cost-benefit analysis. Cost curve analysis allows determined pathways to bring sufficient and appropriate public, private and social sector solutions as well as to significantly impact sanitation coverage with DEWATS services. It provides a comprehensive framework for investments as well as a prioritisation framework for the allocation of funds, by identifying effective, scalable and sustainable sanitation solutions and their associated financing needs and economic attractiveness. It classifies scenarios into business lines that can be pursued by different institutions according to their expertise and interest.

(iv) Stakeholder Consultation on Scenarios

The identified key stakeholders should be consulted on the objectives, targets, and cost-benefit analysis for sanitation and DEWATS development scenarios. Stakeholders should also be consulted to determine the types of sanitation services to be developed to meet each area's specific needs. Many factors, including cost curves and funding, must be considered in selecting the types of services. Input from the community is vital. Where possible, existing facilities should be maintained and improved.

(v) Setting Prices for Wastewater Services

Some other aspects also need to be considered when setting prices for wastewater services:

- Affordability: Prices should make access to sanitation affordable for different income groups, since as lack of sanitation services has a major impact on human and environmental health resulting in negative effects for all members of society. The price should, therefore, not be too high to drive consumers to unsafe alternatives of wastewater discharge.
- Fairness and equity: The demand for equity implies that those who produce more wastewater or wastewater with a higher pollution load should pay proportionally more for sewerage and treatment. This usually means that water dischargers pay wastewater bills that are proportionate to the costs they impose on the utility. This would also be in line with the "polluter pays principle". Fairness, however, might require that the wastewater bill does not account for a disproportionally large share of a household's total income.
- Transparency and feasibility: Meeting all the above mentioned objectives of wastewater charges would imply relatively complex tariff systems as well as intricate monitoring mechanisms, which would include installation, maintenance and reading of different meters, including smart meters. Administrative expenses for billing and monitoring payment should, however, are kept financially feasible. When designing tariffs, it should be kept in mind that these should be easy to explain, understand and implement. Some of these objectives, however, might conflict with each other. For example, the affordability for poor could require low prices, which do not provide for full cost recovery, or measurement of pollution loads in wastewater might not be administratively feasible.
- The political feasibility of any particular tariff or fee system is likely to depend on some familiar factors along with some unexpected factors. In general, familiarity will increase political acceptability—sewer or sanitation surcharges are familiar tax instruments in many countries, nutrient taxes are not. Public understanding of the environmental harm needs to be addressed, as well as belief in the usefulness of the particular fee system in mitigating that harm.
- Designing and enforcing cost recovery mechanisms is a complex process. It requires arrangements (technical, institutional, legal, and financial) for a good monitoring system, including regulations and legislations on meeting water quality levels

and emission standards and issuance of discharge licenses. An efficient revenue collection system should be in place. It should include capabilities and capacity to assess the right tariffs, to implement appropriate billing systems, and to enforce fines if needed. A special fund should be established in which revenues from user charges or pollution fees are deposited. Such a fund can then be used for targeted co-financing of wastewater treatment facilities, and for their actual operation and maintenance, instead of being considered as tax revenues that enter the national budget.

- Some of the failures of tariff systems, especially in providing affordable services for the poor while recovering costs, can be compensated by subsidies. In poor areas of middle and low-income countries, subsidies are necessary to cover basic sanitation services for poor customers. Sanitation services may be more natural candidates for subsidies than water services, as the willingness to pay for such services is often lower than for water services, and the wider social benefit in terms of both public health and surface water quality provide an economic rationale for subsidies. Government subsidies can, for example, either be paid directly to the customer (demand side subsidies) or to the service provider (supply side subsidies). However, research has shown that subsidies should rather be used to promote access to basic sanitation services (connection to the local sewer) rather than providing ongoing support for consumption.
- From a social and economic perspective, decentralised systems forbid cross subsidies and financial solidarity between the rich and poor. From the point of revenue, the financial attractiveness of decentralised wastewater treatment systems is limited by the fact that revenues come from water tariffs and other charges, and do not reflect the positive externalities for the society at large. Typically, revenue streams from non-potable reused water are limited since only a few applications qualify and the willingness of people to pay for them is low. This happens for two reasons: first, the price of wastewater treatment does not reflect its full cost; and second, non-potable uses are valued less by the community and the consumersthan drinking water.

To achieve our long-term strategy, the following guiding principles should be more carefully considered:

- Sustainability of financing
- Sustainability of technological know-how
- Sustainability of infrastructure management
- Sustainability of social interaction

The list of related case studies provided in PART 2, includes the following:

Case Study 5.1: Components of Sanitation Mapping

Case Study 5.2: The National Sewerage and Septage Management Program in the Philippines

Case study 5.3: Five-Point Strategy for Promoting Pro-Poor Household Connections in Viet Nam

Case Study 5.4: The Unified Sanitation Sector Strategy and Action Plan in Viet Nam

Case Study 5.5: Mainstreaming DEWATS into Integrated Wastewater and Septage Management

Case study 5.6: Capacity Building at Scale: One-Stop Shops, Indonesia

FOCUS AREA 6

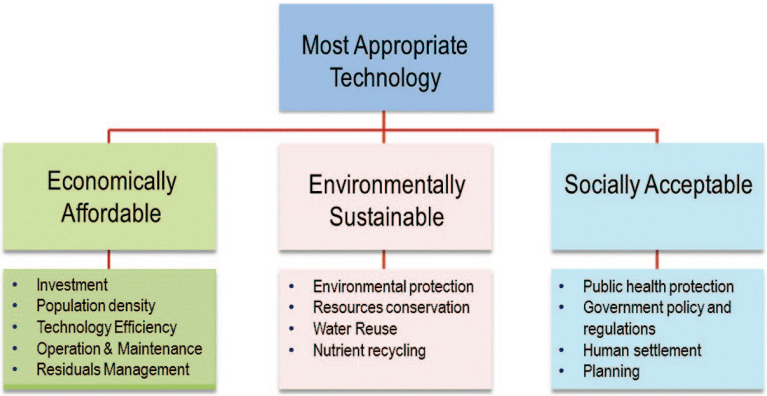
Choose the Technology System

Choosing the most appropriate technology is not an easy task, but it could reduce the risk of problems and failures in the future. The two key issues in choosing a treatment technology are affordability and appropriateness. Affordability relates to the economic conditions of the community, while appropriateness relates to the environmental and social conditions. As such, the most appropriate technology is the technology that is economically affordable, environmentally sustainable, and socially acceptable. The different factors affecting the selection of the most appropriate technology are described in Figure 11.

In a sustainable wastewater treatment system, the community should be able to finance the implementation of the system, the operation and maintenance, including the capital improvement needed in the future, and the necessary long-term repairs and replacements.

Providing local people with access to resources, education and the information

Figure 11: Characteristics of the most appropriate technology (Massoud et al., 2009)



necessary to influence environmental and economic issues that affect them is a crucial step towards sustainable management of DEWATS. The technological choice could be also undertaken through step by step approach, with careful observation on impacts, for example through indicators on the amount of COD removal. For example, using septic tanks would remove 50-60 per cent of COD, using pre-treatment phase without removal of nutrients, would remove only 80 per cent of COD. Please refer to Table 1 on "Advantages and Disadvantages of DEWATs System", Case Study 2 of Part 2 of the Policy Guidance Manual.

Training programmes for municipality employees are essential for the proper operation and maintenance of equipment and facilities, including monitoring of wastewater quality.

Another opportunity for reuse is the Clean Development Mechanism (CDM) capturing and recycling of biogas from sewage treatment, treatment of wastewater in combination with solid waste, by co-composting or in an anaerobic digester. In many countries, the anaerobic digestion of wastewater and sludge could produce a useful biogas for heating or onsite electricity generation (Government of Japan, 1997; Government of Republic of Poland, 2001; China). Such projects could also be suitable for Joint Implementation and CDM. In future, waste sector projects involving municipal wastewater treatment, carbon storage in landfills or compost, and prevention of Greenhouse gas (GHG) emissions due to recycling, composting, or incineration could potentially be implemented pending the development of approved methodologies.

Brief information on related Policy Frameworks and case studies described in Part 2 includes the following:

Case Study 6.1: Wastewater Treatment and Reuse through Constructed Wetlands in Vientiane

Case Study 6.2: Centralised Wastewater Treatment Plant in Sihanoukville

Case Study 6.3: Water Aid in Nepal - Ecological Sanitation (EcoSan)

Case Study 6.4: Drinking Water through Bio-sand Filtration at Household-level in Pakistan

Policy Framework 6.1: Critical Technical Inputs and Outputs for the Design of DEWATS

Policy Framework 6.3: Advantages of Prefabricated Modular DEWATS Components

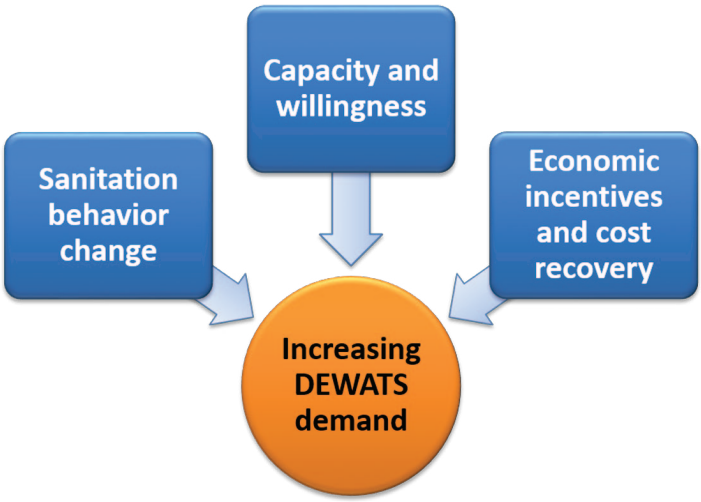
FOCUS AREA 7

Increase the Demand for DEWATS

Demand for sanitation is often low in LDCs, so fostering a demand for sanitation and DEWATS can be seen as the first step in the chain of sanitation services (Figure 12). Interventions to increase household and community demand for sanitation typically include promotion of the benefits of sanitation, marketing of specific sanitation products, hygiene promotion, social development, and mobilisation (often linked to the formation of community groups in urban areas) and community triggering.

Ultimately, it is demand from citizens that will lead to better sanitation services. The key ingredients for triggering improvements to sanitation from recent Southeast Asia regional experiences are: adoption of hygienic behaviour (hand washing at critical times; free from open defecation) with community-led total sanitation (CLTS) and other hygiene

Figure12: Components for increasing DEWATS demand



promotion/education approaches instilling emotions of disgust, embarrassment as well as status and convenience; strong citizen awareness arising from an appreciation of the health and environmental consequences of poor health, hygiene, and services; access and free flow of information on environmental and utility performance between public authorities and civil society; and leadership by the public sector and organised civil society.

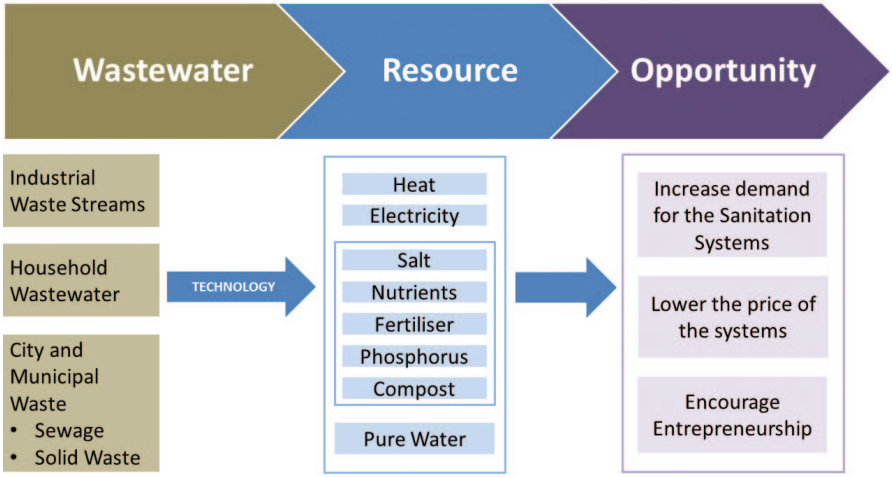
By this logic, it would make sense to encourage key policymakers and practitioners to develop a 'training toolkit,' or simple accessible database that provides practical advice on getting to know the background of a range of options for service delivery, suggestions on how various institutions may support improvements in service delivery, and also identifying and explaining key policy, legal and regulatory features, and the capacity building tools to continuously enact the community of practice, etc.

Market the Wastewater and Wastes as a Resource

There are a number of opportunities for reusing wastewater and waste as a resource (Figure 13). However, experiences on water reuse are limited. Nutrient reuse, water reuse, and energy production from wastewater are not common in Cambodia, Laos and Viet Nam. However, there are successful experiences in the region that can provide lessons in this field. In Republic of Korea, as part of the green growth initiatives, there are plans to increase water reuse and reduce energy use at treatment plants. Increasingly, water in Korea is called the "Blue Gold" of the future. Similarly, in Singapore recent advances in converting wastewater into drinking water have shown that concrete measures can be taken to address the issue of water shortages that many cities will increasingly face in the future. In Singapore, the recycled water is called NEWater and it already meets about 30 percent of demand (Mediacorp News, 2012). It is expected that by 2060, 50 percent of the water used will be recycled water. Singapore also has a plan to increase its supply of desalinated water, and by 2060 about 80 percent of the water will be either NEWater or desalinated water (Leong, 2012).

Depending on local conditions, policies for the use of wastewater, excreta and greywater may be emphasized within the water and food security sectors, or within the environmental protection and climate change policy frameworks. Whatever the case may be, for their safe use, effective links will have to be established and aligned with the national public health policy and environmental protection frameworks. The main policy issues to investigate are:

Figure 13: Opportunities forusing wastewater as a resource



- Public health: To what extent is waste management addressed in national public health policies? What are the specific health hazards and risks associated with the use of wastewater, excreta and/or greywater in agriculture and aquaculture? Is there a national health impact assessment policy? Is there a policy basis for non-treatment interventions in line with the concepts and procedures contained in the Stockholm Framework?
- Environmental protection and adaptation to climate change: To what extent and how is the management of wastewater, excreta and greywater addressed in the existing environmental protection policy and adaptation to climate change frameworks? What are the current status, trends and expected outlook with respect to the production of wastewater, excreta and greywater? What is the capacity for effective management of wastewater, excreta and greywater? What are the current and potential environmental and climate change impacts? What are the options for reuse in agriculture or aquaculture?

Policymakers should use the updated evidence concerning health impacts associated with the use of wastewater, excreta and grey water in agriculture and aquaculture presented, for instance, in the WHO guidelines to develop rational and cost-effective policies for protecting public health and maximizing the beneficial use of natural resources.

Related Policy Frameworks and Case Studies are summarized in Part 2 and listed as follows:

Policy Framework 7.1: Resources in Human Waste & Markets for Safe Disposal & Reuse

Policy Framework 7.2: Measures to Stimulate Demand for DEWATS & Sanitation Services

Case Study 7.1: Marketing the Waste as a Resource

Case study 7.2: Lessons Learnt from Capacity and Willingness to Pay for DEWATS in Indonesia

Case Study 7.3: Integrated Water Management Policy in Shenzhen

Case Study 7.4: Alternative Approaches to Stimulate Demand for Sanitation in India

Case Study 7.5: Platform for climate change advocacy

Case Study 7.6: Policy Framework on Measures to Stimulate Demand for DEWATS and Sanitation Services

FOCUS AREA 8

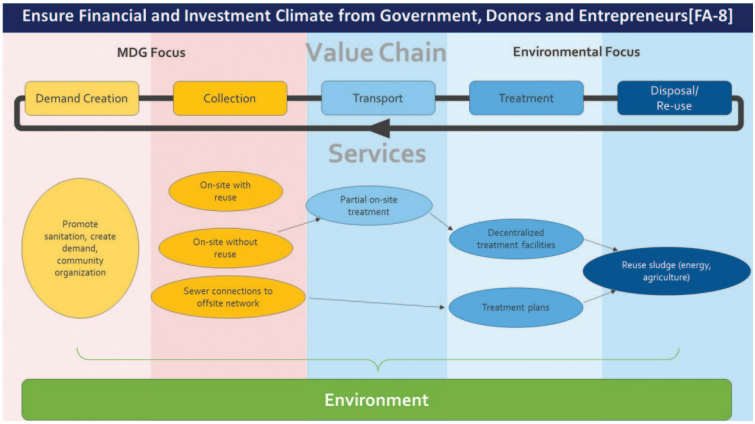
Ensure Financial and Investment Climate from Government, Donors and Entrepreneurs

It is useful to think of sanitation and DEWATS in market terms, with different actors demanding and providing services along what is now commonly referred to as the 'sanitation value chain'. Figure 14 shows that the sanitation value chain can be broken down into a series of services (also referred to as 'segments') which include the collection, transport, treatment, safe disposal and reuse of faeces and urine. In addition, given the importance of generating demand for sanitation, services relating to the promotion of demand for sanitation can also be included as the first step of the value chain.

Demand Creation

The government has a key policymaking role to stimulate private sector participation through various means such as political prioritisation, providing a functioning legal framework, ensuring transparency in the award of contracts, including fairness in tariff setting, and avoiding unnecessary political interference. Weak institutional frameworks

Figure 14: The Sanitation Value Chain (ESCAP, 2014)



and financing policies may result in an ineffective and inefficient use of existing resources within the sanitation market (ESCAP, 2013a).

While money for sanitation programmes exists, there is a growing need to ensure quality and sustained sanitation service delivery. Therefore, governments have to acknowledge and give sanitation adequate attention and promote it as a core national issue. In Asia, the policy areas of water and sanitation that should be improved include annual sector reviews, monitoring and evaluation, civil society participation, investment planning, sector absorption of government and donor budgets, use of equity criteria in budget allocations, and capacity building of human resources (World Health Organization, 2012).

While the demand for wastewater treatment is often low, it is difficult to recover costs from the public budget and even more challenging to attract investment from the private sector. This is especially true in developing countries where people are often concerned with more pressing issues, and priorities, such as access to food, water and roads.

Demand can be stimulated by conducting sanitation promotions and behaviour change campaigns, and is one of the interventions that governments can use to empower communities and households to cover more of the costs for sanitation hardware and reduce the share of the government expenditures.

Given the importance of such PR campaigns, location-specific demand studies using a systems approach should be conducted by the public sector (Government, academia, NGOs, etc.), prior to designing an intervention, so as to better understand what encourages or discourages households to invest (Trémolet, 2012).

Without stimulation coming from the public sector, households may often underestimate the value and tangible benefits of practising hygienic behaviour, and not urge the government to ensure the basic human right of access to sustainable sanitation services, including health benefits and other benefits from clean ecosystems (rivers and lakes) within urban and peri-urban areas.

Although this may be the case, experience suggests that focusing on intangibles can be more effective in stimulating demand, along with suggestion of policy tools and technological options that could be accessible through the market. Evidence presented by (Jenkins and Sugden, 2006) has shown that even if changes in behaviour are experienced, when focusing on health benefits, these new behaviours are only sustained over the short-

term. Instead, factors such as dignity, comfort and privacy appear to be more important factors for households to change their behaviour in the long-term.

Another way to change behaviour is to focus sanitation interventions in public areas, such as in schools, hotels, resorts and hospitals. Most changes in behaviour do not actually occur to individuals per se, but through introducing the new social norms for the next generation. Therefore, building toilets in schools can be an effective way of moving a community towards total sanitation services, where students assume the role of change agents in society (Trémolet, 2012). Another example of making next generations as agents of change would be mobilising the youth and tapping their social resources and engagement for raising awareness, advocacy, public relations campaigns and youth-led research projects for sanitation and health (ASSIST, 2015).

Another tool for stimulating demand is to target affordability through financing schemes, such as micro-credit. A toilet with a septic tank is a long-term investment, and if households are given the opportunity to repay it through micro-credit and loans, they are more likely to invest.

Loans can use targeted subsidies for poor households to reach as large a part of the population as possible. Please refer to details within the chapter on financial frameworks (Figure 16-18).

Collection and transport

Collection and transport are commonly carried out by private service providers. For many developing countries, finding credible suppliers providing quality services is a problem and is affecting the demand for sanitation services (WSP, 2005). To help solve this, organizations such as Bremen Overseas Research & Development Association (BORDA), Japan Sanitation Consortium (JSC) and Indah Water Konsortium (IWK) of Malaysia, can play important roles in helping to develop local private sector service providers with adequate technical skills.

There are also several interventions that government can undertake, such as regulating the sector by promoting firms that are registered and/or licensed, and taking actions against those who operate illegally. Another policy tool is to strengthen consumers' rights for compensation in cases where the service is subpar. To reach the poorest households, government can provide subsidies to communities.

One common issue with transport service providers is that they might dispose of wastes untreated into nearby lakes or rivers to save on transportation costs. A potential scheme to avoid this is to use Output-Based Aid (OBA) to encourage discharges at designated points and stimulate the society for conscious monitoring through the use of a regular check list and reporting mechanisms. This means paying service providers for waste (compensating good behaviour through positive reinforcement) brought to the safe disposal points rather than charging them to do so.

In contrast to the demand for wastewater treatment, which is often low, the demand for collection services is high because households with septic tanks have little choice but to get their tanks emptied. A potential issue for this segment is monopoly over service provisions in given areas. As in all situations of monopoly, governments need to help remove these when they occur.

Disposal/Reuse

Despite the huge potential for resource recovery, reuse of wastewater still remains at a nascent stage in most developing countries, and a lot more research is needed.

The waste (or sludge) after being transported and treated, ultimately needs to be either disposed of or reused. Large-scale disposal of urban wastewater often occurs in an unregulated manner. If value can be found in the by-products so as to be able to reuse them productively, this will be of great help to discourage unsafe disposal.

Although the BCR for some of these reuse schemes can be high, most of the markets have so far failed to scale up (Trémolet, 2012). High transport costs are a major hurdle in making the reuse of by-products economically viable. This is particularly true if urban areas are congested and fuel prices are high. Subsidies can be used to overcome this problem, but costs and benefits have to be analysed to determine if this is a good policy. For example, it makes little sense to subsidise gasoline used for transport, only to recover a smaller amount of biogas from the waste it is carrying. Therefore, the most successful examples of reuse are when treatment facilities are located near large agricultural or industrial areas where transport costs are limited (AQUAREC, 2006).

An option to overcome the cost of transportation is to reuse waste onsite. For example, there are urine dividing toilets, separating faeces and urine and other types of composting toilets that will allow for direct reuse in nearby fields. Case Study 6.3 shows in detail what financial and socio-economic benefits urine diversion may bring through the example of a Nepali project in 2008. This module could be high tech and costly if used alone, but with support from Government and enabling policies, it would be more affordable like in the Nepal case.

Another technology module is that of the domestic biogas digester. It has been especially successful in rural areas without access to electricity. To generate sufficient biogas for a household, it requires sufficient livestock numbers, and therefore is not suitable for urban areas. Biogas digesters come with a range of benefits. They provide biogas that can be used for cooking and for lighting at the night time. The sludge, which is the remaining output of the wastewater, can be used as a fertiliser for growing crops. The biogas digester also has the indirect benefit of helping to keep the garden clean and free of animal faeces.

According to a study by Water and Sanitation Program (WSP) in Viet Nam, a typical domestic biogas digester produces fertiliser worth USD 100, and biogas worth USD 50, annually. The construction cost is approximately USD 600 – USD 700 for a duration of 20 years if built with quality material (WSP, 2012b). Thus, the return on investment can be realised within six to eight years.

In addition to the usual O&M cost-recovery instruments, public investment programmes and donor funding in decentralised sanitation, there are a variety of innovative financing mechanisms that could be used for DEWATS implementation.

Any on-site wastewater treatment facilities (including some of the BORDA DEWATS and Packaged Aerated Wastewater Treatment Plant, - PAWTP - Johkasou in Japan), do not function as the wastewater treatment facility unless they are regularly desludged, otherwise facility would become the source of pollution by itself. Therefore, it is essential to establish the system, in which any type of DEWATS are regularly desludged according to the required frequency, the extracted sludge is transported to the sludge treatment facility, where it is properly treated and disposed. This process, which includes desludging, transport and treatment of sludge from on-site wastewater treatment facilities, is called as '**septage management**'.

Only in Japan and Malaysia, septage management has been given a proper consideration, while most of the septic tanks, being most popular form of on-site wastewater treatment facility in South-East Asia, are in deteriorated conditions. Septage Management System is presented as a Case Study 9.3.

Maximisation of Local Small-Scale Independent Private-Sector Involvement

Small-scale private-sector involvement can improve DEWATS service delivery through increased efficiency resulting from competition among service providers, and through a closer relationship with local communities (allowing more effective customer service and more efficient revenue collection). These smaller independent operators may perform auxiliary roles that centralised wastewater treatment service providers (e.g. utilities) are

unable to provide; or they may play a transitional role, performing functions that in five to 20 years' time may be taken over by the utility or municipality. Financing institutions and governments can catalyse these contributions and leverage local small-scale private-sector finance either by channelling finance directly to private-sector operators or by investing in programmes and systems that stimulate private-sector activity:

a) through support of small-scale delegated management;

b) through sanitation marketing initiatives;

c) through microfinance programmes and revolving funds that offer lines of credit to the local community operators of DEWATS services (ESCAP, 2015).

Output-Based Aid (OBA)

Under a typical OBA agreement between a financing institution (e.g. a development bank) and an implementing agency (e.g. a water-sector asset holder), disbursement of grant funds for DEWATS infrastructure construction is withheld until verification that the systems are operational. This approach is promoted by the Global Partnership on Output-Based Aid (GPOBA), a multi-donor trust fund managed by the World Bank, and its application in the water and sanitation sector has been relatively limited as compared to other sectors. OBA is increasingly being implemented in sanitation. Moreover, although OBA was initially promoted by the World Bank and GPOBA, it is increasingly being adopted by other major financing institutions and by national governments.

The Life-Cycle Costs Approach for Achieving Sustainable Financing

Detailed assessment of life-cycle costs is critical for pro-poor finance solutions. A major prerequisite for application of the Life-Cycle Costs Approach is to look at unit costs to serve the poorest of the poor within a given town, district or community, and to assess the differences between 'designed-for' and 'received' quality of service. This is a fundamental issue, as almost all existing data on costs refer to the service as designed, with no exploration of the real costs that people actually pay for the services received. Key questions that need to be considered include the following:

a) How much are poorer households paying compared with less poor households?

b) What are the cost components of delivering sanitation services to the lowest income quintile?

c) What proportion of a population can be allowed to experience a sub-standard quality of service before the entire service is seen as failing?

The COILED Framework

To ensure a financial and investment climate for DEWATS, and to move to outcome models across the investment spectrum, ESCAP recommends the COILED framework (Wood, 2011). COILED framework (Figure 15) is systems based and identifies the new **Capital** market tools for development based on achieving tangible **Outcomes**. It is structured by **Intermediaries** with the skills to apply the new financial innovation to the needs of "blended" capital sources, where the social mission is **Legally** built-in in its engagement with the commercial sector. The incentives and dynamism of local **Entrepreneurship** applied to social solutions can be delivered on scale through new **Distribution** mechanisms, which are enabled in many cases by new technology, civil society or new collaborative hybrids. As shown in the Figure 15, different sources of financing are combined in blended market returns, signifying that different returns to different financing sources can be paid within the same structure. The blending of these factors, therefore, provides the real opportunity of outcome-based models.

Figure 15: The COILED model (ESCAP, 2013a)

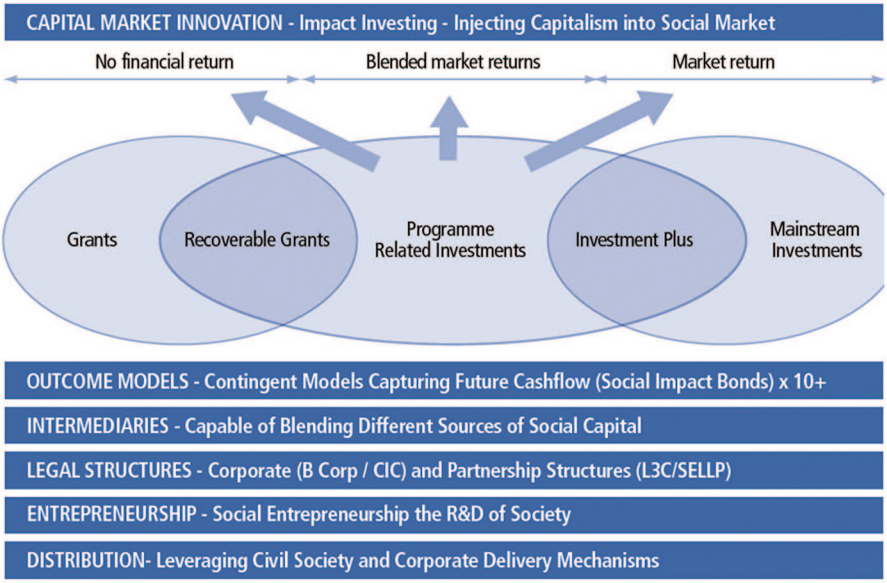
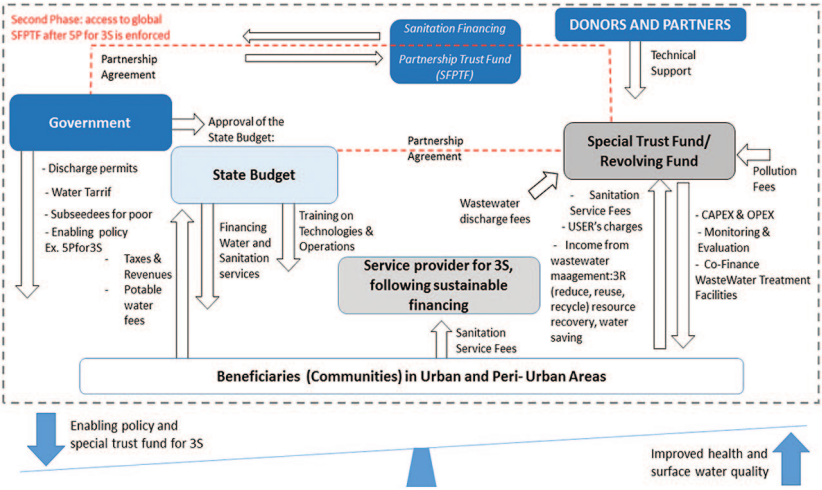


Figure 16: Framework for Financing Sustainable Sanitation Services



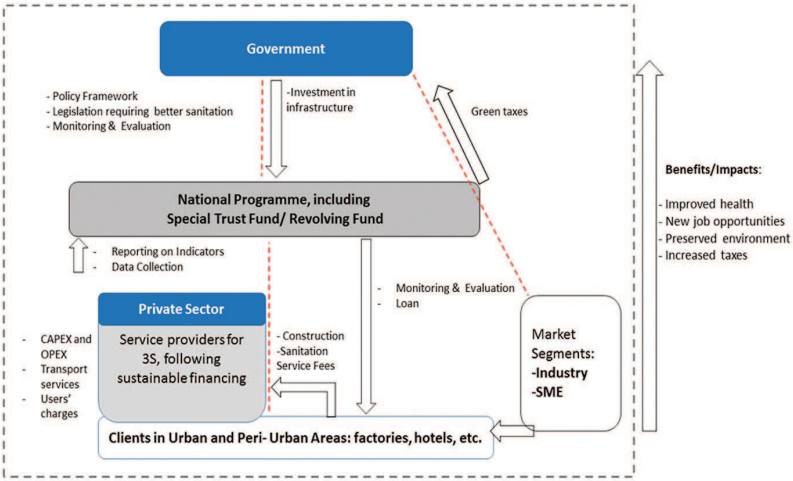
Progress-Linked Finance (PLF)

PLF is designed as a targeted use of public finance that can incentivise pro-poor service provision, while in the long term, leveraging both household finance (by extending improved services to more paying customers) and market finance (by increasing the financial viability of the service provider, and thus their ability to access and repay credit).

International funding for DEWATS

Figure 16 presents an example of framework for the development and financial management of sustainable sanitation services. The framework is based on a multi-stakeholder or public-private-partnership (PPP) approaches that include government, private sector, donors and communities. The role of the government is highlighted to set up enabling policies, manage the overall coordination, and ensure that regulatory frameworks are followed. The private sector is engaged in early planning, for example, as service providers, in particular in construction and operation & maintenance of the DEWATS. Donors and partners could cooperate with the government with funding and technical support through PPP agreements.

Figure 17: Financial scheme of wastewater treatment for industry and businesses



For example, one source of support is the Sanitation Financing Partnership Trust Fund (SFPTF), which was set up in 2014 in a partnership between Asian Development Bank (ADB) and the Bill & Melinda Gates Foundation. The SFPTF aims to support identification, testing and pilot implementation of innovative sanitation solutions—new policies, business models, and technologies—to increase support for non-networked sanitation (ADB, 2013b). ADB is administering the fund under its Water Financing Partnership.

Foundations

There are a growing number of foundations actively involved in the sanitation sector. The Bill and Melinda Gates Foundation is probably the most involved in sanitation, particularly in sub-Saharan Africa and South Asia. It focuses its grant making activities on three areas: sanitation science and technology, delivery model at scale, and policy and advocacy.

Financial Framework for Industry & SMEs

Figure 17 presents example of a financial scheme of wastewater treatment for industry and businesses. Development of wastewater treatment for industry and other businesses

needs to be driven by regulations. Campaigns to stimulate demand and highlight benefits are unlikely to work, as the costs for polluting the environment are mainly external costs, i.e. the negative effects are imposed on third parties and not on polluters themselves.

A guiding principle for industry and SMEs should be to try and avoid subsidies. In contrast to households, large industries have enough resources to pay for full cost recovery, and more incentives are needed to encourage water conservation and release of less polluted water. One way to achieve this is through environmental taxes, or "green taxes."

The "Low Carbon Growth Roadmap for Asia and the Pacific" by ESCAP proposes the green tax and budget reform towards environmental taxes (within the green growth framework). Basically, it refers to fiscal measures that have the potential to simultaneously increase revenue and foster green growth, such as through: 1) shifting the tax burden from traditional areas of taxation, such as income, savings and capital gains, to products and activities with harmful impact on the environment, like fossil fuels and waste, and 2) redirecting subsidies from environmentally harmful activities towards activities that promote green growth and poverty reduction.

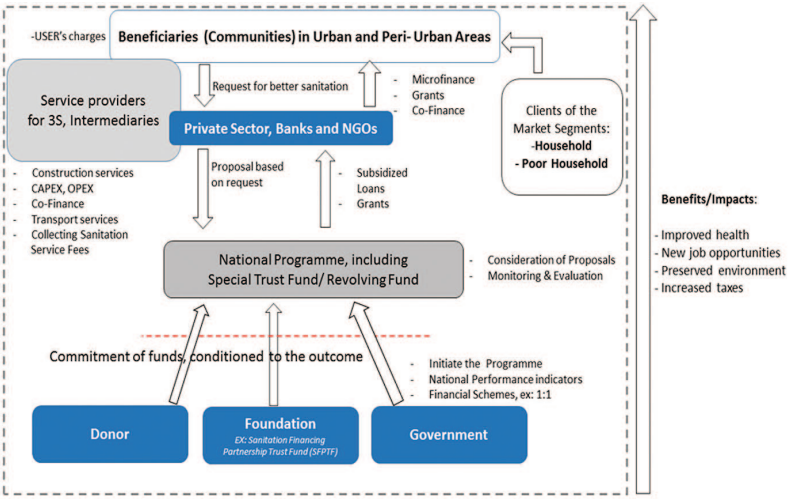
Financial framework for households

In contrast to industry, wastewater treatment for households should preferably be driven by stimulation of demand. No OECD country has managed to fund its sanitation infrastructure from private funds (ESCAP, 2013a) and this is unlikely to be possible for developing countries with even scarcer resources. The basic idea behind stimulating the demand is to adopt financing schemes to maximise leverage ratios, i.e. maximise the ratio of privately invested funds to public funds (Trémolet, 2012). It will also give households a greater sense of ownership, which will reduce the risk of building sanitation modules that will not be used.

Figure 18 presents an example of a financial scheme of wastewater treatment for households. In this framework, a National Programme should be set up to coordinate activities, ensure that responsibilities are in one location, and manage a special trust fund. Some of its activities and responsibilities would include:

- Marketing of DEWATS to stimulate demand
- Developing targeted subsidies and micro-credit schemes
- Developing partnerships with MFIs, service providers, and NGOs
- Attracting funding from donors to boost the special trust fund

Figure 18: Financial scheme of wastewater treatment for households



- Dispersal of funds to selected projects
- Encouraging and nurturing the private sector for constructing and installing septic tanks to ensure reliable supply
- Exploring private investment opportunities
- Monitoring and evaluation of ongoing and completed projects

In an ideal scenario, requests for better sanitation services should come from the community; requests that can be picked up by NGOs or other private service providers and translated into proposals for the National Programme.

Below is a list of related Policy Frameworks and Case Studies taken from Part 2:

Policy Framework 8.1: The WASH Cost Calculator

Policy Framework 8.2: COILED and Business Drivers in Sanitation

Policy Framework 8.3: Enabling the Supply Chain

Case Study 8.1: Progress-Linked Finance (PLF)

Case Study 8.2: International Funding for DEWATS

Case Study 8.3: The Sanitation Revolving Fund in Viet Nam

Case study 8.4: Community Hygiene Output-Based Aid (CHOBA)

Case Study 8.5: ADB Water Financing Partnership Facility (WFPF)

Case Study 8.6: Some Foundations Grantmaking for Cambodia, Lao People's Democratic Republic, Viet Nam

Case Study 8.7: Tariff Scheme in Phuket

Case Study 8.8: Helioz - WADI Financing schemes

Case Study 9.3: Septage Management System

FOCUS AREA 9

Ensure Exit Strategy and Sustainability

Governments can use several sustainability frameworks that show how to move from failing systems to reliable and lasting DEWATS services. For example, the Dutch WASH Alliance has developed a sustainability portal that uses the basic structure of five sustainability elements of FIETS—Financial Institutional Environmental Technical Social sustainability—to categorise many different frameworks, approaches and tools of the 3S model:

- **F**inancial: Continuity of DEWATS products and services through local financing (free from foreign funds);
- **I**nstitutional: Sustained and functional local DEWATS systems with capable institutions, policies and procedures;
- **E**nvironmental: Sustainable management of water and waste flows that is considerate of the natural environment and climate and can be recycled and reused;
- **T**echnical: Operation & maintenance of hardware by local people that preserves and not depletes (natural) resources;
- **S**ocial sustainability: Demand-driven, inclusive (equity), gender equal, culturally sensitive and need-based approach to WASH.

Beside this, there are a number of tools which are available to help facilitate the implementation and sustainability of water and sanitation services, such as the form of contract drafted, a set of legal documents, indicative list of water supply and services, action checklists, databases, financing feasibility reports, procurement management plans, and so on.

Related Case Studies provided in Part 2 include:

Case study 9.1: Egyptian Community Development Association (CDA) Model of Life-Cycle Costs

Case Study 9.2: City Sanitation Strategies Lessons Learned in Indonesia

Case Study 9.3: Septage Management System

STEP 3

This step is very much interlinked with the Focus Area 1 on setting up the Vision and Targets and each of the Focus Areas 2-9. The Evaluation mainly follows observation of the quality of the process of planning, design and operations and maintenance through the technical requirements to the facility. Step 3 or Focus Area 10 is described below.

FOCUS AREA 10

Evaluate DEWATS Implementation

The outputs of national and municipal sanitation implementation in a given year will be evaluated and used as inputs to revise the following year's action plan. Therefore, any sanitation development plan should include a monitoring and evaluation component, with three components of evaluation, and consider the milestones of planning and targeting (cross-reference to Focus Area 1):

1. **Effectiveness of the planning process:** Assess the effectiveness of the phases in the preparation of the national and city sanitation strategy, including sanitation mapping, defining the sanitation development framework, and preparation of reports. The results of the evaluation will be used to improve the preparation of national or citywide sanitation strategy in the next cycle in addition to assessing the coordination within the sanitation sector. This type of M&E is generally qualitative, interactive, and participatory.

2. **Implementation of sanitation development activities:** Assess the progress and level of achievement of sanitation development activities. This M&E uses indicators set at the time the sanitation activities were proposed for this assessment. Quantitative

results will be used to evaluate whether goals and targets have been reached. The results of the evaluation will be used to improve action plans for the following year.

3. **Benefits of sanitation development:** Assess the impact of sanitation development programmes against trends in sanitation conditions and general environmental conditions, level of sanitation coverage, sanitation behaviour of the community, public health conditions, and environmental health risk in each section of the city. The results of the evaluation will be compared with the baseline set in Step 2 and 4, and will be used as a reference to revise objectives and targets.

In regulating the DEWATS service provider, key performance indicators need to be set against the previously identified outcomes and targets in Focus Area 1, which are used to measure performance. These often include quality of the wastewater discharged, number of households connected to the local sewer, on-time payment of tariffs/fees, timely and efficient de-sludging of septic tanks and Operations & Maintenance of other DEWATS components, and how often the service is interrupted. A good monitoring and reporting system is needed from the beginning to monitor standards as per the contract and regulations. There is also a need to forge a dynamic relationship between the local government and the community, to ensure that the community is satisfied with the services they are receiving. Mainstreaming gender issues into these relationships will ensure that the voices of women and men are heard. The national Performance Measurement Framework can be designed by tapping into International Benchmarking Network for Water and Sanitation Utilities (IBNET). The objective of IBNET is to support access to comparative information that will help to promote best practices among water supply and sanitation providers at the national level, which will eventually provide consumers with access to high quality, and affordable water supply and sanitation services. It can also inform international experts on what works in which location. Furthermore, by providing access to comparative information, key stakeholders will get the information they need to do their job better.s

- DEWATS managers and employees can identify areas for improvement, adopt realistic targets and—not the least—convince authorities of the need for change;
- Governments can monitor and adjust sector policies and programmes;
- Regulators can ensure that customers get value, providers have incentives to perform;
- Customer groups and NGOs can exercise “voice” in an informed way;

- International aid agencies, advisers can identify what works, advise their clients accordingly, back the advice with convincing “before-after” and “with-without” stories;
- Private investors can identify viable markets and opportunities for creating value

A key challenge in the sanitation sector (and other services which do not simply relate to infrastructure delivery, but also require changes in behaviour and deeply rooted cultural practices) is that outputs and outcomes are often difficult to measure and even harder to attribute to a single intervention. As a result, the definition of reliable performance verification mechanisms can be challenging. Methods to measure behaviour change from sanitation interventions have been developed in recent years and can be used, but outputs may be comparatively harder to measure than for other sectors, thereby increasing the costs of performance verification (OBA sanitation framework).

Related Case Study and Policy Frameworks taken from Part 2 include:

Policy Framework 10.1: DEWATS Compliance Monitoring and Efficient Enforcement in San Fernando City, Philippines

Policy Framework 10.2: The Main components of DEWATS Quality Management System

Policy Framework 10.3: Performance Indicators for Sanitation Services

Case Study 10.3: Performance indicators for Sanitation services

PART 2:
CASE STUDIES AND PRINCIPLES OF DIFFERENT POLICY FRAMEWORKS

FOCUS AREA 1

Vision and Setup Targets

Policy Framework 1.1: Aligning with Global Goals and Targets

The vision of a proper wastewater treatment system with sustainable sanitation service provision should be an integral part of the national vision statement, and included in both the mid-term and long-term strategic plans. In this context, specific plans and strategies on wastewater management and sanitation are essential to ensure these issues are accorded sufficient priority and effectively inform the general framework at the national level. The planning process should start from Focus Area 1: Vision and Target Setting, which is inclusive and would lead to the sustainable development of the entity involved (e.g. community, district, municipality, provincial, and national) through the integration of environmental, economic and social impacts of DEWATS.

Therefore, existing national strategies and plans on wastewater and sanitation should be aligned and re-examined to follow the Sustainable Development Goals (SDGs) of post-2015 development agenda. For example, during the discussions of SDG 6 on "Ensure availability and sustainable management of water and sanitation for all", only SDG 6 is considering wastewater, namely, SDG 6.3: by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x percent globally (UNDESA, 2014).

Policy Framework 1.2: Successful Wastewater Management Policy

To successfully align wastewater management policy in support of sustainable development and the SDGs, the following strategies and practices are recommended:

- Passage and/or establishment of legislation, norms, standards (effluents, Standard Operating Procedures; SOP, Quality Management Plant; QMP) and subsidiary regulations (including a legislation in compliance with relevant obligations under international law), along with implementation, compliance, and enforcement actions to ensure their effectiveness;

- Clear delineation of roles, responsibilities and mandates among supporting actors (e.g. national and local authorities, operators, producers, importers) and adequate allocation of resources, authority, and power to fulfill these responsibilities (including sub-national or regional cooperation mechanisms);
- Monitoring of progress and gathering and publication of data and information;
- Providing appropriate support for all cooperating institutions and ensuring effective coordination among them all;
- Establishing protocols for the equitable sharing of technologies and best practices, and where appropriate, facilitating regional cooperation;
- Coordination with other relevant sustainable development policy areas, e.g. trade policy;
- Link to supporting frameworks for wastewater reduction, and for materials recovery and recycling operations (e.g. extended producer responsibility agreements or regulations);
- Creating systems of tariffs, fees, taxes and financial incentives that support the sector, such as providing necessary investments, or avoiding perverse subsidies;
- Creating pilot programmes and technical support/exchange initiatives to assist local implementation;
- Passage of appropriate regulation and control of private sector and household behavior;
- Building of inclusive community participation mechanisms;
- Education and publicity programs to change public attitudes and behavior;
- Maintaining programs to develop and maintain a body of skilled and committed waste management workers, not only in the waste management industry itself but also in government (at all levels) and in those organizations that are major generators of waste;
- Ensuring institutional mechanisms for review and reform of any of the above actions. (UNEP and UNITAR, 2013)

Case Study 1.1: Cycle of Sanitation Development in Indonesia (Policy level)

The development of sanitation in a city starts with the preparation of a strategic sanitation development strategy, officially known as the Citywide Sanitation Strategy. This strategy includes five sequential phase or steps to ensure successful municipal sanitation development.

Step 1: Preparing a citywide sanitation plan and strategy: This phase involves preparing a sanitation plan for the medium term (five years). The vision, mission, objectives, and development strategy are all determined here, including programmes and their indicative activities, related to both technical as well as non-technical aspects.

Step 2: Preparing an annual action plan: This phase reviews, consolidates, and prioritises sanitation development activities identified in the strategic plan into an annual action plan. The action plan provides detailed information on the activities, parties involved, and the estimated budget for each activity.

Step 3: Plan synchronisation: The sanitation action plans are inserted into the conventional development planning process. Proposed activities listed in the annual sanitation action plan will be translated by each municipal agency into their respective draft agency work plans (or Rancangan Rencana Kerja SKPD). This phase ends with budget endorsement for the proposed activities.

Step 4: Implementation: During implementation, the proposed activities are implemented as planned. Besides the municipal government, private companies, NGOs, and community groups may be involved. During the course of implementation, both the process and the performance will be monitored.

Step 5: Evaluation: The success or failure of the implementation phase is evaluated and measured in this phase. The results are used as inputs for adjusting the following year's action plan. In certain situations, the evaluation may also determine whether a Citywide Sanitation Strategy needs to be reviewed or revised. (WSP, 2010)

The subsequent series of steps indicate a continual development process. Implementation results of one cycle will be evaluated and used as inputs for adjusting the following year's action plan. The iterative process allows the development process to accommodate the dynamic conditions of a city and its residents.

Case Study 1.2: Organic Wastewater Treatment and Biogas Utilization in China

This case presents the findings from livestock, chicken breeding and cassava processing units equipped with biogas processing plants that can produce 10,000m3/d of biogas, thus reducing approximately 40,000 tons of CO2 equivalents per year. The process uses anaerobic fermentation technology to treat organic wastewater and produce biogas in the typical two-way cleaning process. See the case study presented by the Executive director of the Chinese Association of Circular Economy at the Regional Workshop on DEWATS, Bangkok. (Cai, 2014).

Case Study 1.3: Community-based Project Addresses Wastewater Treatment Challenges in Cambodia (Implementation level)

The project was initiated under the Joint UNDP GEF Small Grants Programme and PEMSEA. More than 600 families are located in Stung Hav. A majority of the families in the project area derive their income from fishing, with supplemental income coming from small-scale agricultural production. The Reservoir Utilisation and Community-based Sustainable Ecotourism Development project was implemented in order to achieve two specific objectives:

(1) rehabilitate a 5.9-hectare water reservoir to abate the impact of climate change on the water level, and recharge the underground water wells in the surrounding area that have dried up; and

(2) provide a water source for agricultural production and other supplemental livelihood activities.

The project resulted in the rehabilitation of a community reservoir with a holding superscript for m3. Furthermore, it was estimated that community members were, on average, able to save up to USD 34 on their water-use fees. The rehabilitated reservoir also serves to recharge groundwater in nearby water wells, thereby reducing the time and effort by family members (mostly women and children) to access and transport water for household use. A wastewater garden was created as a natural water treatment system to prevent water contamination from household wastewater discharge back into the reservoir and agriculture irrigation system. Planting of approximately 380 trees around the reservoir was also carried out to prevent soil erosion and maintain the reservoir's water-holding capacity, while also improving the overall aesthetics of the landscape. (UNEP and UN-HABITAT, 2010)

Case Study 1.4: Marching Together with a Citywide Sanitation Strategy (Policy level)

Total Sanitation Services (TSS) embodies the principles of an ideal sanitation service for a city. These principles should be used as reference for a city in improving its sanitation services. The key principles of TSS are as follows:

Accessibility: Sanitation services should be accessible to all city residents, including the poor.

Coverage: Sanitation services should have citywide coverage. No part of the city, including the slums, should be left without any sanitation services.

Technically complete: Sanitation services should include all components, i.e. domestic wastewater, solid waste and drainage.

Participatory: Sanitation services should be developed and operated with the participation of all stakeholders, in line with their respective roles and capacities. This includes relevant municipal agencies, private sector, NGOs, men and women as both users and home-owners or tenants.

Sustainability: Sanitation services need to function sustainably. Besides appropriate tariffs for operational funds, the services require a conducive institutional and regulatory framework.

Environmental Protection: Sanitation services should not create negative impacts on the environment or downstream areas. The services must be operated properly and comprehensively even if this requires higher operational costs. (WSP, 2010)

FOCUS AREA 2

Asses Sanitation Strategies and Socio-Economic Impacts of Policies

Case Study 2.1: Pros and Cons of DEWATS

According to FA6, the two key issues in choosing wastewater treatment technology are affordability and appropriateness. These have important implications for the selection of sanitation strategies that will be used, including the selection of wastewater treatment technologies. The seven main wastewater treatment technologies that are commonly used are: i) septic tank; ii) imhoff tank; iii) anaerobic filter; iv) baffled septic tank, v) horizontal gravel filter; vi) anaerobic pond; and vii) aerobic pond. Each is best suited for different environmental and social-economic conditions, which must be thoroughly evaluated prior to selection. All these technologies have advantages and disadvantages, especially in terms of requirements for remediation efficiency, cost and other factors, as shown in Table 1.

The technological choice may follow the step-by step gradual approach of progressive implementation. For example, the first four types may be chosen within a first step, namely, installation of the septic tank or imhoff tank (removes 50-60 percent of COD), anaerobic filter (removes 90 percent of COD) or baffled septic tank (removes 70 percent to 80 percent of COD). The anaerobic pond may serve as an alternative to the first technological choice. The next or second technological choice may be the horizontal gravel filter. An aerobic pond may serve as the third choice of technology. After thorough observation, the first choice may be replaced with the second and third choice depending on the local circumstances and the results of quality assurance, developed in consultation with the affected community of practice at the local level.

Case study 2.2: Major Lessons Learnt from DEWATS Projects in Peri-urban Areas of Viet Nam

A number of insights and lessons learnt on DEWATS have come from projects implemented in the peri-urban context in South-East Asian countries, such as Viet Nam through various pilot and demonstration activities. A compilation of these insights and lessons learnt include the following:

Table 1 Advantages and disadvantages of DEWATs system

Type	Kind of treatment	Used for type of wastewater	Advantages	Disadvantages
Septic tank	Sedimentation sludge stabilization	Wastewater of settle able solids especially domestic	Simple, durable, little space because of being underground	Low treatment efficiency, effluent, effluent odor
Imhoff tank	Sedimentation sludge stabilization	Wastewater of settle able solids especially domestic	Durable, little space because of being underground, effluent no odor	Less simple than septic tank, needs very regular desludging
Anaerobic filter	Anaerobic degradation of suspended and dissolved solids	Pre-settled domestic and industrial wastewater of narrow COD/BOD ratio	Simple and fairly durable if well-constructed and wastewater has been properly pre-treated, high treatment efficiency, little permanent space required because of being underground	Costly in construction because of special filter material, blockage of filter possible, effluent smells slightly despite high treatment efficiency
Baffled septic tank	Anaerobic degradation of suspended particles and solid	Pre-settled domestic and industrial wastewater of narrow COD/BOD ratio suitable for strong industrial wastewater	Simple and durable, high treatment efficiency, little permanent space required because of being underground, hardly and blockage, relatively cheap compared to anaerobic filter	Requires larger space of construction, less efficient with weak wastewater, longer start-up phase than anaerobic filter
Horizontal gravel filter	Anaerobic facultative anaerobic degradation of dissolved and fine suspended solids, pathogen removal	Suitable for domestic and weak industrial wastewater where settle able solids and most suspended already removed by pre-treatment	High treatment efficiency when properly constructed, pleasant landscaping possible, no wastewater above ground, can be cheap in construction if filter material is available at site, no nuisance of odor	High permanent space requirement, costly if right quality of gravel is not available, great knowledge and care required during construction, intensive maintenance and supervision during first 1-2 years.
Anaerobic pond	Anaerobic pond	Strong and medium industrial wastewater	Simple in construction, flexible in respect to degree of treatment, little maintenance	Wastewater pond occupies open land , there is always some odor, can even be stinky, mosquitoes are difficult to control

Type	Kind of treatment	Used for type of wastewater	Advantages	Disadvantages
Aerobic pond	Aerobic degradation pathogen removal	Weak, mostly pre-treated wastewater from domestic and industrial sources	Simple in construction, flexible in respect to degree of treatment little maintenance	Large permanent space requirement, mosquitoes and odor can become a nuisance if undersized, algae can raise effluent BOD
PAWTP (Johkasou)	Aerobic biochemical degradation	Domestic wastewater and other organic wastewater	Little space because of being underground, high treatment performance (BOD&T-N<=20mg/L, nitrogen removal, pathogen removal by disinfection), factory made (quality of construction assured), conveniently built for desludging, less accumulation of hydrogen sulfide in the tank.	Costly in construction and O/M compared to septic tank, regular maintenance work and desludging by technicians are required.

Source: BORDA and WEDC, 2009, Decentralized Wastewater Treatment Systems (DEWATS) Ibid. and inputs from Japan Sanitation Consortia

- There is a general lack of policies and national targets concerning peri-urban areas. Besides, at present there is no regulation for grey wastewater treatment, which represents up to 50 percent of the total wastewater. Septic tanks do not handle grey wastewater, as the current technology is not sufficient to achieve a good treatment quality, especially in the urban and peri-urban areas.
- Although piping systems allow numerous advantages, detailed field surveys should be strongly considered, especially in regard to the connectivity of existing households' wastewater outlet. Separate systems may reveal technical difficulty, and may be impossible to connect to the wastewater outlets of existing homes. Before recommending a separate piped system, the designer has to ensure that the real connectivity is worth the investment costs.
- Anaerobic baffled reactor (ABR) + Anaerobic filter (AF) technologies require a long starting time for proper functioning and effectiveness in wastewater treatment. Wastewater that is likely to undergo high hydraulic loads is not recommended for such devices since it can result in the flushing out of the anaerobic bacteria. Consequently, ABR + AF systems cannot tolerate a large input of rainwater, and thus are not appropriate for areas that experience heavy precipitation events in a short time frame.

- Among both the technical solutions proposed by BORDA within the prefeasibility study, the one using the existing combined system was associated with only one treatment component: CW. Since this solution would have required a large piece of land for construction, the partners of the project opted for separate systems associated with 'ABR + AF + Constructed Wetland (CW)'. However, this solution was not technically able to connect every household to the system. The rate of connection (80 percent) would have been higher for larger coverage areas. With small and simple systems preventing rainwater and solid wastes from entering the treatment installations, existing combined sewer could be a cheaper and easier alternative to collect wastewater for ABR + AF + CW. It can save a significant amount of money (separate system = 55 percent of investments costs).
- The technologies favored for implementation within the decentralized concept systems generally incur minimal O&M liabilities and investments, thus enabling the commune/community to self-provide its own sanitation service.
- People would preferably pay for a collective service system for their O&M, rather than for individual systems. More efforts need to be made in order to promote this type of technology in locales where people do not have any sufficient alternative to face the current and projected future wastewater hazards.
- Combined open sewer with anaerobic/aerobic ponds or CW can be a cheap alternative but requires a large tract of land.
- Residents might be enticed to discharge black and grey wastewater into the collective sewer system, and to invest in their in-house disposal system where it is lacking.
- High population and land use pressure on peri-urban land makes this parameter critical for decision makers. (ADB, 2009)

FOCUS AREA 3

Analyse Institutions and Partner

Policy Framework 3.1: Pro-Poor Public-Private Partnerships for Sustainable Sanitation Services (5P for 3S)

The 5P for 3S is a guide on Pro-poor Public-Private Partnership will be implemented to provide sustainable sanitation services in South-East Asia and will encourage a discussion on Issues and best practices learned on previously implemented 5P projects.

Definition of Public-Private Partnerships and Pro-Poor Public-Private Partnerships

Public-private partnerships are one of the best mechanisms to supplement and overcome government budgetary constraints, as they can allocate project-risks effectively between the public and private sector (ESCAP, 2013b).

While PPPs have proven their worth in traditional large-scale infrastructure projects, the addition of a 'Pro-Poor' element brings forward their application to smaller projects with active participation of the community.

Table 2. Characteristics of 3P and 5P (ESCAP, 2013b)

Category	Public-Private Partnerships	Pro-Poor Public-Private Partnerships
Projects	Large-scale infrastructure	Community-based infrastructure
Role of the poor	Consumers that receive benefits	Partners in business ventures
Stakeholders	Government and private sector	Broad number of institutions. Each of them play a distinct role while fulfilling their respective needs
Focus	Financial outcomes	Overall social and economic development

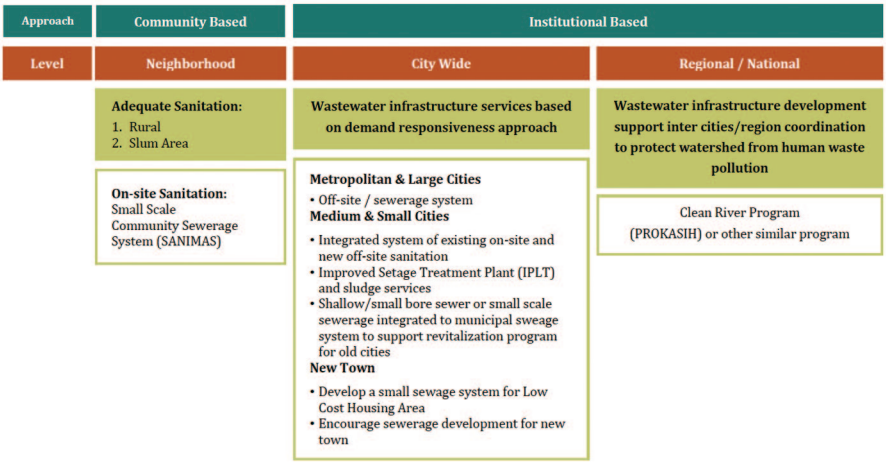
Case Study 3.1: BAPPENAS and the Sector Working Group in Indonesia

The principal national body for coordinating the implementation of Indonesia's national sanitation strategy is the National Steering Committee for Drinking Water and Environmental Health (Air Minum dan Penyehatan Lingkungan, AMPL). The executing body for AMPL is an intersectoral Working Group, POKJA AMPL. The POKJA comprises director-level and sub-director-level representatives and provides policy and implementation guidance to the implementing provincial, district, and municipal agencies. Both the Steering Committee and the POKJA are chaired by BAPPENAS, and comprise members from the ministries of Public Works, Health, Home Affairs, Finance, Industry, Environment, Public Housing, Education, and the Central Statistics Bureau. Many of the POKJA members have been collaborating closely on water and sanitation policy issues for more than a decade. The group shares a common vision of the PPSP and the STBM strategies, and meets frequently to maintain momentum and direction in the implementation process. There are also working-level "implementation units" supporting city sanitation strategies led by MPW, city/district AMPL working groups led by MOHA, and sanitation/health promotion groups led by MOH with the goal of achieving the PPSP objectives. (World Bank and AusAID, 2013)

Case Study 3.2: Individual, Community and Institutional-based Sanitation Approaches in Indonesia

In reference to FA3, there are many actors influencing the decision-making process with respect to wastewater management and sanitation issues. It is important for governments to map the key stakeholders, as well as analyse the current situation for each stakeholder in the different sectors (i.e. environment, society, economy), and propose options for more integrated planning, including bringing wastewater treatment systems into the core policy discussions and urban/peri-urban planning. As shown in Figure 3, an appropriate institutional framework and effective implementation of plans are required to improve the quality of water and sanitation in Indonesia.

Figure 1: Individual, Community and Institutional-based Sanitation Approaches (World Bank and AusAID, 2013)



Case Study 3.3: What Communities Can Expect to Manage in Indonesia

The decision-making process involved in wastewater management and sanitation may be delegated to lower administrative levels such as provincial, municipal or district authorities (See FA3: Analyze Institutions and Partners). Small-scale wastewater projects may be completely informal, initiated by local communities with or without the help of local government authority or non-governmental organizations. For instance, In Indonesia, community-managed DEWATS that communities can manage themselves offer the possibility of swift sanitation improvements in high-priority neighborhoods.

Three types of DEWATS are being implemented for small-scale wastewater treatment. To date, 77 percent have been community sanitation centers (CSCs), with toilets, washing and laundry facilities. Alternatively, in 16 percent of the cases wastewater is collected from household toilets by a simplified sewer system (SSS) and gravity-fed to a DEWATS plant. In a further 6 percent, a local sewer network and a communal sanitation facility are combined, making these the most inclusive as they accommodate both household connections as well as access to sanitation for those unable to connect to the network. Community management is reconceived as co-management, where user communities take responsibility for routine operation and maintenance, and local government and partners provide technical and non-technical support. Sustained improvements in sanitation and hygiene practices require ongoing reinforcement, support, and monitoring.

Community-managed DEWATS can be effective for serving poor communities where an appropriate system is built in the right location, the number of users is optimized and sustained, and there is shared responsibility with government for operation and maintenance. Community-managed DEWATS should be developed as part of a broader city sanitation plan, but only where a community has the motivation to make them work.

Figure 2 summarizes Indonesia's experience in implementing community-managed DEWATS on a growing scale.

Case Study3.4: SANIMAS ("Sanitation by Communities") in Indonesia

The original SANIMAS concept was aimed at developing community-managed simplified sewer systems as a cost-effective medium-term solution for wastewater management in high-density residential areas. The Ministry of Public Works (MPW), local governments and a number of non-governmental organizations (NGOs) have experimented with a range of technical options for both DEWATS and on-site wastewater management as interim sanitation solutions, since expanding coverage with conventional sewerage is often a slow process at best. Through the Government of Indonesia-sponsored SANIMAS Program, the MPW developed a community-led approach to installing communal sanitation systems that serve between 50 to 100 households each. In 2006, the concept was formally adopted by the MPW and has since been rapidly expanded with support from local governments, donor agencies, and NGOs. Three types of basic SANIMAS systems are currently constructed: (a) community sanitation centers comprising public toilets, bathing and washing facilities constructed over a primary treatment system

Figure 2: Community-managed DEWATS systems in Indonesia. (WSP, 2013)

(known as MCK+); (b) shallow sewerage systems connected to a communal anaerobic digester; and (c) combined systems with both shallow sewers for house connections, and a public facility at the digester site.

As of mid-2012, approximately 1,700 DEWATS have been constructed (including some 500 under the SANIMAS program). A recent evaluation of DEWATS found that the technical performance of most systems is satisfactory. Of the 120 DEWATS sampled, 92 percent were in compliance with MPW effluent standards for septic tanks (<100 mg/l BOD). However, it is as yet unclear if these community-managed systems will be de-sludged on a sufficiently regular basis to maintain performance. Sampled communities are satisfied it seems; however, the collected revenue was found inadequate to cover the cost of de-sludging as well as regular maintenance and major repairs. The majority of DEWATS that were constructed before 2010 were built under NGO-supported programs with extensive facilitation during the planning, design, and construction supervision process. Since the start of the recent scale-up, such a high level of facilitation has not always occurred. Accordingly as the Road Map for Acceleration of Urban Sanitation Development is implemented, adequate social and technical supervision must be provided through MPW and local governments to ensure that the systems are effectively used and sustainably maintained. (WSP, 2013).

FOCUS AREA 4

Analyse Costs and Benefits

Case Study 4.1: Affordability Assessment for DEWATS in Khe Tre town, Viet Nam

The DEWATS affordability assessment for Khe Tre town was based on combined water and wastewater charges covering the average O&M cost plus 5 percent of capital cost. The analysis takes into account possible different consumption levels for two low-income households, one with an average household income corresponding to the national poverty line and one corresponding to 70 percent of the poverty line. The poverty line is set at 400,000 VND/person/months as per Decision No. 02/2011/QD-TTg dated January 30, 2011 by the Prime Minister. In Khe Tre town, 27.7 percent of the households live below the poverty line.

Results of the assessment indicate that a low-income household with a consumption of 120 liters per capita per day (l/cd) still remains under the affordability level of 5 percent of this population. In respect to households below the poverty line, the charges would also be below the affordability of 5 percent if a consumption level of 80 l/cd or less is applied. This is even more true considering that the applied wastewater fee (O&M plus 5 percent capital cost) is actually an average with some cases being more expensive and others less. The respective level for domestic customers in a tariff system with cross subsidization, as already applied, is likely to lead to a considerably lower tariff level (ADB and SNV, 2012).

Case Study 4.2: Cost-effectiveness Analysis of 4 Wastewater Management Options in South Can Tho, Viet Nam

The study compared four wastewater management alternatives for the new urban center of South Can Tho, Viet Nam, with an area of 2,080 hectares that is likely to house more than 250,000 people in the future. The intent was to examine the applicability of recent innovations and international trends in wastewater management. Alternatives considered included centralized treatment (Option 1), decentralized treatment at the scale of several

hundred households (Option 2), a combination of a small-scale capacity upgraded to the centralized treatment plant and use of a proven decentralized technology for less dense areas likely to be developed in the future (Option 3), and an option with resource recovery in decentralized areas (Option 4). The resource recovery option involves urine diversion and storage for further use as fertilizer in nearby agricultural areas. A cost-effectiveness analysis of the four options was conducted that took into account the various stages of development in the new urban area. All capital and operation and maintenance costs were included (including energy, labor and equipment/asset replacement) over a 30-year period of analysis. A discount rate of 8 percent was applied to determine the net present value for each option. A participatory sustainability assessment process was conducted with project partners and seven government departments to consider the wider implications of each option. Criteria were then developed collaboratively for five broad areas of concern: technical and risk, social, environmental, economic and financial, and finally, the city future. Stakeholders engaged with relevant information about the various options, and made judgments of performance against the various criteria.

Table 3: Cost Analysis of Sanitation Options

Cost of option in present value Million VND (2010)	Option 1 Fully centralized	Option 2 Fully decentralized	Option 3 Centralized / Decentralized	Option 4 Centralized / decentralized with resource recovery in decentralized areas
Present Value Capital Cost	517,000 (27m USD)	276,000 (14m USD)	256,000 (13m USD)	330,000 (17m USD)
Present Value Operation and Maintenance Cost	4,000	1,900	2,200	2,300
Present Value Revenue from Fertiliser Sales				11,800
Net Present Value	-521,000 (-27m USD)	-278,000 (-14m USD)	-258,000 (-13m USD)	-321,000 (-18m USD)
Levelised cost per household	20 (1,000 USD)	11 (600 USD)	10 (500 USD)	13 (700 USD)
Levelised cost per m^3 water consumed	0.064 (3.4 USD)	0.030 (1.6 USD)	0.029 (1.6 USD)	0.036 (1.9 USD)

Case Study 4.3 Results of the Cost Analysis of Sanitation Options

Table 3 presents results of the cost analysis of four sanitation options, as follows: Option 1 (Fully centralized), Option 2 (Fully decentralized), Option 3 (centralized/decentralized) and Option 4 (centralized/decentralized with resource recovery in decentralized areas).

The conclusion derived from the sustainability assessment was that the most cost-effective option would be Option 3. Socially, public health would be protected and affordability is ensured through relatively low O&M costs (which are the basis for setting tariffs). Environmentally, the energy requirement for pumping (related to greenhouse gas emissions) is significantly less for Option 3 than for a fully centralized system, and the proposed treatment would contribute markedly to improved surface and groundwater quality. Financially, this option has the lowest net present value and leveled unit cost.

The second preference was for Option 4 (urine diversion and use as fertilizer), with strong interest in this option for future wastewater planning. The costs of this resource recovery option demonstrated that the revenue stream from fertilizer sales was significantly larger than the operational costs of the wastewater system. Option 1 (fully centralized) was the least favored as it had the highest overall cost and lowest performance against the environmental criteria. Overall, city stakeholders in Can Tho demonstrated a strong interest in the study and its findings. For a rapidly growing urban center such as South Can Tho, understanding the cost and sustainability implications of alternative sanitation infrastructure scenarios provides a much needed evidence base to assist government agencies in determining how best to invest and provide services. The study shows decentralized systems to be a valuable component in developing cost-effective, sustainable wastewater solutions, particularly in the face of uncertain rates of urbanization, and in the context of climate change mitigation and adaptation (Willetts et al., 2010).

Policy Framework4.1: Co-benefits of Sustainable Wastewater Management Options

Flexible wastewater options and technologies can benefit other urban sectors. Examples of co-benefits are given in Table 4.

Policy Framework 4.2: Assessing Cost-Effectiveness of Decentralized Wastewater Treatment

With regard to financial planning and risk, the small unit size of decentralized wastewater treatment system allows closer matching of capacity to actual growth in demand. Decentralized capacity can be built house-by-house, or cluster-by-cluster, in a “just in

Table 4: Co-benefits of sustainable wastewater management options

Options	Urban water management benefits	Selected quality of life benefits and co-benefits to other urban management sectors
Porous paving, swale, etc.	♻ Stom water management: Reduced run off ♻ Water supply: Recharge of underlying aquifers ♻ Wastewater treatment: Pollutant removal	♻ Urban economic activities: Reduced flooding risk ♻ Quality of life (aesthetic enjoyment and amenity value): Swales provide grassy areas
Rainwater harvesting	♻ Stom water management: Reduced runoff ♻ Water supply: Reduces demand for potable water	♻ Ecosystems: Less water needs to be abstracted from the environment ♻ Urban economic activities: Provides a more reliable supply of water ♻ Agriculture and urban green areas: Provides a cheap source of irrigation water ♻ Quality of life (general): Reduces water bills and provides a more secure supply of water
Green roofs	♻ Stom water management: Reduced runoff ♻ Waters supply: Can reduce demand for potable water ♻ Wastewater treatment: Removal of airborne pollutants from runoff	♻ Ecosystems: Creation of urban ecosystems ♻ Quality of life (Health): Improves air quality and reduces the urban heat island effect ♻ Quality of life (aesthetic enjoyment and amenity value): Increase in urban green space ♻ Energy: Reduced Energy consumption through the use of less heating and air condition
Detention ponds and basins	♻ Stom water management: Reduced runoff ♻ Water supply: Recharge of underlying aquifers ♻ Wastewater treatment: Pollutant removal	♻ Quality of life (aesthetic enjoyment and amenity value): Increase in urban green space. Use as playgrounds or sports facilities possibly during dry weather ♻ Urban economic activities: Encourages investment in urban areas that would otherwise be prone to flooding
Aquifer Storage and Recovery	♻ Water supply: Increases storage capacity ♻ Water supply: Protects water quality ♻ Stom water management: Runoff Reduction ♻ Wastewater treatment: Contaminant removal	♻ Quality of life (health): ASR provides natural protection from organic pollution and contaminated stromwater runoff ♻ Ecosystems: Subsurface base flows from ASR can be used to support natural ecosystems ♻ Agriculture and urban green areas: Provides a cheap source of irrigation water

Options	Urban water management benefits	Selected quality of life benefits and co-benefits to other urban management sectors
Urine diversion toilets	♻ Wastewater treatment: Reduces costs	♻ Agriculture and urban green areas: Provides a cheap fertilizer, and increases urban food security ♻ Ecosystems: Reduction of the nutrient load from wastewater effluent
Soil Aquifer Treatment	♻ Stom water management: Peak runoff reduction ♻ Wastewater treatment: Reduces costsl	♻ Agriculture and urban green areas: Provides a cheap source of irrigation water
Constructed wetlands	♻ Wastewater treatment: Reduces costs ♻ Stom water management: reduces runoff ♻ Water supply: Reduces potable water demand	♻ Quality of life (aesthetic enjoyment and amenity value): Increase in urban green space ♻ Urban development: On-site treatment of greywater and Stom water ♻ Ecosystems: Creation of urban Ecosystem
Waste Stabilisation Ponds	♻ Wastewater treatment: Reduces costs ♻ Water supply: Reduces potable water demand	♻ Agriculture and urban green areas; Provides a cheap source of irrigation water ♻ Quality of life (disposable income): Source of local income through harvesting of fish and plants
Biogas production from sludge	♻ Wastewater treatment: Reduces costs	♻ Agriculture: Provides a cheap fertilizer ♻ Quality of life (increased disposable income): Reduces cooking and heating bills
Sludge reuse	♻ Wastewater treatment: Reduces costs ♻ Stom water management: Improves soil moisture retention	♻ Ecosystems: Source of nutrients ♻ Agriculture and urban green areas; Provides a cheap feritlizer and soil conditioner ♻ Urban economic activities: Provides a cheap and renewable energy or fuel source
Greywater reuse	♻ Water supply: Reduces demand for potable water ♻ Wastewater treatment: Reduces costs	♻ Ecosystems: creation of urban ecosystems ♻ Agriculture and urban green areas: Provides a cheap source of irrigation water ♻ Quality of life (aesthetic enjoyment and amenity value): Increase in urban green space
Site planning	♻ Stom water management: Reduced runoff ♻ Wastewater treatment: Pollutants are contained at the source and nonpoint pollution is managed	♻ Ecosystems: Protection and enhancement of local habitats ♻ Urban development: Development of land can be implemented cost-effectively ♻ Quality of life (aesthetic enjoyment): Stom water-sensitive landscaping emphasizes aesthetic features

(ICLEI European Secretariat, 2011)

time" fashion. This provides a number of important benefits. For one, it moves the capital costs of capacity to the future. The result is often a more economical approach than building a centralized treatment capacity or extending sewers (depending on many other factors). Secondly, spreading out capital costs also typically means that a community needs to incur less debt, compared to the borrowing requirements of a large upfront capital investment in capacity. This can reduce the financing costs for the community. As an example, a spreadsheet for economic calculation of DEWATS is provided in Table 4.

Some potential financial disadvantages of decentralized systems are that the large number of systems can increase design, permission, financial, and other transaction costs of a wastewater service strategy. Also, lenders may perceive individual and small wastewater system debt as higher risk investments compared to municipal borrowing, so the unit costs of the incurred debt may be higher. Decentralization also concentrates the financial risks of individual system failures on individuals or clusters of residents, in contrast to the insurance-like spreading of risks of failure across large numbers of users that centralized systems can provide. (Hamilton et al., 2004)

Policy Framework 4.3: Indicators for Monitoring; Guidelines on Strategic Planning and Management of Water Resources

Types of indicators

There are two types of indicators.

a. System Status Indicators

The best status monitoring systems for water resources management are based on cause and effect frameworks. OECD's Drivers-Pressures-State-Impact-Response (DPSIR) framework (Figure 5) is the most widespread framework for classifying environmental indicators for use in status monitoring. This framework has been adopted by all EU countries as well as the United States, Canada, Australia, Japan and many developing countries, such as Malaysia. This cause and effect framework is based on five sub-types of indicators (see Figure 5 below), namely:

(i) Driving forces indicators: These describe social, demographic and economic forces and corresponding changes in lifestyles, consumption and production patterns (e.g., increased travel and leisure).

(ii) Pressure indicators: These describe pressures on the environment related to the drivers, (e.g., emissions of pollutants, use of land for roads, water withdrawals, deforestation, fisheries catch, etc.)

(iii) State indicators: These describe the quantity and quality of physical phenomenon (e.g., BOD, heavy metal concentrations)

(iv) Impact indicators: These measure how changes in the state of environment result in socio-economic impacts, e.g., impacts on crop productivity, value of fisheries output, water availability, flooding

(v) Response indicators: These measure the effectiveness of attempts to prevent, compensate, ameliorate or adapt to environmental changes. For example, the number of cars with pollution control, or houses with water efficient utilities, recycling amounts.

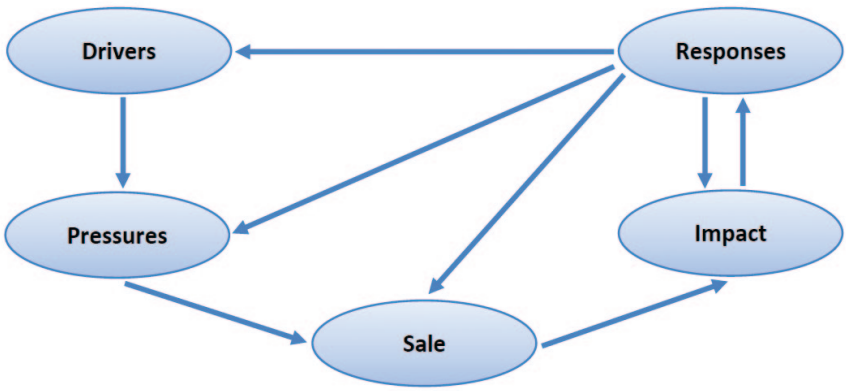
b. Performance Indicators

Performance monitoring and evaluation is oriented around the accomplishment of actions that transform inputs into outputs, and outcomes (sometimes called results). A performance-oriented framework is based on four sub-types of indicators, namely:

(i) Input indicators: These describe the resources used in producing an output or outcome. They are usually expressed as amounts of money or employee time.

(ii) Process indicators: These describe the quality and functional effectiveness of activities and tasks that add value to inputs to create outputs and outcomes. Quality

Figure 3: Indicators for monitoring (DPSIR) framework



may refer to the total cycle time of the process, to time between key steps of the process, or to the amount of rework time (to correct mis-steps) within the process.

(iii) Output indicators: These measure the products and services provided by a program or process. For example, the number of hectares reforested in a watershed. If a quality indicator is used, it might be the number of hectares reforested to match the schedule (i.e. on time).

(iv) Outcome indicators: This measure the results of a program activity compared to its intended purpose. It is often useful to distinguish intermediate outcomes from end outcomes when end outcomes cannot be determined for two or more years into the future.

(a) End outcome indicators: These measure the desired and ultimate results that are hoped to be achieved by the program activities. These results are directly related to the agency's missions, e.g., clean water.

(b) Intermediate outcome indicators: These measure outcomes that are expected to lead to the desired ends, but are not themselves the "ends". In many programs, a progression or sequence of outcomes usually occurs.

Developing effective indicators

In terms of performance indicators, there should not be a target or objective without an associated indicator, and no indicator without a target. Organizational goals and policy objectives only become clear when indicators are identified.

To be most effective, indicators should be:

(i) Useful

(ii) Reflect an agency's strategic plan and be linked to key policies

(iii) Be responsibility-linked: i.e. the "process owner", program manager or program team who is accountable for making progress on any indicator should be clearly identified.

(iv) Based on the right framework (DPSIR or Input-Process-Output- Outcome);

(v) Balanced: Does the set of indicators span all dimensions of efficiency, quality, client/ stakeholder satisfaction and mission effectiveness?

(vi) Analytically sound: Indicators should be designed with sound scientific understanding and should meet the scientific criteria of validity, reliability, and accuracy. Specifically, is the indicator valid and relevant? That is, does it really meet

the agency's objective? Does a change in measured value of the indicator reflect improvement or decline in performance?

(vii) Based on credible data: Often data sources have to be created as none have existed prior to the work.

(viii) Simple and easy to understand, especially by the key stakeholders groups.

(ix) Practical: Timely information at reasonable cost (human and financial resources) is very important.

(x) Limited in number: It is important to identify key performance indicators because acquiring and using information is costly. After identifying a list of potential indicators, a subset of the more extensive indicator list (priority indicators) should be selected to provide the maximum information with the least number of indicators.

(xi) Consistent over time: Do the selected indicators permit comparison of system and organizational performance from one time period to the next?

(xii) Conducive to aggregation, both spatially and thematically.

(xiii) Transparent: The construction of the indicator should be public and transparent.

(xiv) Developed in close cooperation with data users and data suppliers: i.e. both oversight and operational interests should be involved in developing and using the indicators, particularly the performance indicators.

In summary, developing indicators is a challenging process requiring considerable judgment. Trade-offs may be required among the desirable characteristics noted above in the interests of designing practical systems that serve the needs of the project and the stakeholders. Once defined, they should be continually refined as the usefulness of data is revealed, and as the organization strengthens its ability to measure and use indicator.

Policy Framework 4.4: Spreadsheet for Economic Calculation of DEWATS (based on annual costs)

Table 5 Spreadsheet for the economic calculation of DEWATS (based on annual cost)

Calculation of annual costs of DEWATS										
Planning and site supervision cost				Investment cost					Total annual cost	
Salaries for planning and supervision	Transport and allowance for visiting or staying at site	Cost for wastewater analysis	Total planning cost including overheads and acquisition	Cost of plot including site preparation	Main structures of 20 years durability	Secondary structures of 10 years durability	Equipment and parts of 6 years durability	Total Investment Cost (incl. land and planning)	Total Annual Cost (including land)	Total Annual Cost (excluding land)
l.c.	l.c.	l.c.	l.c.	l.c.	l.c.	l.c.	l.c.	l.c.	l.c.	l.c.
1.200	650	500	2.350	150.000	295.000	9.000	3.000	459.350	74.359	62.359
Wastewater Data				Annual Capital Costs						
Daily wastewater flow	Strength of wastewater inflow	COD/BOD ratio of inflow	Strength of wastewater outflow	Rate of interest in % p.a. (bank rate minus inflation)	Interest factorq = 1+i	On investment for land	On main structures of 20 years lifetime (incl. planning fees)	On secondary structures of 10 years lifetime	On equipment of 6 years lifetime	Total Capital Cost
m^3/d	mg/l COD	mg/l mg/l	mg/l COD	%		l.c. / year	l.c. / year	l.c. / year	l.c. / year	l.c. / year
20	3.000	2	450	8%	1.08	12.000	30.286	1.341	649	37.179
Operational Cost					Income from biogas and other sources					Explanation
Cost of personal for operation, maintenance and repair	Cost of material for operation, maintenance and repair	Cost of power (e.g. cost for pumping)	Cost of treatment additives (e.g. chlorine)	Total Operation Cost	Daily biogas production (70% CH4, 50% dissolved)	Price 1 liter of Kerosene (1m3 CH4 = 0.85L kerosene)	Annual income from biogas p.a.	Other annual income or savings (e.g. fertilizer, fees)	Total Income per annum	l.c. = local currency; mg/l = g/m^3
l.c. / year	l.c. / year	l.c. / year	l.c. / year	l.c. / year	m^3/d	l.c. / liter	l.c. / year	l.c. / year	l.c. / year	
100	100	50	0	250	12.75	2.69	7.347	0	7.347	

Source: (BORDA and WEDC, 2009)

FOCUS AREA 5

Asses the Strategic Future of DEWATS

Case Study 5.1: Components of Sanitation Mapping

When considering the various components of sanitation, there is a lot of information that needs to be collected in order to undertake an accurate sanitation mapping process. Given below is a list of the types of data needed. However, only information that will be analyzed should be collected.

- City Overview
- Community Health Profile
- Sanitation Facilities & Services
- Institutions & Regulations
- Financing
- Community Engagement and Participation
- NGO Participation
- Private Sector Participation
- Sanitation Programs & Projects
- Development Plans
- Problems & Obstacles
- Media Communications
- Roles of Women
- Environmental Health Risk Assessment
- Community Demand

All the items listed above make up the state of the city sanitation mapping, whereby

sanitation development trends, needs, and opportunities are identified. Recommendations for intervention follow from the sanitation mapping process and results.

Case Study5.2: The National Sewerage and Septage Management Programme in the Philippines

In June 2012, the Philippine Government approved the National Sewerage and Septage Management Program (NSSMP). For the first time in SEA, a national government is pursuing an agenda to drive wide-scale sanitation improvement through the implementation of sewerage and Fecal Sludge Management (FSM) projects. The NSSMP will provide up to a 40 percent cost share to local cities and municipalities to implement sewerage projects. It will also launch a national program to promote FSM and the values associated with regular septic tank cleaning. The NSSMP will further provide technical assistance and targeted outreach and training to motivate and build the capacity of local officials to undertake FSM programs. While no national government cost share is to be applied to FSM projects, these programs can generally be designed, operated, and maintained at a significantly lower cost, with operation and maintenance expenses spread among the municipal government, private companies, and end-users through use and service fees (tariffs).

Case study 5.3: Five-Point Strategy for Promoting Pro-Poor Household Connections inViet Nam

In both the cities of Da Lat and Boun Ma Thout in Viet Nam, a series of information, regulatory, institutional, and pro-poor measures were needed to effectively promote household wastewater connections. These included:

- The launching of an Information Education Communication (IEC) campaign to increase public awareness and change behavior with regard to open defecation through CLTS. These efforts included promoting the benefits of connecting households to the public sewer system both in terms of family health and quality of life as well as environmental improvement for the community as a whole.
- The issuance of a decree by local authorities mandating that all households located within an area served by public sewerage system or drains must be connected to the sewage treatment system.
- A government subsidy was provided for household sewage connections to encourage households to connect and to reduce the financial burden on the more vulnerable households, especially the poor.

- Local authorities established a specific house connection group or department responsible for operating the sewer system. The purpose of such a group was to promote, issue permits and monitor the permitted household connections throughout the sewerage service area.
- Household connections are required to be an integral part of project formulation, funding, and implementation for any new sanitation projects as well as any existing sanitation projects that will be expanded. (ESCAP, 2015)

Case Study 5.4: The Unified Sanitation Sector Strategy and Action Plan in Viet Nam

In Viet Nam, the targets of three national-level sanitation programs, including the National Rural Clean Water Supply and Sanitation Strategy, National Strategy for Integrated Management of Solid Waste in Viet Nam to 2025 and Vision to 2050, and the Orientation for Drainage Development in Urban Areas, were aggregated together into one comprehensive unified sanitation strategy and action plan. This led to the following outcomes:

- Establishing an enabling environment for effective coordination among the different state agencies and stakeholders in environment protection activities;
- Greater access to improved sanitation in rural and urban areas, especially the poor;
- Development of a National Strategy and a National Target Programme for Urban Sanitation that applies the principles of Integrated Water Resources Management and a River Basin approach to urban sanitation based on Law of Environment 2005 and Law of Water Resources 2012;
- Establishment of clear regulatory mechanisms for the sector, the consolidation of service providers, and an emphasis on water quality management across river basins leading to improved sector performance monitoring at the central level
- The U3SAP formulation process included the following four steps:

  Step 1: Formulating a Unified Sanitation Sector Strategy and Action Plan (U3SAP) Outline

  Step 2: Drafting of the U3SAP

  Step 3: Consensus-building for U3SAP

  Step 4: Finalization of U3SAP and submission for approval

The Ministry of Construction with technical assistance supported by the World Bank has prepared the final report on U3SAP. Within the U3SAP project, a demonstration project

on Environmental Sanitation Development had been carried out in Can Tho City (2011-2013). The output is a City Action Plan on U3SAP (drainage/ wastewater and solid waste management). In 2014, the Final Report was submitted to the Government of Viet Nam (Prime Minister) with two options for approval:

- Option 1: National Strategy on Sanitation;
- Option 2: Action Plan to integrate into current national policies, regulations, legal documents in the sector. Central and local governments of Can Tho City are seeking financial resources for implementing the AP done under the demonstration project in Can Tho.

Case Study 5.5: Mainstreaming DEWATS into Integrated Wastewater and Septage Management

In the early 2000s, with support from the USAID-financed CLEAN Urban project, the City of Malang, Indonesia, initiated a decentralized sewerage pilot project aiming to demonstrate effective collaboration between communities and the city cleansing department (Dina's Kebersihan, DK). It began with the setting up of a mobile support team in the city's Human Settlements Department to provide post-construction support to community-managed DEWATS. With donor financing coupled with joint planning between the community and DK, a site was identified and land contributed by the community for a wastewater treatment plant with the capacity to serve about 10,000 people in two wards within the city. A plan for a network of shallow sewers was developed and neighborhood groups were formed to provide labor for the tertiary network construction and subsequent periodic maintenance. The local government was expected to finance expansion of the trunk sewers to allow more neighborhoods to be connected. The neighborhood groups collect regular fees from the connected households to finance periodic pipe de-clogging and repairs of the tertiary network. In the first years of the pilot project, connections rapidly expanded to about 1,000 households, but further expansion required extensions of the trunk lines by DK, which manages the treatment plant with financing from the municipal government. This is posing a challenge for DK, as up to now the local government has not provided finances to expand the trunk network to allow additional neighborhoods to be connected to the system.

The Malang experience provides a good example of a model for local government and community collaboration, with lessons on the possible unforeseen challenges and pitfalls in similar municipal sanitation strategies. A very large proportion of the households in the

original service area have connected to the sewer system, and they pay regular tariffs for the sewage service. DK has proven capable of managing the small treatment plant, providing a de-sludging service besides handling septage and drainage in the city. However, it is dependent on local government financing rather than on tariffs to cover its operating costs. If the local government invests in expanding the sewage network to allow additional connections as per the capacity of the treatment plant, it is likely that the system could achieve financial sustainability without local government financing. (WSP, 2013)

Case study 5.6: Capacity Building at Scale: One-stop Shops, Indonesia

In Indonesia, the one-stop shop has been used a model of sanitation provision where customers can select the latrine option and organize for their household latrine to be constructed in one visit. One-stop shops are run by sanitation entrepreneurs, with local governments providing resources to support the training and coordination for these entrepreneurs. The role of the public sector is to generate demand, develop capacity, accredit one-stop providers, and promote and monitor the quality of trained providers. The public sector must also oversee the increased community demand for improved latrines with entrepreneurs ready to serve them. The private sector's role is to ensure product and service availability to meet the local demand at an affordable price and acceptable quality, as well as respond to community demand. Sanitation entrepreneurs have also formed the Asosiasi Pengelola and Pemberdayaan Sanitasi Indonesia (APPSANI, or Indonesia Sanitation Developer and Empowerment Association). APPSANI entrepreneurs will be able to collectively advocate standardization of pricing, standards, recruitment of new entrepreneurs and a training curriculum. (UNICEF, 2013)

FOCUS AREA 6

Choose the Technology System

Case Study 6.1: Wastewater Treatment and Reuse through Constructed Wetlands in Vientiane, Lao People's Democratic Republic

The increase in pollution and the steady decline in drainage water quality is becoming a serious challenge to managing Vientiane's water resources as it gets more and more urbanized. The situation could easily worsen due to the continuous loss of the city's surrounding wetlands. As flooding is still a very big problem during the rainy season, traditional combined sewage overflow is not suitable for Vientiane capital city. Heavy rainfall will cause system overload, which will lead to raw wastewater overflow by dysfunctional septic tanks. Although the construction of a centralized treatment system should be part of the long-term planning of the city, a decentralized approach should be immediately promoted outside of the city center. A combination of properly functioning septic tanks (primary treatment) and small individual or communal treatment wetlands (secondary treatment) would be highly suitable.

The EU-funded Thatuang Marsh wastewater management project was designed to improve wastewater treatment and drainage for the central Vientiane area. The project designed and built a system of stabilization ponds at Thatuang Marsh to serve an estimated population of 44,590 (circa 2005) with a per capita BOD discharge rate of 45g/capita/day, assuming 50 percent of the pollutant load would reach the treatment plant. The EU-ponds restoration could be seen as an example of an approach to build a larger neighborhood treatment system that would not require the installation of household septic tanks. In all designs, raw wastewater would be treated and reused locally. Any sustainable development of Vientiane capital city should also include the long-term implementation of a Sustainable Urban Drainage System along with a Resource-Based Sanitation (Ecological Sanitation) approach. Such approaches would not only help protect the remaining urban wetlands, but would also contribute to both renewable energy production (e.g. biogas from septic tanks sludge and aquatic plants cropping) and long-term food security (e.g., urine as fertilizer and biogas residues as soil conditioners).

Case Study 6.2: Centralised Wastewater Treatment Plant in Sihanoukville, Cambodia

The Sihanoukville wastewater treatment plant was constructed in May 2003 with an ADB loan, and completed in July 2005. The wastewater unit is currently operated under the administration of the Department of Public Works and Transport, with the responsibility of financial management being shouldered jointly by the Ministry of Public Works and Transport and the Ministry of Economy and Finance in the form of a semi-autonomous entity.

This wastewater treatment plant with improved sewerage network, completed through an ADB loan, currently obtains its O&M budget from tariffs charged to households and large service and industrial establishments. Individual households are charged USD 1 a month, while larger establishments, including industries, are charged on the basis of their service capacities. Industry and large service establishments comprise 60 percent of the total O&M while households tariff comprise the remaining 40 percent. The investment cost (USD 11M) is being paid by the government. It has been an expensive undertaking, costing almost USD 5,500 per connected household based on its expected operating capacity (or USD 544 per year, based on a 20-year lifespan and discount rate of 8 percent). Given that in the years after its construction, only around 20 percent of the households have connected (this requires a one-off connection fee and a monthly wastewater fee), the actual construction cost of USD 27,500 per household is five times the planned cost per household. This translates to a benefit-cost ratio of 0.14 under full capacity use, and 0.03 under actual capacity use. However, the value of the improved environment and sea water quality to residents and tourists, and the associated revenues from tourism which are potentially substantial have not been included in the calculation (Chivina, 2014).

Case Study 6.3: Water Aid in Nepal - Ecological Sanitation (EcoSan) (Maharjan, 2008)

Many of the toilets currently used in Nepal contribute to the spread of disease. Toilets connected to sewage systems often empty directly into rivers and streams, while pit toilets can leach contents into groundwater, spreading pathogens from faeces and excess nutrients from urine into local water bodies. Excess nutrients in water bodies can lead to excess algae growth, which leads to eutrophication, depriving fish of oxygen and making water unsafe for human consumption or bathing. Pathogens from faeces can lead to disease for those bathing in, washing with, and drinking contaminated water. For children and vulnerable individuals, diarrhoea and waterborne illnesses can lead to dehydration and death.

As an alternative to these harmful cycles, EcoSan's primary goals are:

- Prevention of disease
- Recovery of nutrients
- Protection of the environment

EcoSan stores faeces in a composting chamber where ash, lime or other additives are used to raise the pH of the waste, thereby breaking down pathogens. After about six months of storage without the addition of fresh faeces, the resulting material should be dry, rich, soil-like compost containing relatively few pathogens and may be used as a soil conditioner for various agricultural products (e.g. fruit trees and food forest).

If EcoSan is installed and used properly, it effectively assists in the prevention of disease. Unlike conventional toilets, urine diverting EcoSan toilets generate benefits in the form of organic fertiliser that can replace the use of chemical fertilisers. Experiments carried out by ENPHO have shown that urine can replace the use of certain chemical fertilisers and it can also significantly improve the quality of compost if it is added to compost piles. On average, an adult produces 550 litres of urine annually. The volume of the urine contains four kilograms of nitrogen, 400 grams of phosphorus and one kilogram of potash. Faeces have similar nutrients and effects on soil as that of compost. The nitrogen, phosphorus and potash contents of urine and faeces increase the productivity of agricultural crops and vegetables[2]. Thus they carry a certain monetary value and hence, a financial analysis has been carried out to examine the financial viability of an EcoSan toilet, particularly with regard to the pay-back period.

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[2] *It is not recommended that human faeces by directly applied to the soil of vegetable crops whose leaves have contact with the soil.*

The following key assumptions are made for the financial analysis of EcoSan:

- The construction time for EcoSan toilets is less than one year.
- All costs and benefits are expressed in April 2007 prices.
- The generation of benefits are realised in the value of urine and faeces collected in the toilet as a cost-free replacement for chemical fertilisers.
- Financial analysis of an EcoSan toilet is carried out over a period of 20 years.
- The residual value of the civil structure of the toilet is assumed to be 60 percent of the initial cost in the 20th year.

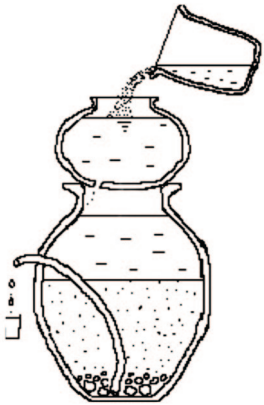
Case Study 6.4: Drinking Water through Household-Level Bio-Sand Filtration in Pakistan

The Nadi Water Filter is a unique solution to extract potable drinking water from contaminated water at the household level by using everyday objects such as clay pots and sand. This is accomplished by the utilisation of biological water treatment through microbes.

The advantages of this method lie in its relative simplicity as the filter is easily assembled, there is little or no cost of the materials involved, and its requires low maintenance. It basically involves filling up a clay pot with different sized rocks and sand that will provide the living environment for beneficial bacteria, which in return purify ingested wastewater that can then be used for drinking water after a few days. The only materials needed are a Nadi clay pot, Matka clay, sand, gravel of different mesh sizes, and a rubber tube.

One single filter may have tremendous implications for households:

- It may serve up to 30 people
- Helps families save USD 5 to USD 10 per month
- Save cost of travel and transportation
- Relieve women from fetching water from long distances



- Helps improve the health of women and children, thereby saving USD 10 to USD 20 per month
- Helps to save energy by using local materials (AHD, 2012)

Since 2007 the Association for Humanitarian Development (AHD) in Pakistan has installed more than 23.000 Nadi Filters and provided secured drinking water to 2.300 flood-affected families from 2010 to 2013. For its accomplishments, AHD won the Energy Globe Award 2014 (Energy Globe, 2014).

Policy Framework 6.1: Wastewater Methane Mitigation and Recovery Approaches

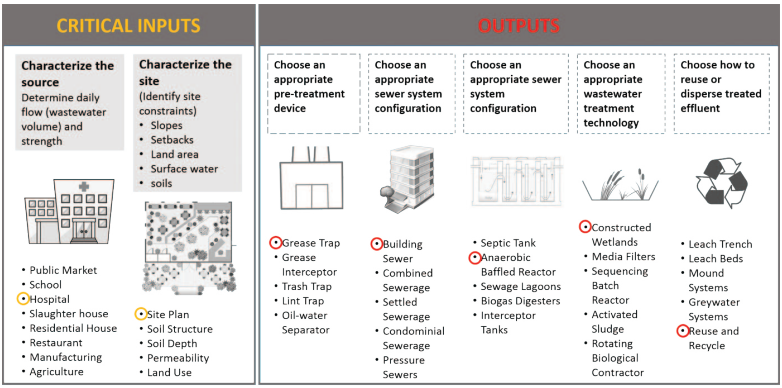
In the context of climate change, there are several approaches to wastewater methane mitigation and recovery. These are highlighted in the Table 6.

Table 6: Greenhouse gases mitigation and recovery approach

Recovery Approach	Description
Installation of anaerobic sludge digester (new construction or retrofit of existing aerobic treatment systems)	Many facilities in the developed world effectively use anaerobic digesters in tandem with an aerobic treatment to process wastewater bio-solids. This produces biogas that is used onsite to offset the use of conventional fuel that would otherwise be used for energy at the wastewater treatment facility. In addition to producing a "free fuel" that can be used to generate energy, anaerobic digesters can improve water quality, isolate and destroy disease-causing organisms that might pose a risk to human and animal health, and provide additional revenue streams, such as organic soil fertilizers that can be produced from digester effluents. The best way to realize the potential of anaerobic sludge digesters is either through the construction of new centralized aerobic facilities driven by increasing population growth and demand, or through the retrofitting of existing centralized aerobic treatment facilities.

Recovery Approach	Description
Installation of biogaz capture system at the existing open air anaerobic lagoons	Biogas capture systems for anaerobic lagoons are the simplest and easiest method of biogas implementation, and have been used around the world as a manure management practice at livestock farms. Many parts of the world currently rely on open-air anaerobic lagoons to treat wastewater. Rather than investing in a new centralized aerobic treatment plant, covering an existing lagoon and capturing the biogas can be the most economically feasible means to reduce methane emissions. This is especially true in regions of the world that do not have the resources to invest in new infrastructure, or cannot support and maintain a centralized aerobic treatment facility. However, several barriers have prevented its large-scale use, including absence of the need to install covers, lack of experience in applying the technology to municipal systems in developing countries, and lack of capacity in developing countries to support the design, construction, and installation of covered lagoons.
Installation of new centralise aérobic treatment facilities or covered lagoons	Installation of new centralized aerobic treatment systems or new covered lagoons to treat wastewater in place of less-advanced de-centralized treatment options (or no treatment at all) can also greatly reduce current and future methane emissions associated with wastewater. This option is most viable in areas with expanding populations that have the infrastructure and energy available to support such systems. Although conversion of anaerobic systems to aerobic systems can be quite costly for existing communities, it is less so for a new community under development or experiencing high growth. For these communities, installation of a centralized aerobic treatment system can prevent increases in future emissions due to the increasing population, and may in fact result in decreases to overall methane emissions even while populations increase.
Optimize existing facilities/systems that are not being operated correctly and implement proper operation and maintenance (O&M)	Optimization of existing facilities and wastewater systems that are not being operated correctly to mitigate methane emissions is a viable alternative to installing new facilities or wastewater treatment processes such as anaerobic digesters. Proper O&M also ensures that facilities continue to operate efficiently with minimal methane emissions. (Global Methane Initiative, 2012)

Figure 4: Critical technical inputs and outputs for DEWATS



Policy Framework 6.2: Critical Technical Inputs and Outputs for the Design of DEWATS

Figure 4 illustrates the critical inputs for choosing appropriate DEWATS technology along with arange of possible system configurations.

The process starts on the left with source and site characterization; with that knowledge, appropriate decisions on specific technologies are made.(Robbins, 2011)

Policy Framework 6.3: Advantages of Prefabricated Modular DEWATS Components

There are a number of advantages found in the use of prefabricated modular DEWATS components. They include some of the following:

- Mitigation of the shortage of wastewater treatment design and construction professionals due to the use of standardized modular components;
- Achievement of consistent manufacturing and construction quality by pre-certified manufacturers;
- Reduction in the implementation time and simplification of construction on site;
- Suitable for challenging environments in tidal areas or a high water table;
- Reduce the project oversight responsibilities of the community management organization;
- Reduce the facilitator's scope of work and training requirements;
- More transparent standardized costing
- Easier maintenance with lightweight manhole covers;

(BORDA and WEDC, 2009)

FOCUS AREA 7

Increase the Demand for DEWATS

Case Study 7.1: Marketing the Waste as a Resource

Generally, there is limited experience and research on the reuse of wastewater for other purposes in the SEA. Nutrient reuse, water reuse, and energy production from wastewater is not common in Cambodia, Laos and Viet Nam. However, there are several successful experiences in the region that can provide lessons in this field. In South Korea, as part of the green growth initiatives, there are plans to increase water reuse and reduce energy use at treatment plants. Increasingly, water in Korea is called the "Blue Gold" of the future. Similarly, in Singapore recent advances in converting wastewater into drinking water have shown that concrete measures can be taken to address the issue of water shortage that many cities will increasingly face in the future. In Singapore, the recycled water is called NEWater and it currently supplies about 30 percent of the national water demand, especially for manufacturing utilization. It is expected that by 2060, 50 percent of the water consumed in Singapore will be recycled water. Singapore also plans to increase its supply of desalinated water, with the target that by 2060 approximately 80 percent of the water consumed in the country will be either NEWater or derived from desalinated water.

Case study 7.2: Lessons Learnt from Capacity and Willingness to Pay for DEWATS in Indonesia

There are a number of important lessons learnt from the experiences of Indonesia in general capacity building and creating a willingness to pay for wastewater treatment facilities by the public. Some of these include the following:

- Build understanding of the real costs of keeping DEWATS facilities working long term.
- Lay greater emphasis on financial management, and on raising sufficient revenue when training community management representatives.
- Increase understanding among users of the benefits of improved sanitation and a clean environment, and use social marketing and other methods to maintain willingness to pay for these benefits.

- Ensure local government budgets for its co-management responsibilities, including monitoring, ad hoc support, and major maintenance.

Improvements in hygiene were evident based on a health impact assessment conducted in 2010. BORDA's assessment of 68 sites across Indonesia revealed lower rates of open defecation, higher toilet usage and usage of soap at critical times, and reportedly better quality of water from the main source of water for bathing and cooking as well as an improvement in privacy for women compared to the baseline. There was a very low incidence of reversion to unimproved toilets and open defecation. (WSP, 2013)

Case Study 7.3: Integrated Water Management Policy in Shenzhen, China (ADB, 2010)

The city of Shenzhen is leading the reform in local water management in the People's Republic of China (PRC). It has established a relatively complete legal system for water management and is one of the first cities in the country to combine all water-related government functions into a single government agency, the Shenzhen Water Resource Bureau. It has also completed market-oriented reform in the water sector, having successfully negotiated the first concession for municipal public utilities in the PRC on 23 August 2004. On this date, the Shenzhen Water Group completed its transformation from a wholly state owned enterprise to a joint venture approved by the Ministry of Commerce. Today, it is the largest water supply and drainage service enterprise in the country.

Meanwhile, the integrated operation of water supply and drainage together helped Shenzhen's sewage treatment improve substantially over a short period of time. The wastewater treatment sector in Shenzhen has made rapid development since its reform in2001, and the sewage treatment rate in the Shenzhen Special Economic Zone has increased from 56 percent during pre-integration to over 88 percent in 2008, ranking first among large and medium-sized cities in the PRC.

Case Study 7.4: Alternative Approaches to Stimulate Demand for Sanitation in India (WSP, 2010)

WSP's assessment of India's Total Sanitation Campaign (TSC) reviewed numerous different approaches undertaken by districts across the country, including CLTS, to stimulate demand for sanitation against the backdrop of the TSC rollout with the help of the government of India, but with approaches differing from State to State. For example, Sirsa district, located in the state of Haryana, showed particularly positive results. The responsibility to move the community members away from open defecation amongst the collection of villages in the district fell upon a team of motivators who helped

communities undertake a self-analysis of their sanitation situation at the time (2007). It was found that the principal motivator of behaviour change in the Sirsa district related to disgust and shame. The communities changed their perception of sanitation when they started realising that open defecation led them to consume each other's faecal material. Formation of Sanitation Committees and the use of Information Education and Communication (IEC) techniques led to 277 out of the 333 Gram Panchayats (GP) winning the Nirmal Gram Puraskar (NGP) at the time of the WSP study in 2010. This incentive programme introduced by the Government of India (GoI) awards cash prizes to local governments that achieve community-wide total sanitation. With the remaining GPs in Sirsa applying for this award, the district was the first to achieve complete ODF status in the entire country. Under the TSC, the state of Maharashtra also opted to support a community-based approach. The sanitation coverage in that State increased from 18 percent in March 2003 to 53.4 percent in February 2008, and was projected to rise further to 82.2 percent in March 2012, demonstrating remarkable impact on the ground.

Case Study 7.5: Platform for Climate Change Advocacy, USA

In six US states, a 3P partnership among industry, schools and local non-profits organisations collaboratively carry out climate change advocacy and encourage social innovation within elementary schools (UCP, 2014).The school students are valued as change makers and are educated on the principles and daily practices of sustainable living, while the members of the schools' Parent and Teachers Association (PTA) earn significant rebates from vendors of energy and water-saving products when they or their families buy their products.

The way the programme works is that elementary and middle schools, together with their students and their families, have committed to take actions to reduce their carbon and water footprints for a special project called climatechangeiselementary.org. Participating schools and students are issued GreenActionCards™ for their use. They can also pass these on to relatives. When they purchase a product or service on the list at any store, and swipe their GreenActionCard™, the magnetic strip on the card automatically gives the purchaser a discount and sends a rebate to the issuing school. Families can distribute GreenActionCards™ among their neighbours or relatives, thereby earning credit for their own school. The programme implementers predict that in a few years the card will be used in every hardware chain or big-box store where families can swipe it while purchasing products and services listed on their Green Action Checklists. The card's magnetic strip carries information about the school, not the customer, so families can share GreenActionCards™ with neighbours or relatives in other states and still get credits for their school.

The GreenActionCard™ builds a bridge between families that promise to take action to go green and vendors looking for customers to buy energy and water-saving products. Schools can start using cards on their own or invite Climate Change Is Elementary to deliver our programme to get children and parents excited, thus building up demand for the products. Public and private schools can thus make thousands of dollars for action by families without having to handle products or make sales. (Finnigan, 2014)

Case Study 7.6: Policy Framework on Measures to Stimulate Demand for DEWATS and Sanitation Services

A policy framework to take measures for stimulating the demand for DEWATS and sanitation services in general should consider the following:

1. Improve household understanding of better sanitation:
   - Complement private marketing of sanitation solutions to fill gaps in community understanding and address misinformation about the capabilities and maintenance requirements of improved on-site sanitation;
   - Develop education and awareness campaigns directly targeting households that already have some kind of sanitation system in place in order to complement campaigns targeting open defecation, and address limited household understanding of the characteristics of improved sanitation systems (ASSIST, 2015);
   - Ensure that these campaigns address the gender dimensions of sanitation awareness and decision-making where appropriate;

2. Smooth and subsidise poor household sanitation expenditures:
   - Use instruments to help very poor households mobilise cash to pay for improved latrines/toilets that do not distort markets;
   - Develop and support facilities that enable payment on installment terms, intermediated either through agency arrangements with manufacturers and suppliers of components or through financial institutions that provide consumer loans to households;
   - Develop and finance targeted subsidies for extremely poor households or in locations where suitable technology cannot be delivered at reasonable costs;

3. Make champions of policymakers pushing for change: In the Philippines, champions such as the mayor or a senior official in the local authority have often been behind sanitation advances;

4. Disclosure of information on negative environmental and health impacts of bad sanitation.

   - In the Philippines, the decision to invest in septage treatment in the cases of Baliwag and San Fernando was taken because of the fear of groundwater pollution. In the cases of Bayawan and Dumaguete, the decision to invest arose because of concern over pollution of recreational coastal waters; and the local authorities of Baguio and Boracay built sewage treatment systems after incidents of pollution threatened the tourism industry. (Jemima et al., 2014)

FOCUS AREA 8

Ensure Financial and Investment Climate from Government, Donors and Entrepreneurs

Case Study 8.1: Progress-Linked Finance (PLF)

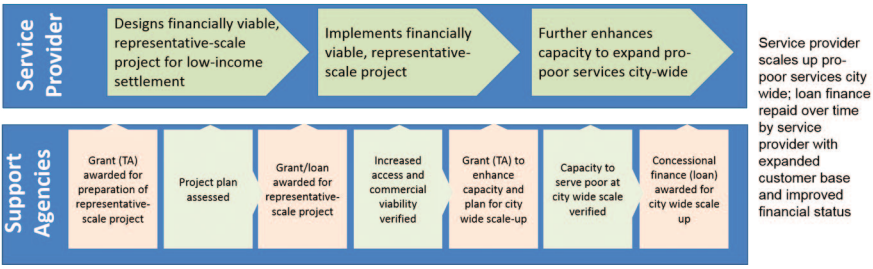
Progress-Linked Finance (PLF) is designed as a targeted use of public finance that can incentivize pro-poor service provision in the long term whilst also leveraging household finance (by extending improved services to more paying customers) and market finance (by increasing the financial viability of the service provider and thus their ability to access and repay credit) (Fig.5).

Case Study 8.2: International Funding for DEWATS

Over the past decade a variety of funds aimed at supporting Water, Sanitation and Hygiene(WASH) services have emerged. The most relevant for Cambodia, Laos and Viet Nam are as follows:

- ADB Water Financing Partnership Facility (Case study 8.5).

Figure 5: Progress-Linked Finance (PLF)(WSUP and ODI, 2011)



Source: WSUP/ODI (2011) Progress-Linked Finance: A study of the feasibility and practicality of a proposed WASH financing approach.

- The Global Sanitation Fund of the Water Supply and Sanitation Collaborative Council (available for Cambodia).
- Foundations (Case study 8.6): There are a growing number of foundations actively involved in the sanitation sector. The Bill and Melinda Gates Foundation is probably the most involved in sanitation, particularly in the sub-Saharan Africa and South Asia. It focuses its grant making on three areas: 1) sanitation science and technology, 2) delivery model at scale, and 3) policy and advocacy.

Case Study 8.3: The Sanitation Revolving Fund in Viet Nam

A Sanitation Revolving Fund (SRF) component was incorporated in the broader Three Cities Sanitation Project in Viet Nam to provide loans to low-income households for building on-site sanitation facilities. Working capital for the revolving funds was provided by the World Bank, DANIDA (Denmark) and FINNIDA (Finland) for three sub-projects in Danang City, Haiphong City and Quang Ninh Province (Halong City and Campha Town). The program benefited almost 200,000 people over the course of seven years. The average hardware costs of the sanitation facilities built through the program was USD 197. The SRF provided small loans (USD 145) over two years at partially subsidized rates to low-income and poor households to build a septic tank or, in fewer cases, a urine diverting/composting latrine or a sewer connection. The subsidized interest rate was equivalent to providing a USD 6 subsidy on each loan. The loans covered approximately 65 percent of the average costs of a septic tank installation and enabled the households to spread these costs over a two-year period. Though the loans acted as a catalyst for household investment, households needed to find other sources of finance, such as borrowing from friends and family, to cover the total investment costs. Additional funding was provided by the project for software activities. (Trémolet, 2012). It was found that these subsidies were highly effective in mobilizing households' own investment, with each USD 1 of public investment generating USD 20 of investment from households. Targeting also appeared to be extremely good, as all of the beneficiaries were found to be in the bottom income quintile. Moreover, the program has proved to be highly sustainable as the funds have already been revolved several times and the scheme, which is now administered through Women's Unions, can continue operating until the demand is exhausted. (WSSCC, 2009)

Case study 8.4: Community Hygiene Output-Based Aid (CHOBA), Cambodia and Viet Nam

This project, operating in poor rural and peri-urban areas of Cambodia and Viet Nam, is led by the East Meets West Foundation (EMW) and its local partners, including the Cambodian Women for Peace and Development Union (CWPD) in Cambodia, and the

Viet Nam Women's Union (VWU) and the Reproductive and Child Health Alliance (RACHA) in Viet Nam. The project is based on an output-based aid (OBA) approach, which EMW has been pioneering extensively in the fields of education, clean water, and sanitation over the past four years.

CHOBA aims to raise awareness, develop local supply chains, and provide access to finance through an OBA incentive, which is either a consumer rebate (about USD 20) or conditional cash transfer (CCT) that encourages poor households and communities to actively participate and increase sanitation uptake. Essentially, the consumer rebate serves as a demand-triggering tool, while the conditional cash transfer is a reward for communes that achieve at least a 30 percent increase in sanitation coverage. This encourages the development of the community sanitation value chain (e.g. trash removal, clean drinking water). Overall, the incentives serve as smart subsidies designed to address specific sanitation market failures while also increasing participation among poor households and other stakeholders by building local capacities with an emphasis on women and community leaders.

A key feature of the EMW model is the verification process. EMW staff will verify a) the construction of new improved latrines with standards approved by MOH, and hand washing devices, and b) hygiene behavioral changes in usage, hand washing, garbage disposal and safe water.

Case Study 8.5: ADB Water Financing Partnership Facility (WFPF)

On 25 July 2013, the Bill & Melinda Gates Foundation (the Foundation) signed a Channel Financing Agreement with ADB to contribute USD 15 million through a Sanitation Financing Partnership Trust Fund (the Fund) under the trust fund component of the WFPF. The Fund resources will be used to support projects whose focus will include: (i) piloting innovative and improved sanitation technologies and septage management systems; (ii) supporting innovations in ADB sanitation projects for septage management, non-networked and decentralized sanitation and wastewater management projects; (iii) formulating policies, regulations, and business innovations to create enabling environments for improved quality and coverage of septage management; and (iv) promoting new service delivery mechanisms and innovative financing models for sanitation systems, including maintenance and upgrades.

First priority will be given to Bangladesh and India. Second priority countries are Indonesia, Philippines and Viet Nam. Other countries may be considered based on need, in consultation with the Foundation. (ADB, 2013b)

Case Study 8.6: Some Foundations Grant-making for Cambodia, Lao People's Democratic Republic and Viet Nam

Table 7. List of grant-making foundations in Cambodia, Lao People's Democratic Republic and Viet Nam

Grantmaker	Recipient	Years	Subject	Location	Amount (USD)
Gates Foundation, Bill & Melinda	East Meets West Foundation	2012	Basic sanitation	Viet Nam, Cambodia	10,900,000
Gates Foundation, Bill & Melinda	East Meets West Foundation	2012	Basic drinking water supply and sanitation (and hygiene)	Viet Nam, Cambodia	10,892,820
Gates Foundation, Bill & Melinda	International Development Enterprises	2011	WASH research	Cambodia	3,987,717
Stone Family Foundation, The	iDE Cambodia	2012	Education and training in water supply and sanitation	Cambodia	2,132,433
Vanguard Charitable Endowment Program	Splash	2011	Basic drinking water supply	Cambodia, China, Ethiopia	1,200,650
Stone Family Foundation, The	WaterSHED	2012	Education and training in water supply and sanitation	Cambodia	962,143
Stone Family Foundation, The	SNV Cambodia	2012	Basic sanitation	Cambodia	943,527
JPMorgan Chase Foundation, The	Planet Water Foundation	2011	Basic drinking water supply and sanitation (and hygiene)	Cambodia, India, Indonesia	900,000
Anonymous 5	HALO Trust	2011	Basic drinking water supply and sanitation (and hygiene)	Cambodia	70,000
Laird Norton Family Foundation	Splash	2012	Health education (hygiene)	Cambodia	50,000

Grantmaker	Recipient	Years	Subject	Location	Amount (USD)
Gates Foundation, Bill & Melinda	International Development Enterprises	2011	WASH research	Cambodia	3,987,717
Stone Family Foundation, The	iDE Cambodia	2012	Education and training in water supply and sanitation	Cambodia	2,132,433
Vanguard Charitable Endowment Program	Splash	2011	Basic drinking water supply	Cambodia, China, Ethiopia	1,200,650
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Anonymous 5	HALO Trust	2011	Basic drinking water supply and sanitation (and hygiene)	Cambodia	70,000
Laird Norton Family Foundation	Splash	2012	Health education (hygiene)	Cambodia	50,000

Case Study 8.7: Tariff Scheme in Phuket, Thailand (Phuket Gazette, 2011)

Phuket is one of three cities in Thailand charging a tariff for wastewater treatment. The other two are Chonburi and Pattaya. The tariff scheme uses a combination of fixed fees paid annually along withvariable fees, depending on the level of usage. The tariff based on water usage starts at 2.5 Baht per cubic metre for households. Government offices, state enterprises, foundations and small business are paying 3.75 Baht per cubic metre. Industrial operations and big businesses pay the highest fees at 5 Baht per cubic metre (numbers reflect the 2011 fees). On average, households pay a fee of 400 Baht/house/year, while hotels pay 600 Baht/hotel room/year, and restaurants and bars are charged 40 baht per square metre.

Case Study 8.8: Helioz - WADI Financing Schemes (Indiegogo, 2013)

Helioz is an Austria-based social enterprise start-up that provides affordable and efficient tools to low-income households, humanitarian organisations, and emergency aid organisations around the globe. In 2013, Helioz launched a new product that aims to purify contaminated water effectively. It is called the WADI (Water Disinfection). In order to finance its endeavour to sustainably distribute WADI over the long-term to India's poorest and prove that it can reduce water-borne diseases by over 50 percent; Helioz is using the following financing schemes:

1. To partially finance a costly comprehensive study such as this, Helioz was looking to raise about USD 135,000 through a crowd-funding exercise on the platform Indiegogo. Of the intended target, USD 16,707 was raised. The minimum that could be donated was USD 6.77, entitling the donor to a thank you email and access to the private blog. The maximum donation of USD 13,533.00, gives the contributor a chance to be part of the study onsite for two weeks, with all expenses paid, including flight, stay and food. Helioz on its part promised to invest USD 94,731.00 into the Health Impact Study.
2. Four months after the crowd-funding campaign, Helioz stated that though they were able to launch product sales and distribution, they had to delay the HIS for want of sufficient funds.
3. Posting and marketing the product and start-up itself on the local Austrian start-up platform (www.inits.at) and through international web portals (http://social.yourstory.com/).
4. During its establishment earlier in 2010, Helioz managed to raise USD1, 000,000 seed funding according to crunchbase.com.

Furthermore, Helioz uses local and international social structures and partners to make the most of its knowledge, networks, and long-term ownership approach to effectively target communities.

Policy Framework 8.1: The WASH Cost Calculator

The WASH Cost Calculator is an intuitive & dynamic life-cycle costs tool for the evaluation of water, sanitation, and hygiene services. The tool caters to both those who are just getting started with life-cycle costs and service levels as well as more advanced users who are already applying the life-cycle costs approach in their work. In both cases, the tool provides quick feedback in a comprehensive report on the cost of providing a service, the level of service achieved, and specific risks.

The WASH Cost Calculator also organizes analyses and visualizes cost and service-level data. The tool aggregates input data over time, generating a powerful database of cost and service-level data across technologies and countries. Users who can assess costs within their country context are able track the performance of their own programs against this dynamic database and industry benchmarks.

Since the end of 2012, an IRC team has been working on the development of the WASH Cost Calculator with the support of Hattery (San Francisco) and Native (London). A team of designers and developers was formed to support development of a tool that is robust in handling data sets and calculations, while remaining simple, elegant, and user-friendly. (IRC, 2013)

Policy Framework 8.2: COILED and Business Drivers in Sanitation

1. Municipal financing for urban infrastructure is a major business driver in Asia and is associated with a number of financing tools. Municipal financing for subsidized investment community sanitation services usually includes the public part of the system – sewerage pipes and treatment plants. The provision of financing from municipal or national government is an important source because it is based on regulations, and with these funds come guarantee.
2. Housing/mortgage financing. The provision of sanitation is seen as an intrinsic part of new housing development. Services include toilets, pipes, septic tanks, and connection to sewers.
3. Entrepreneurs/private sector consumables. There is a range of by-products and markets that the provision of more widespread sanitation will open up. Some of these products include sanitation towels, soaps, and disinfectants.
4. Public toilets. The private sector/social entrepreneur may provide toilets to the community or schools, either directly or linked to services they offer to the community through waste management.
5. Energy. The methane and energy produced are key by-products that can be used and monetized directly through more efficient technologies for heating or energy.
6. Fertilizer. Systems in which the ranges of waste products can be used as fertilizers in agriculture can be developed commercially through the sale or own use of compost and possibly sludge from treatment plants. With chemical fertilizer prices on the rise in the face of demand outstripping supply, this could become a critical market.
7. Carbon market. When in regulation, reductions in the release of greenhouse gases (GHGs) can have a monetary and tradable value (e.g. clean development mechanism). (ESCAP, 2013a)

Policy Framework 8.3: Enabling the Supply Chain

Table 8: Opportunities for Domestic Investments in Water and Sanitation

Encourage innovation and facilitate efforts to relax business model and supply chain constraints		
Policy Goal	**Recommended Action**	**Actor**
Spur innovation	Stimulate and, if necessary, financially support the development of affordable technologies like membrane bioreactor (MBR) and smart readers with consumer appeal: ♻ Help develop technologies (preferably proprietary or licensable) that use materials that are light and easy to transport; easy to clean and maintain; and amenable to mass production, branding, and marketing through distribution networks coordinated and supported by manufacturers. Also help develop modular technologies that enable incremental improvements to sanitation facilities as household interest grows and as households are able to mobilize funds. ♻ Explore options for stimulating research and development by the private sector such as through patents, contracts, and grants. ♻ If the preferred model of commercial development and roll-out of proprietary technology is not forthcoming, consider expanding funding by the international development community of research and development to develop technologies that are appropriate for delivery through a market-based system.	Governments, development partner
Encourage larger businesses to enter the on-site sanitation sector	Foster the entry of well-capitalized enterprises with marketing skills to drive consumer interest and capacity to coordinate supply chains, and support installation and maintenance by small-scale local enterprises: ♻ Support the collection and dissemination of market intelligence such as information on the size and nature of the market, including those significant segments of households above the poverty line that are a part of the market.. ♻ Explore options for incentives to entry, including start-up financing and support. ♻ Encourage the formation of associations of enterprises involved in sanitation to develop a distribution channel to the "last mile" and assist in the dissemination of market and technical information.	Government, development partners

Encourage innovation and facilitate efforts to relax business model and supply chain constraints		
Policy Goal	**Recommended Action**	**Actor**
Support quality assurance	Enable quality assurance and accreditation: ♻ With the entry of larger businesses in the supply chain, assist the microenterprises at the front end to more credibly signal service quality to a larger market, and assure potential purchasers that they will get value for money durability, and continuity of service. ♻ If capacity exists, introduce public sector certification of technologies, or government endorsement of international certification by development partners, but avoid government regulation of standards. ♻ Facilitate industry-based accreditation systems for enterprises or solutions to enable manufacturers to offer warranties on installation.	Governments, development partners, business community
Support business capacity development	Help the microenterprises currently delivering the bulk of on-site solutions expand their limited business expertise so that they can better participate in an expansion of supply: ♻ Facilitate capacity building through partnerships with larger actors in the supply chain in agency, distribution, or subcontracting networks that also address the capacity and commercial issues of the front end of the supply chain. ♻ Develop elements of public sector sanitation marketing and education campaigns that can be used as information and marketing material by small-scale private sanitation service providers.	Governments, development partners

Source: (Jemima et al., 2014)

FOCUS AREA 9

Ensure Exit Strategy and Sustainability

Case study 9.1: Egyptian Community Development Association (CDA) Model of Life-Cycle Costs

In Egypt, CDAs manage the operation of low-cost sewerage systems in small towns and villages, including the collection of tariffs from household owners; however, operation and maintenance are contracted out to a private entrepreneur. The success of the approach is secured by intensive awareness raising and community mobilization, coupled with simple technology and management procedures that the CDAs can cope up with. To foster sustainability, the partner organization, Kafr El Sheikh Water and Sewerage Company, is involved in capacity development of CDAs, while the financial aspects are audited and supervised by the Ministry of Social Solidarity. (WSUP and IRC, 2012)

Case Study 9.2: City Sanitation Strategies Lessons Learned in Indonesia

As of mid-2012, cities in Indonesia had prepared 240 sanitation plans. The broad lessons that are emerging from the preparation of these plans are insightful. They fall under the following key strategy areas:

- Ownership: The city has to take charge and ownership of the process and the plan. This also implies that adequate institutional capacity must be in place for the cities to lead the development of sanitation plans.
- Comprehensive and Multi-functional: Strategies have to take into account not just sanitation, but also drainage and solid waste management.
- Coordinated: Strategies have to involve not just the public sector, but also the private sector and civil society. Within the public sector, they should involve all the relevant departments ensuring that the planning, health, environment, and public works functions are at the core of the process.
- Top-down meets bottom-up: Strategies must engage with both top-down planning based on targets and bottom-up planning based on community and demand-driven processes. But it is true that a 12-month multi-stakeholder planning process can be a cumbersome

affair for a community or municipal authority that wants quick results, as there are no shortcuts to a sound, demand-led planning process that attains real ownership.

- Evidence-based: Based on empirical data, the plans must be credible and well founded on demographic data, and based on a thorough investigation of the existing facilities and services in an urban environmental sanitation context. (Jemima et al., 2014)

Case Study 9.3. Septage Management System

Any on-site wastewater treatment facilities (including some of the BORDA DEWATS and Packaged Aerated Wastewater Treatment Plant, - PAWTP - Johkasou in Japan), do not function as the wastewater treatment facility unless they are regularly desludged, otherwise facility would become the source of pollution by itself. Therefore, it is essential to establish the DEWATS system, in which any type of DEWATS are regularly desludged according to the required frequency, the extracted sludge is transported to the sludge treatment facility, where it is properly treated and disposed. This process, which includes desludging, transport and treatment of sludge from on-site wastewater treatment facilities, is called as 'septage management'.

Only in Japan and Malaysia, septage management has been given a proper consideration, while most of the septic tanks, being most popular form of on-site wastewater treatment facility in South-East Asia, are in a deteriorated conditions.

South-East Asian countries have already a huge stock of sludge to be extracted from the existing septic tanks. If DEWATS is diffused, the volume of sludge to be managed would further increase. Without introducing the proper septage management system (ref Table 9), any type of DEWATS would fall into the same condition as the current septic tanks.

In order to establish septage management system, the persons, directly conducting desludging operation are the most important. If there are existing desludging operators, once proper regulatory framework is established, they will be engaged in regular desludging business and will make money, additional income, like in Japan.

Currently, desludging of one septic tank (3 m^3) costs US$ 30 in Jakarta, US$ 50 in India, US$70 in Malaysia, which is quiet expensive. It is expected that the introduction of the regular desludging system would reduce the desludging cost, since desludging operators are enabled to plan their desludging operation systematically, unlike their current ad hoc on-call base desludging operation. In Japan, the desludging is considered not a profitable business unless at least 4 PAWTPs (household type) can be desludged daily by one vacuum truck. Efficiency matters.

Table 9: Essentials components of septage management system

Policy Goal	Recommended Action
Desludging obligation of DEWATS users	Desludging must be the legal obligation of all the owners of any DEWATS.
Licensing and training system of desludging operators	There must be the trained good desludging operators. Formalize them, if there are existing desludging operators. Let them make companies. Establish the licensing system and training system.
Data base of all DEWATS in the city	Creating data base of all DEWATS in the city is the very first step of septage management. Both the municipality and the desludging operators should share the data base.
Government (Municipality) responsibility to develop sludge treatment facility	Local municipality's obligation to develop septage/sludge treatment facility. Central government's obligation to provide financial support to Local municipalities.
Technology (DEWATS)	DEWATS must be desludging friendly. Improve the structure and installation of DEWATS for the efficient desludging.
Technology (Desludging)	Use vacuum truck for efficient and hygienically safer desludging operation.
Technology(Transportation)	Use the sludge relay tank to shorten hauling time.
Technology(Sludge Treatment)	There are many technologies. Sludge drying bed is an appropriate method if land is available and if there is no risk of environmental pollution. If there is a Sewage Treatment Plant (STP) nearby, co-treatment at the excess sludge treatment section of STP is the best option. Proper pre-treatment facility is required to minimize the adverse effect on the operation of STP.

Source: Japan Sanitation Consortium

The desludging operator shall be given license for a limited period. If there is a misconduct of the desludging operator, his license shall be revoked. In Japan, currently, there are 200,000 qualified peoples engaged in the business related to septage management such as desludging business, maintenance business, manufacturing and installation business and inspectors of PAWTPs. Septage management will create a lot of job opportunities. The role of government is to create the favorable environment for these people engaged in septage management.

FOCUS AREA 10

Evaluate DEWATS Implementation

Case Study 10.1: DEWATS Compliance Monitoring and Efficient Enforcement in San Fernando City, Philippines

One of the more recent local DEWATS policies is the Amended Sanitation Code for San Fernando City, La Union, Philippines (San Fernando City, 2010). It sets a clear path for DEWATS implementation by defining where DEWATS are required, how to go about obtaining permits to construct DEWATS, and the consequences of non-compliance. Some features of the ordinance are especially insightful and geared towards simplifying the DEWATS process, and creating a transparent regulatory framework. The ordinance defines clearly who shall be required to have proper wastewater management systems in Article LXVI. Following are the mandatory requirements of the wastewater management system:

- Owners of all new buildings and structures, whether public or private, residential, commercial, institutional, and/or industrial, must have proper wastewater management systems.
- Owners of existing buildings shall be required to provide compliant wastewater systems when buildings are sold, substantially remodeled, or in the case where an imminent public health hazard exists (San Fernando City, 2010).

The policy recognizes that in some instances, it is difficult, if not impossible, for owners of existing buildings to fully comply with this law, due to space or other site constraints. In these instances, the policy provides for the following: "If upgrading is not feasible, and no imminent health threat exists, a condition of noncompliance shall be attached to the property deed, and provisional approval for continued use of the property may be granted" (San Fernando City, 2010). The city thus recognized that it would be of little benefit to pass an ordinance that was unenforceable or that placed an unreasonable burden upon its citizens. (Robbins, 2011)

Policy Framework 10.2: DEWATS Quality Management System

1. The Quality Management System for technical aspects of DEWATS planning and implementation.
2. Standard operating procedures for community facilitation.
3. A training and certification system for human resources who occupy key positions in the implementation process of DEWATS.
4. A certification system for the implemented DEWATS service packages.
5. An organizational setup to maintain the system (Frank, 2010)

Policy Framework 10.3: Performance Indicators for Sanitation Services

IBNET indicators are set according to the following categories:

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

Users can download the IBNET indicator list and the full text on IBNET indicators.

GLOSSARY

Anthropogenic Global Warming (AGW): Global warming with the presumption of human influence, and a predominant driver (or cause) for the warming through release of carbon and other greenhouse gas emissions from our activities.

Closed System: A system which is closed to inputs from its environment. A battery operated radio, for instance, is closed to outside energy. In practice, such systems rarely exist, but many systems are treated as if they were closed.

Climate Change: Climate change refers to a statistically significant variation in either the mean state of the climate or in variability, persisting for an extended period. Climate change may be due to natural internal processes or external forcing such as solar variance, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

Climate System: The climate system is the highly complex system consisting of five major components – the atmosphere, the hydrosphere, the cryosphere, the land surface and the biosphere, and the interactions between them.

Change, Incremental: Incremental change is gradual, as opposed to massive or instant change. This type of change can normally be accomplished within the existing institutions using existing policies.

Change, Structural: Structural change occurs when you alter the way a system functions. This type of change requires changes in existing policies and institutions.

Open System: A system which is open to its environment such that there are recognisable inputs to the system and outputs to the environment, e.g. an organism is an open system for inputs of food (energy).

Sanitation: is the hygienic means of promoting health through prevention of human contact with the hazards of wastes as well as the treatment and proper disposal of sewage or wastewater.

Septage management: is a process, which includes desludging, transport and treatment of sludge from on-site wastewater treatment facilities.

Sewerage: Removal of waste materials by means of a sewer system.

System: a set of elements that interact to achieve some purpose.

Systemic: Means affecting most or all of a system rather than a small portion of the system; in systems thinking, systemic means arising from the structure of the system and affecting the general behavior of the entire system.

Structure: The manner in which a system's elements are organized or interrelated.

System: A group of interacting, interrelated, or interdependent elements forming a complex whole. A system is almost always defined with respect to a specific purpose within a larger system. Example: An R&D department is a system that has a purpose in the context of the larger organization.

Systems Thinking - focuses on recognizing the interconnections between the parts of a system in understanding the whole. This is a way of understanding reality that emphasizes the relationships among a system's parts, rather than the parts themselves. It is also concerned about the interrelationships among parts and their relationship to a functioning whole. The aim of systems thinking is to understand system behavior by identifying the underlying patterns, systemic structures and mental models that influence the patterns of behavior and repeated outcomes so that more sustainable long-term decisions and interventions can be implemented.

Public-Private Partnerships: are one of the best mechanisms to supplement and overcome government budgetary constraints, as they can allocate project-risks effectively between the public and private sector.

Pro-Poor Public-Private Partnership: while PPPs have proven their worth in traditional large-scale infrastructure projects, the addition of a 'Pro-Poor' element brings forward their application to smaller projects with active participation of the community.

Treatment: A process that modifies wastewater characteristics such as its biological oxygen demand (BOD), chemical oxygen demand (COD), pH, etc., to enable it to meet effluent standards.

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