WATER AND SANITATION PROGRAM: **WORKING PAPER**

**Targeting the Urban Poor and Improving Services in Small Towns**

# Fecal Sludge Management Services Diagnostic and Decision-Support Tools: An Overview

**Isabel Blackett and Peter Hawkins**

August 2016

## CONFERENCE EDITION

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WORLD BANK GROUP Water

This document is an output of a World Bank study led by Isabel Blackett and Peter Hawkins. World Bank team members Zael Sanz, Ravi Joseph, Chris Heymans and Guy Hutton also contributed their expertise. Special thanks to the consultancy teams from Oxford Policy Management (OPM) and WEDC at Loughborough University, led by project manager Ian Ross, technical lead Rebecca Scott, and Ana Mujica, Zach White and Mike Smith.

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# Introduction

Addressing the need for appropriately conceived and implemented fecal sludge management (FSM) services from on-site sanitation systems is critical to improving sanitation services in urban areas. A preliminary review of the status of FSM in 12 cities, drawing on secondary data, led to the adoption of some draft diagnostic tools and the proposed development of others (Blackett et al. 2014). Building on this, and using extensive primary data from five cities (Balikpapan, Indonesia; Dhaka, Bangladesh; Hawassa, Ethiopia; Lima, Peru; and Santa Cruz, Bolivia), a series of diagnostic and decision-support tools have been developed to inform the design of FSM intervention options in the context of the economic and political economy realities cities face.

This document provides an overview of the tools and how they might be used, and also provides links to other resources. The outputs of these tools are targeted at government decision-makers, development organizations, service providers/utilities, and city/municipal authorities. An increasing number of urban sanitation toolkits to guide decision-making at the city level already exist, but most of them do not focus specifically on FSM, nor do they address political economy issues. They also tend to focus on municipal and community action, with limited acknowledgment that tackling the challenges will require substantial external support—from other levels of government and/or through investment projects, for example. The tools summarized here take these factors into account, and aim to help stakeholders consider how to develop urban sanitation services that safely manage the large amount of fecal waste which is not discharged into sewers.

CONTEXT

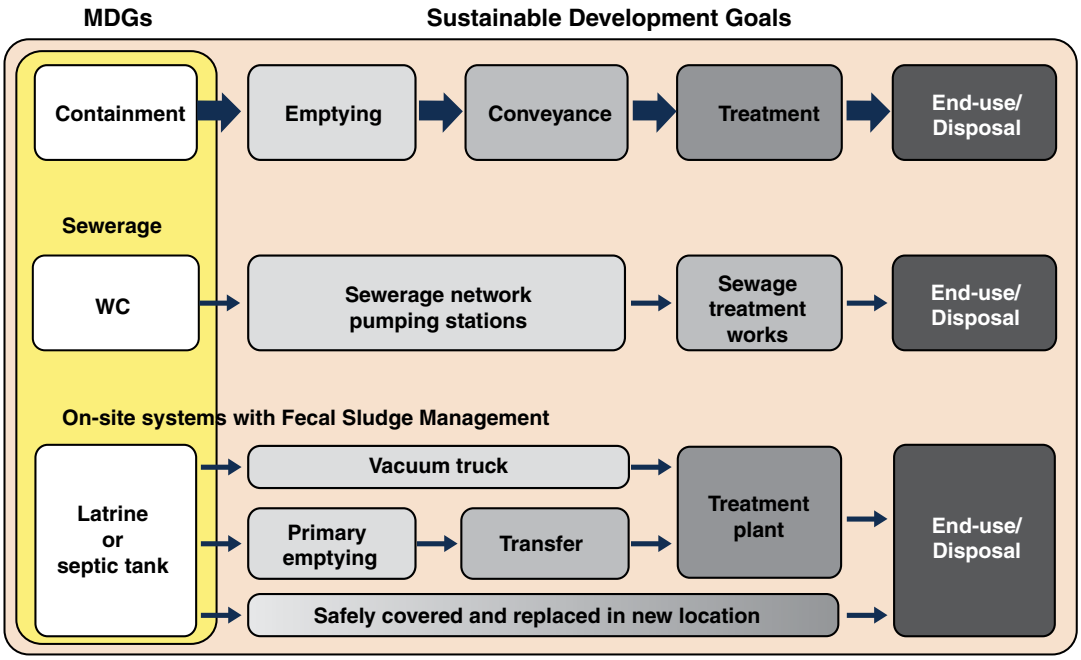
- This document provides an overview of diagnostic and decision-support tools developed for urban fecal sludge management services. Find the tools online: **worldbank.org/fsm**
- Each tool is presented with an example based on primary data and an explanation of how its output can inform program design
- As each city and each country is unique, the tools will need to be adapted to the local situation; selection and design of interventions will always require professional judgment

These tools are primarily intended for carrying out a sanitation situation diagnosis and the preliminary selection of intervention options, bringing a focus to each element of the sanitation service chain (see Figure 1). They will be particularly useful at the project identification and preparation stage.

However, much of the data collected will also be useful in the design of interventions. While some of the tools are applicable to urban sanitation as a whole, others are specific to FSM. In addition to the tools, a number of policy recommendations on FSM emerged from the work, including:

- **FSM must be included in national policy and funding arrangements,** complemented by city-level sanitation planning systems, and bylaws that oblige both households and service providers to play their part in delivering a complete sanitation service chain.
- **The private sector has a crucial role to play,** but needs incentives, technical assistance and access to safe disposal sites at economical distances from collection areas.
- **Clear definition of institutional roles,** enforceable regulations, and effective planning, budgeting and monitoring processes for FSM are essential.
- **Smart, targeted subsidies for poor customers** will usually be needed in order to realize the potential public health benefits from FSM.
- **Sanitation planning should be incremental,** acknowledging the variation of urban conditions within and between areas and over time, and considering both networked and non-networked solutions.

**FIGURE 1:** THE SANITATION SERVICE CHAIN




## Overview of the Tools and How They Fit Together

Table 1 summarizes the tools and their objectives, as well as other related tools which play an important role in the planning and implementation of urban sanitation solutions but which were not developed as part of this initiative. Figure 2 sets out how the different tools fit together.

The following fecal sludge management diagnostic and decision-support tools prepared under this study are listed below and are available online: **worldbank.org/fsm**.

The ***Summary Report*** collates the lessons learned from developing and applying the tools and guidelines in five cities around the world.

The ***Tools and Guidelines*** describe in detail the data and analytical framework used to produce the outputs, and how to apply them.

The ***Data Collection Instruments*** are generic instruments covering all key aspects of the diagnostics, and should be adapted to each specific local situation.

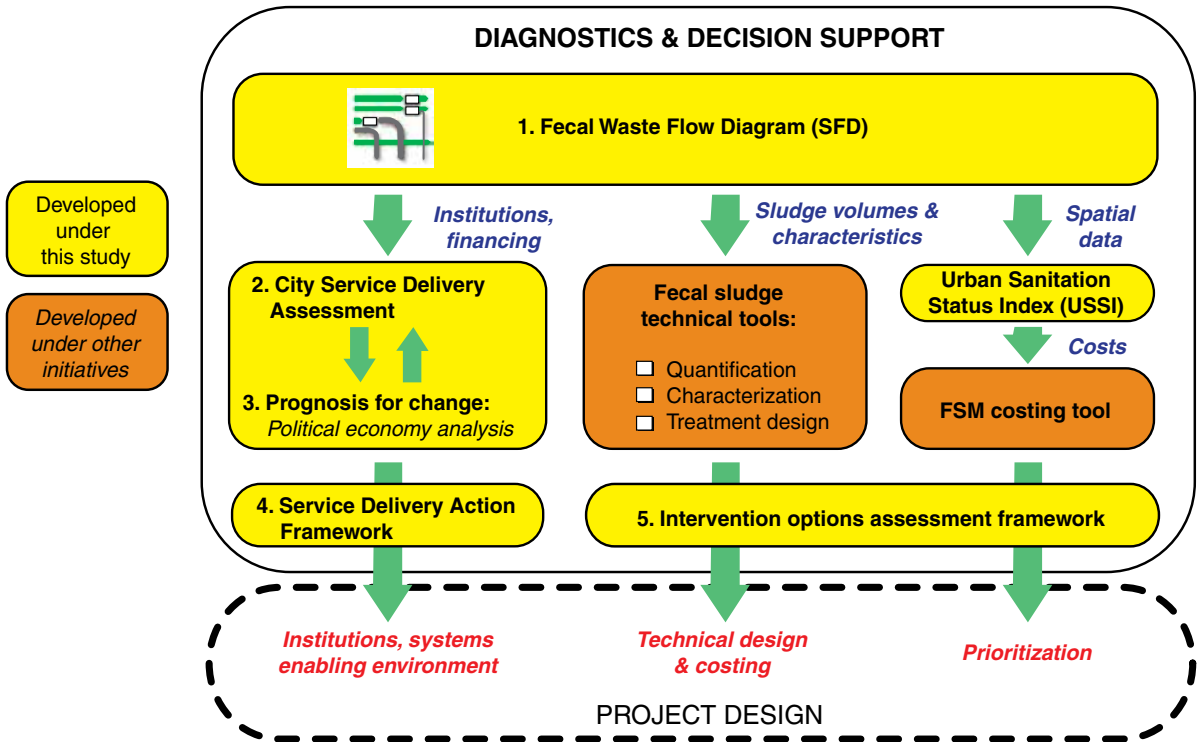
The ***Terms of Reference*** are generic documents for contracting the FSM diagnostics to consultants, and should be adapted according to the local situation and to the scope of studies and analysis required.

City case studies for **Balikpapan, Dhaka, Hawassa, Lima,** and **Santa Cruz.**

**TABLE 1:** SUMMARY OF TOOLS AND THEIR OBJECTIVES

| | Tool | Objective |
|---|---|---|
| Diagnostic tools | 1 Fecal Waste Flow Diagram | Represents where fecal waste goes, what proportion is managed and where the unmanaged portion ends up |
| | 2 Service Delivery Assessment | Assesses the enabling environment and quality of service delivery along the service chain, identifying areas for attention |
| | 3 Prognosis for Change (Political Economy Analysis) | Identifies the interests and incentives that could block action, and possible entry points for overcoming them |
| Decision-support tools | 4 Service Delivery Action Framework | Guides identification of actions in relation to the enabling environment, necessary to deliver the desired results |
| | 5 Intervention Options Assessment | Guides the identification of technical interventions along the service chain—linking to project/program design guidelines |

**FIGURE 2:** HOW THE FSM TOOLS FIT TOGETHER



# Diagnostic Tool 1: Fecal Waste Flow Diagram

A Fecal Waste Flow Diagram (often referred to as an "SFD") is a visualization of how fecal waste (both fecal sludge and wastewater) flows along the sanitation service chain in a given city. The proportions of households using different sanitation options are identified according to where the waste goes (e.g., sewer, on-site containment, etc.). At each stage of the chain, the proportion of fecal waste that is *effectively managed* continues as a green arrow, while any proportion identified as *ineffectively managed* turns into a brown (or red) arrow.

Data sources used to develop the figures for the diagrams include household surveys, key informant interviews, secondary and grey literature, reports, observation of service provision/providers, and measurements at treatment facilities. A growing number of SFDs funded through a Bill & Melinda Gates Foundation initiative are available at **susana.org/sfd**.

Figures 3 and 4 show examples of fecal waste flow diagrams for Lima, Peru. The first represents a city-wide picture, while the second represents the situation for the city's informal settlements. This separate analysis allows decision-makers to focus on delivering city-wide services which are also responsive to the needs of poor communities.

As illustrated in this case (and as is the case in the majority of cities around the world), the sanitation situation in low-income, informal settlements is generally much worse than the city-wide picture, with far more fecal waste going directly into the local environment, and, in the Lima case (Figure 4), via precarious unlined pits which tend to leak. Such disaggregated information can help inform the development of appropriate sanitation interventions for low-income communities, for example improvements to on-site containment or improved desludging services.

**FIGURE 3:** CITY-WIDE FECAL WASTE FLOW IN LIMA, PERU

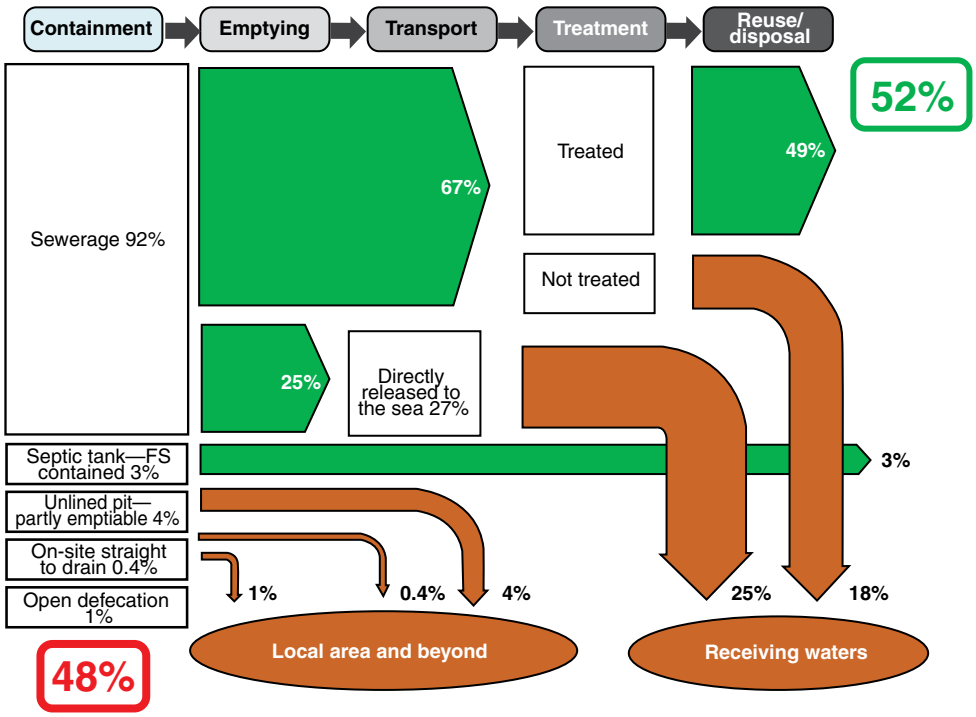
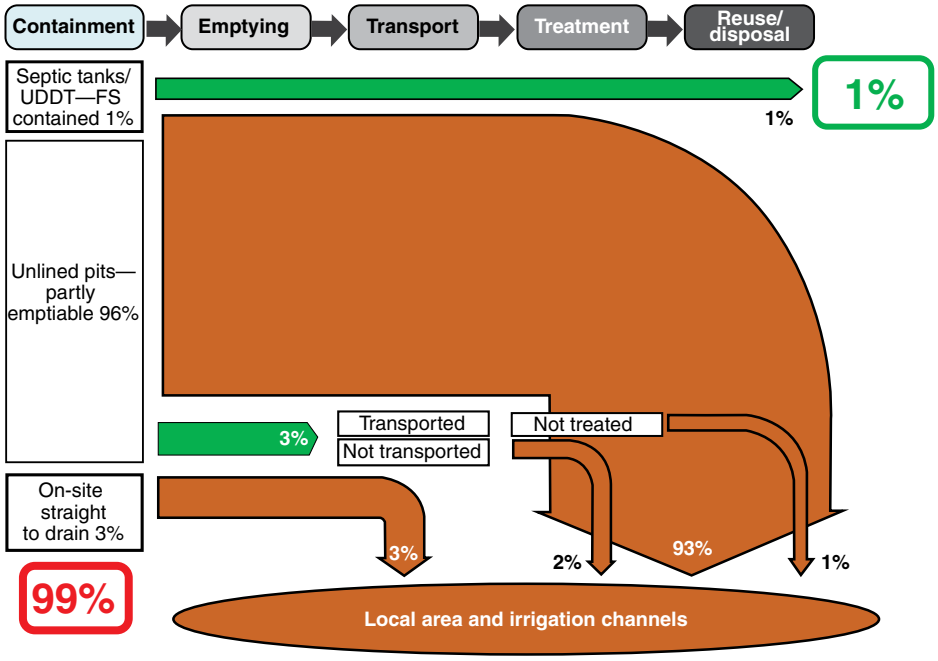



**FIGURE 4:** FECAL WASTE FLOW DIAGRAM FOR INFORMAL SETTLEMENTS IN LIMA, PERU



# Diagnostic Tool 2: City Service Delivery Assessment

The City Service Delivery Assessment (CSDA) for FSM aims to answer overarching questions about the quality of the enabling environment, the extent of FSM service development and the commitment to FSM service sustainability. It provides a structured assessment, based on responding to objective questions on FSM service performance through all stages of the service chain, so as to identify priority areas for action. The current format of the CSDA is adapted from the one used in the FSM 12-city study, which itself was derived from the World Bank Group's Water and Sanitation Program's *Country Status Overviews for Water and Sanitation* (AMCOW 2011).

A key output from the CSDA process is the scorecard. An example for Balikpapan, Indonesia, is shown in Figure 5.

The process of developing the CSDA is just as useful as the results derived, as it requires key stakeholders to discuss all stages of the FSM service chain and to use the evidence regarding the current FSM situation to agree upon the allocated scores.

This evidence may have come from key informant interviews, secondary literature, focus group discussions, or field-based observations. An initial *stakeholder mapping* exercise is necessary to ensure that the interviews are targeted at those best placed to inform and to generate unbiased scoring. Details of questions and indicators used in the process are given in the ***Tools and Guidelines*** and ***Data Collection Instruments.***

**FIGURE 5:** CITY SERVICE DELIVERY ASSESSMENT IN BALIKPAPAN, INDONESIA

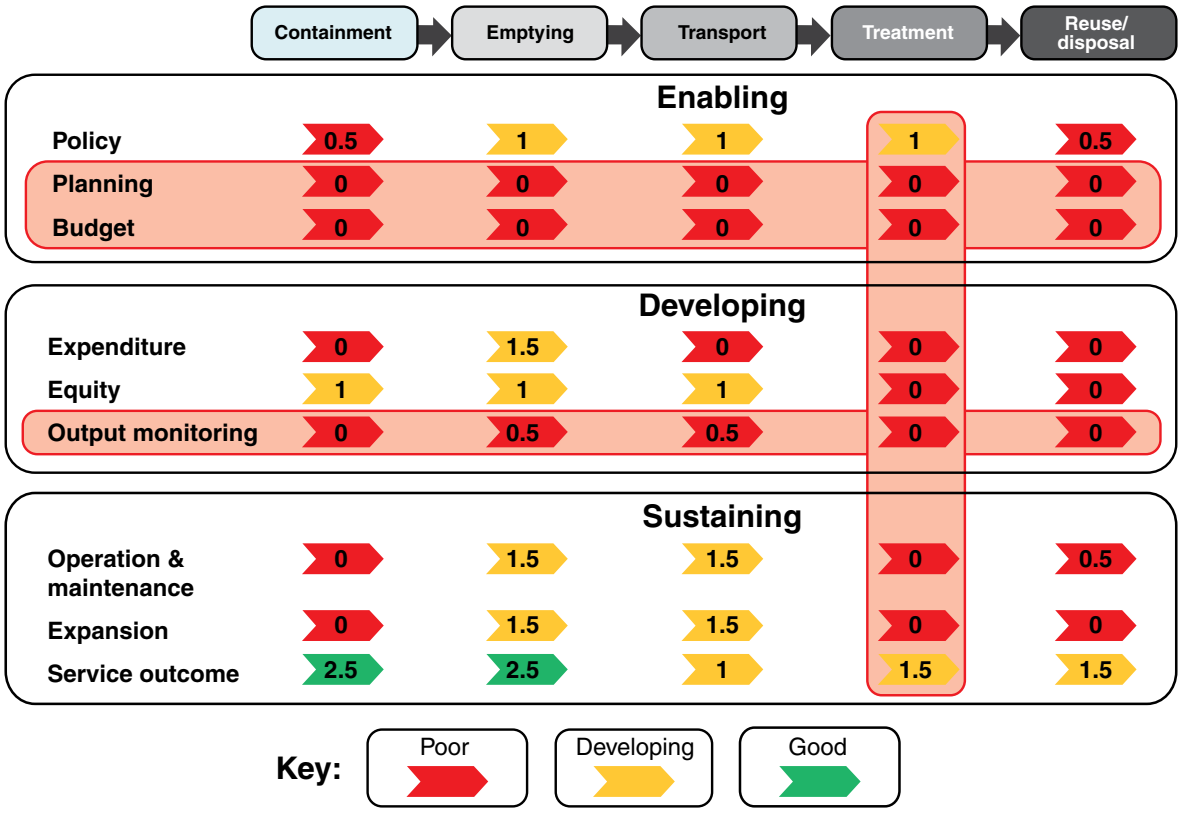
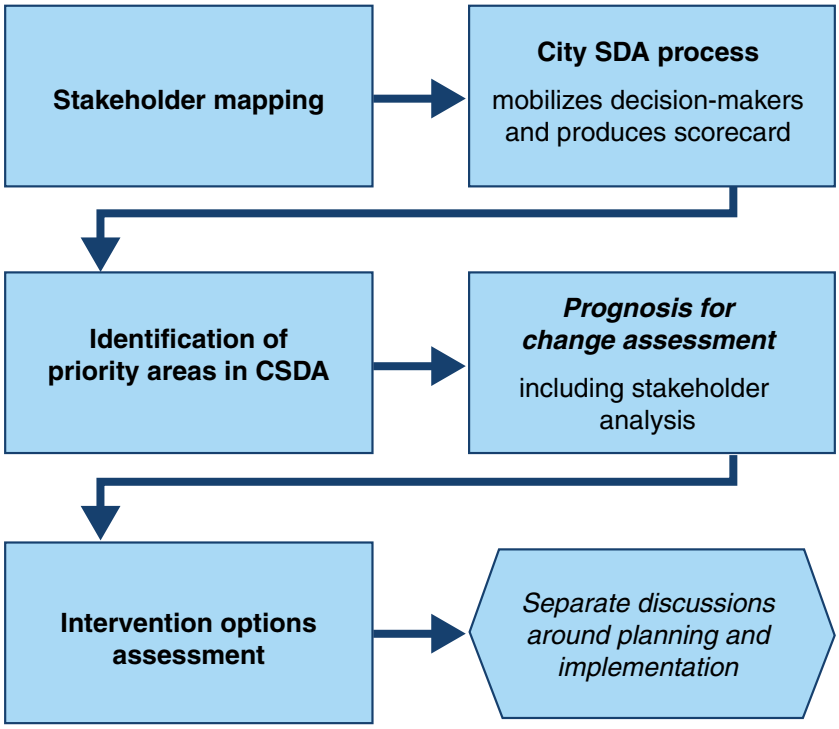


**FIGURE 6:** INTERLINKED CITY SERVICE DELIVERY ASSESSMENT AND PROGNOSIS FOR CHANGE PROCESS




The resulting scorecard shows areas of strength and weakness for FSM in the city and helps identify priority areas for action—which may include a national dimension (see Table 3 under Decision-Support Tool 4). As the illustrative CSDA from Balikpapan shows, some likely priority areas for action might include: establishing plans and associated budgets to improve FSM services; and making poor-inclusive technical interventions to deliver services to all.

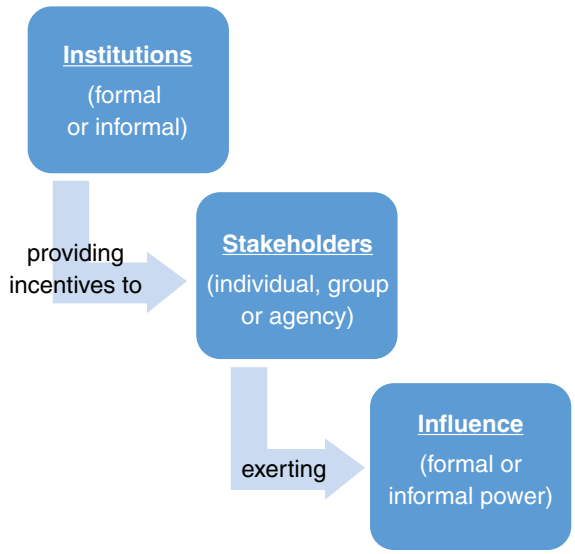
The CSDA process does not, however, explain *why* the current situation prevails, nor does it identify potential obstacles to progress. This is why the CSDA should be undertaken as an iterative process, which also takes into account the political economy of FSM in the city in question. A Prognosis for Change (PFC) assessment (see below) supports an explanation as to why the CSDA looks the way it does. Figure 6 summarizes this interlinked process, starting with the stakeholder mapping exercise. Once priority areas in the CSDA have been identified, a PFC assessment is undertaken. This then informs the intervention options assessment (see below), so that possible intervention options are considered in the context of the city's political economy realities.

# Diagnostic Tool 3: Prognosis for Change Assessment

The Prognosis for Change (PFC) assessment considers the positions of various stakeholders, in particular the institutions and incentives involved in FSM in the city. A PFC assessment is essentially a political economy analysis in which delicate topics are addressed sensitively, such that the analysis can be shared and discussed with all stakeholders.

A PFC assessment aims to understand three things, as discussed in the FSM ***Tools and Guidelines*** and illustrated in Figure 7. Firstly, it considers how "institutions" function. Here, institutions are defined as "the rules and norms governing human interaction," rather than a narrow definition of "organizations." Institutions can be formal (such as regulatory standards or bylaws about dumping fecal sludge [FS]), or informal (such as attitudes towards reusing FS in agriculture, or issues and interests that may run counter to, or be potentially supportive of, FSM).

**FIGURE 7:** THREE KEY CONCEPTS IN PROGNOSIS FOR CHANGE




Secondly, a PFC considers the incentives, which institutions provide to stakeholders. A stakeholder is any individual or group with an interest in the outcome of a national or local policy. In FSM, some examples of relevant stakeholders may include (but are certainly not limited to) sludge truck companies, manual emptiers, the city council, line ministries, and slum-dwellers.

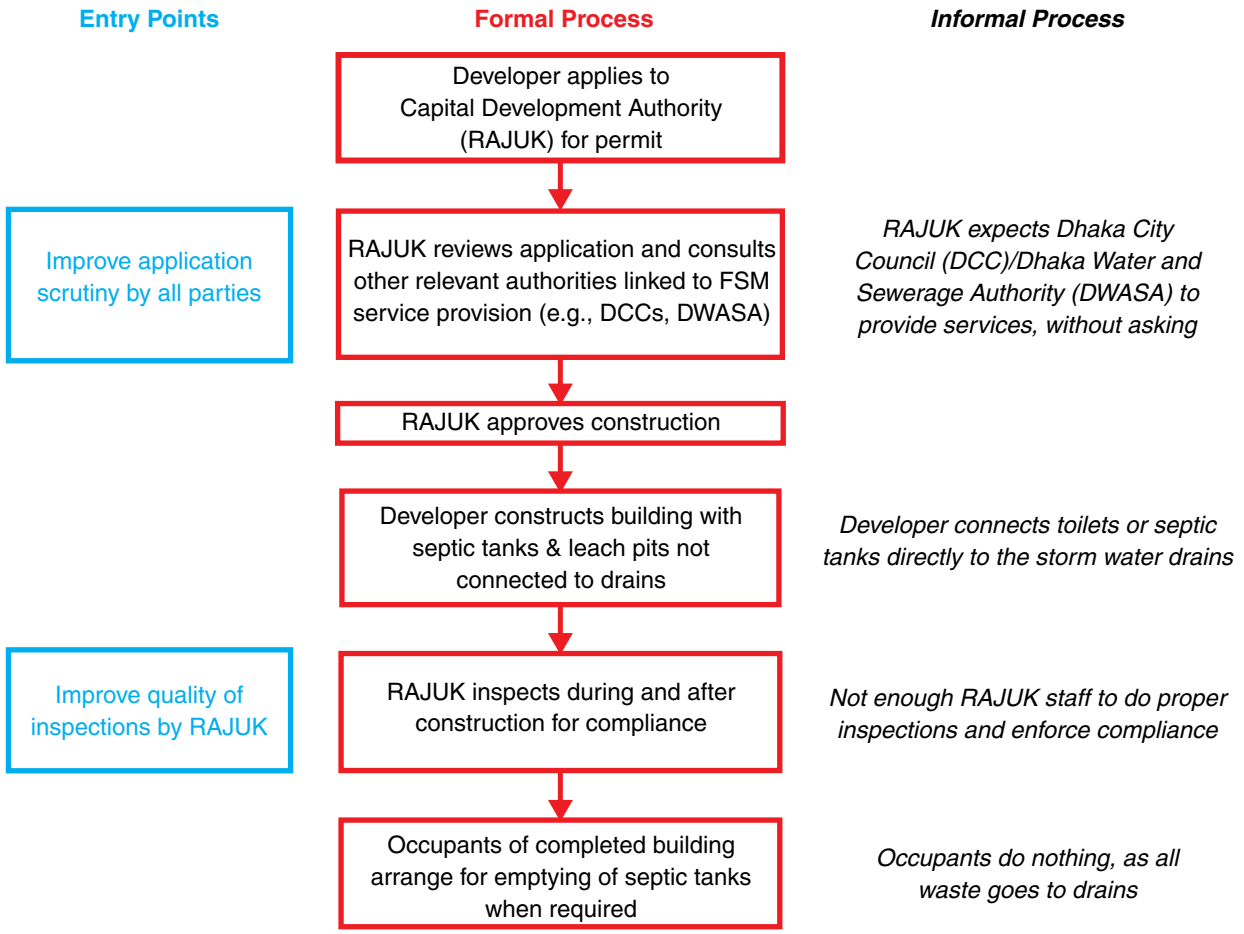
Finally, a PFC considers how stakeholders exert influence, which is defined as the formal or informal power to cause or prevent something. A city council may have formal legal power, but if their FSM bylaws are openly flouted, then their influence is low.

In addition, it is important to understand that the political economy is strongly linked to a financing dimension. The availability of finance, and the mechanisms through which it is distributed, have a profound impact on what actually happens with regard to appropriate FSM in a city.

In order to be practically useful, a PFC assessment should consider the implications of the findings for effective engagement in a reform or change process. National policy and fiscal approaches are relevant here. In many cities, local financial resources are lacking and will continue to require (if not depend upon) some assistance from higher levels of government—such arrangements ought to be clear and rooted in national level policy.

Various tools for undertaking a PFC assessment are included in the full ***Tools and Guidelines,*** but one example is given in the ***FSM Case Study for Dhaka, Bangladesh.*** It shows a process map for the construction of a new building in Dhaka (Figure 8). The central column shows the formal process, while the right-hand column shows the informal process, which happens in practice. The left-hand column then shows entry points for engagement, which are judged crucial for getting value out of the PFC analysis and for consequently improving FSM in the city.

**FIGURE 8:** PROCESS MAP FOR DHAKA, BANGLADESH



# Decision-Support Tool 4: Service Delivery Action Framework

When considered together, the outputs of the diagnostic and decision-support tools provide information that can be used to inform the design of an FSM improvement and investment program. In all cities, interventions to improve the enabling environment will also be needed alongside technical intervention options. Based on the experience gathered in the process of developing the tools, a Service Delivery Action Framework (SDAF, see Table 2) can be developed.

The SDAF sets out the range of non-technical or "institutional" interventions that may be appropriate for a given city, depending on the status of FSM service development, as characterized by the CSDA. Actions are grouped according to how developed the enabling environment currently is, with three stages characterized as: *Basic, Intermediate* or *Consolidating*. Actions are informed by the current reality experienced on the ground and are defined to highlight where best to focus attention for each aspect of the enabling environment, with the goal of improving services. Table 2 presents actions in an abridged format; see the ***Tools and Guidelines*** for more comprehensive descriptions. Further elements of the enabling environment are informed by recent research, such as the *SPLASH Urban Sanitation Research Programme* (Medland et al. 2015).

For each component of the enabling environment (policy, institutional arrangements, budgets, etc.), specific activities can be identified. This may result in actions taken from *Basic*, *Intermediate* or *Consolidating* stages as appropriate to a given city. Those designing FSM interventions should consider how activities will need to be implemented through pragmatic steps such that they are "actionable." The result will be a range of actions targeted at the national, city and user levels, which can then be considered in more detail to inform project and program planning and implementation.

Identifying the most appropriate actions must take into account the reality of any given city and recognize that the stages are essentially sequential—i.e., starting with *basic actions* before moving towards *intermediate* and then *consolidating actions*. Thus, if a city has already addressed *basic actions*, the *intermediate actions* will most likely be the ones to focus on for the particular issues being addressed.

This is illustrated by way of an example of an SDAF in ***FSM Case Study for Dhaka, Bangladesh.*** Table 3 highlights appropriate actions for each element of the enabling environment, informed by the extent to which actions have already been achieved in the city. Identified actions which could be considered by decision-makers are shown in the boxes with red outline and light red shading.

Dhaka city's CSDA scorecard highlighted that progress in the enabling environment is limited to the development of policy around containment at the household (a toilet or latrine). The establishment of an institutional framework for FSM more generally—a focus on *intermediate actions* is needed in relation to these areas. However, *basic actions* remain the priority in all other areas, including in planning, budgeting, promotion and capacity.

**Making actions context-specific:** A further step in the process takes the actions from each of the highlighted areas and translates them into objectives, targets, indicators and inputs that respond to the specific context of the given city, and which does so at an appropriate scale (e.g., city-wide, or focused on specific locations), to enable detailed planning. This step must not be overlooked, as it requires a significant commitment of time, resources and skills to achieve effective results.

**TABLE 2:** SERVICE DELIVERY ACTION FRAMEWORK

*Planning non-technical components (currently for FSM)*

| | Stages of Action | Basic Actions<br>*Critical Interventions for Public Health Protection* | Intermediate Actions<br>*Strengthening Existing Foundations* | Consolidating Actions<br>*Focused on Full-Chain, Sustainable Services* |
|---|---|---|---|---|
| National | **Policy, legislation and regulation** | • Review national sanitation policy and ensure FSM is included<br>• Review regulatory framework around the protection of public health and environment | • Set norms/standards for public health and environmental protection<br>• Establish legal basis for regulation of FSM services | • Require local regulation and its enforcement<br>• Develop a policy/regulatory framework to incentivize treatment and reuse options |
| | **Institutional arrangements** | • Review institutional arrangements for sanitation—ensure FSM is included<br>• Identify an institutional framework for FSM with clear roles and coordination | • Establish institutional framework for FSM with defined roles and coordination mechanisms<br>• Establish institutional roles for fecal sludge treatment and reuse options | • Strengthen institutional framework to enhance service outcomes, with fully implemented roles and coordination<br>• Consider (dis)incentives for improved FSM |
| | **Planning, monitoring and evaluation** | • Build awareness of FSM in national planning entities and relevant sector ministries (works, housing, health, environment, etc.) | • Establish monitoring framework for service standards—focus on emptying services<br>• Establish systems to evaluate service quality | • Strengthen monitoring of all services<br>• Develop plans to enhance treatment capacity and reuse technologies |
| | **Capacity and technical assistance** | • Identify scale of the capacity gap and TA required to address FSM service needs | • Build public and private sector capacity for city-wide FSM services | • Strengthen sector capacity for services, including treatment and reuse markets |
| | **Financing** | • Build awareness and agreement around the budgetary requirements for FSM services | • Develop programs with FSM funding windows and incentives for cities | • Mobilize finance for FS processing, reuse and disposal |
| Local | **Legislation and enforcement** | • Review/establish bylaws, ensuring they address on-site systems and FSM services | • Strengthen bylaws and their enforcement<br>• Introduce regulation of service providers<br>• Incentivize disposal at recognized sites | • Regulate pollution of receiving waters<br>• Penalize for indiscriminate FS dumping<br>• Enforce use of emptiable facilities |
| | **Institutional arrangements** | • Review institutional arrangements for sanitation—ensure FSM is included<br>• Identify local institutional framework for FSM | • Establish local institutional framework for services—with roles defined and agreed<br>• Establish roles for FS treatment and reuse<br>• Consider (dis)incentives for improved FSM | • Strengthen institutional roles for managing improved FS management, including treatment facilities and reuse options<br>• Implement (dis)incentives for improved FSM |
| | **Planning, monitoring and evaluation** | • Conduct area-based, gender and pro-poor focused diagnostic studies<br>• Develop plans, finance and institutional needs<br>• Plan and design FS treatment options | • Establish revenue streams<br>• Refine and implement local service plans<br>• Establish monitoring and evaluation (M&E) of service standards | • Introduce plans to enhance treatment capacity and reuse arrangements<br>• Strengthen M&E of treatment and reuse arrangements against service standards |
| | **Promotion** | • Stimulate customer demand/ willingness to pay (WTP) for FSM | • Disseminate public FSM services information | • Stimulate market demand for reuse of FS |
| | **Capacity and technical assistance** | • Identify capacity gaps and required TA<br>• Promote appropriate private sector services<br>• Implement measures for safer disposal of FS currently dumped in the environment | • Promote/support development of improved, emptiable containment facilities<br>• Strengthen role of service providers<br>• Pilot scheduled desludging/ transfer stations | • Consolidate/expand services based on outcome of pilot studies<br>• Build/rehabilitate FS processing plants and develop business models for reuse of FS |
| | **Financing** | • Identify the extent of financing required to address service improvements to the poorest | • Introduce specific pro-poor financial arrangements (such as targeted subsidies) | • Identify opportunities for financial flows generated from the sale of FS end products |
| Users | **Planning** | • Consult communities, identify needs and wants | • Gain user feedback on improved services | • Gain user opinions on reuse options |
| | **Tenant sanitation** | • Engage with/consult landlords and tenants on constraints to FSM services | • Develop assistance and enforcement packages for landlords | • Focus on enforcement of service quality for landlords |

**TABLE 3:** RESULTING PRIORITIZED ACTIONS: ILLUSTRATIVE EXAMPLE FOR DHAKA CITY

| | Stages of Action | Basic Actions *Critical Interventions for Public Health Protection* | Intermediate Actions *Strengthening Existing Foundations* | Consolidating Actions *Focused on Full-Chain, Sustainable Services* |
|---|---|---|---|---|
| National | **Policy, legislation and regulation** | • Review national sanitation policy and ensure FSM is included<br>• Review regulatory framework around the protection of public health and environment | • Set norms/ standards for public health and environmental protection<br>• Establish legal basis for regulation of FSM services | • Require local regulation and its enforcement<br>• Develop a policy/regulatory framework to incentivize treatment and reuse options |
| | **Institutional arrangements** | • Review institutional arrangements for sanitation—ensure FSM is included<br>• Identify an institutional framework for FSM with clear roles and coordination | • Establish institutional framework for FSM with defined roles and coordination mechanisms<br>• Establish institutional roles for fecal sludge treatment and reuse options | • Strengthen institutional framework to enhance service outcomes, with fully implemented roles and coordination |
| | **Planning, monitoring and evaluation** | • Build awareness of FSM in national planning entities and relevant sector ministries (works, housing, health, environment, etc.) | • Establish monitoring framework for service standards—focus on emptying services<br>• Establish systems to evaluate service quality | • Strengthen monitoring of all services<br>• Develop plans to enhance treatment capacity and reuse technologies |
| | **Capacity and technical assistance** | • Identify scale of the capacity gap and TA required to address FSM service needs | • Build public and private sector capacity for city-wide FSM services | • Strengthen sector capacity for services, including treatment and reuse markets |
| | **Financing** | • Build awareness and agreement around the budgetary requirements for FSM services | • Develop programs with FSM funding windows and incentives for cities | • Mobilize finance for FS processing, reuse and disposal |
| Local | **Legislation and enforcement** | • Review/establish bylaws, ensuring they address on-site systems and FSM services | • Strengthen bylaws and their enforcement<br>• Introduce regulation of service providers<br>• Incentivize disposal at recognized sites | • Regulate pollution of receiving waters<br>• Penalize for indiscriminate FS dumping<br>• Enforce use of emptiable facilities |
| | **Institutional arrangements** | • Review institutional arrangements for sanitation—ensure FSM is included<br>• Identify local institutional framework for FSM | • Establish local institutional framework for services—with roles defined and agreed<br>• Establish roles for FS treatment and reuse | • Strengthen institutional roles for managing improved FS management, including treatment facilities and reuse options |
| | **Planning, monitoring and evaluation** | • Conduct area-based, gender and pro-poor focused diagnostic studies<br>• Develop plans, finance and institutional needs<br>• Plan and design FS treatment options | • Establish revenue streams<br>• Refine and implement local service plans<br>• Establish M&E of service standards | • Introduce plans to enhance treatment capacity and reuse arrangements<br>• Strengthen M&E of treatment and reuse arrangements against service standards |
| | **Promotion** | • Stimulate customer demand/ WTP for FSM | • Disseminate public FSM services information | • Stimulate market demand for reuse of FS |
| | **Capacity and technical assistance** | • Identify capacity gaps and required TA<br>• Promote private sector emptying services<br>• Implement measures for safer disposal of FS currently dumped in the environment | • Promote/support development of improved, emptiable containment facilities<br>• Strengthen role of service providers<br>• Pilot scheduled desludging/ transfer stations | • Consolidate/expand services based on outcome of pilot studies<br>• Build/rehabilitate FS processing plants and develop business models for reuse of FS |
| | **Financing** | • Identify the extent of financing required to address service improvements to the poorest | • Introduce specific pro-poor financial arrangements (such as targeted subsidies) | • Identify opportunities for financial flows generated from the sale of FS end products |
| Users | **Planning** | • Consult communities, identify needs and wants | • Gain user feedback on improved services | • Gain user opinions on reuse options |
| | **Tenant sanitation** | • Engage with/consult landlords on constraints to FSM services | • Develop assistance and enforcement packages for landlords | • Focus on enforcement of service quality for landlords |

# Decision-Support Tool 5: Technical Intervention Options Assessment

The CSDA process highlights priority areas for action through the service chain, which are then considered in relation to the Prognosis for Change. Together with the outputs from the other tools, a comprehensive set of information results, which informs the identification of Intervention Options for technical service improvements and developing program design guidelines. In turn, these will guide further discussions included in detailed project planning and implementation. This section outlines how the collected information may be brought to bear on the identification of Technical Intervention Options.

The starting point in identifying Technical Intervention Options is the fecal waste flow diagram for the area under consideration, which identifies and indicates the magnitude of the *ineffectively managed* fecal waste flows. The significant issues and problems need to be identified for each fecal waste stream shown in the diagram to build up a table that "maps" system types against stages of the service chain. Informed by expertise on good sanitation and fecal sludge management practices appropriate for the target city, potential technical solutions can be proposed for each stage. As a technical solution is identified at a given stage in the service chain, it is essential to consider the implications for the other stages of the chain and identify the associated interventions required.

Table 4 shows an example of Technical Intervention Options along the service chain, proposed for slum areas in Dhaka. It is focused on FSM services as the only feasible short- to medium-term solution for these areas. The same table can and should be applied to other aspects of urban sanitation, including sewered options, as explained in the ***Tools and Guidelines***. This example highlights how technical interventions will be most varied at the stages of containment, emptying and transport, while treatment, disposal and end-use options are likely to coalesce into similar solutions.

Once Technical Intervention Options have been proposed, it is essential to consider the 'institutional' elements within the broader enabling environment that show up as priority areas for action in the CSDA scorecard and in light of the Prognosis for Change. These elements must be addressed if technical interventions are to provide effective and sustainable services. This process is structured around the Service Delivery Action Framework set out in the previous section. A comprehensive description of technical options is found in *Fecal Sludge Management: Systems Approach for Integrated Implementation and Operation* (more information in the Complementary Tools section).

**TABLE 4**: TECHNICAL INTERVENTION OPTIONS FOR DIFFERENT SYSTEM TYPES: FSM IN DHAKA SLUMS

| **System type**<br>• Key problems (one example per system) | Potential Solutions (one or two options for each system type shown here) | | | | | |
|---|---|---|---|---|---|---|
| | **Containment** | **Emptying** | **Transport** | **Treatment** | **Disposal** | **End-Use** |
| **On-site containment: emptiable**<br>• Limited use of emptying services—high rate of FS discharge to drains | Improve the design and construction of septic tanks (STs) and pits, with standards followed to maximize retention of FS | Improve range of responsive and affordable emptying options and services | Identify, pilot and develop innovative transport solutions (mechanized or human powered), offering affordable and responsive services<br><br>Introduce transfer stations for small-vehicle operators—linked to larger collection services to take FS to treatment sites | Introduce a range of de-centralized treatment facilities and/or FS handling station at wastewater treatment plants | Modify existing sites and manage new FS disposal sites—to minimize risk to public and environmental health | Explore financially viable options for FS end-use |
| **On-site containment: non-emptiable**<br>• Poor containment infrastructure | Modify existing STs/pits, to convert to being emptiable and also providing effective containment | Extend emptying services to additional sanitation facilities | | | | |
| **No containment**<br>• Direct discharge to environment | Invest in new household-level containment options, where acceptable to users | Identify ways to service new household containment options without direct discharge | | | | |

## Integrated Design Approach for Treatment

In low-income countries, regulations affecting fecal sludge often do not exist, or are not enforced, which makes defining performance goals for fecal sludge management extremely challenging. Many sanitation infrastructure projects are designed to high performance goals, but end up not performing as intended and frequently failing. While overdesigning of systems wastes money and resources, underdesigning does not provide adequate protection for human health and the environment. Performance goals should ideally include provisions for resource recovery, which can also generate extra financial flows to offset some of the costs in the service chain. Systems including resource recovery can also provide an incentive for efficient and effective collection and transport services, and the optimized operation of treatment plants, in the form of pressures generated by market demand.

SANDEC at EAWAG has published useful reference material in *Fecal Sludge Management: Systems Approach for Integrated Implementation and Operation* (EAWAG/SANDEC 2014) and is currently developing tools to support the integrated design of fecal sludge management and treatment. The tools will be based on field experience in FSM and address five core areas, with the following objectives:

- Market Driven Approach: to aid selection of treated end-products with the greatest potential for market volume and growth;
- Evaluating collection and transport service delivery and the siting of treatment plants;
- Optimized treatment technologies for resource recovery: to optimize existing treatment technologies for increased volumetric capacity or reduced footprint of the treatment plant;
- Fecal sludge quantification and characterization: to estimate the characteristics and quantities of fecal sludge on a city-wide scale, or an appropriate scale to suit the intended treatment plant; and
- Laboratory methods: to prepare reliable and replicable standard methods for laboratory analysis of fecal sludge.

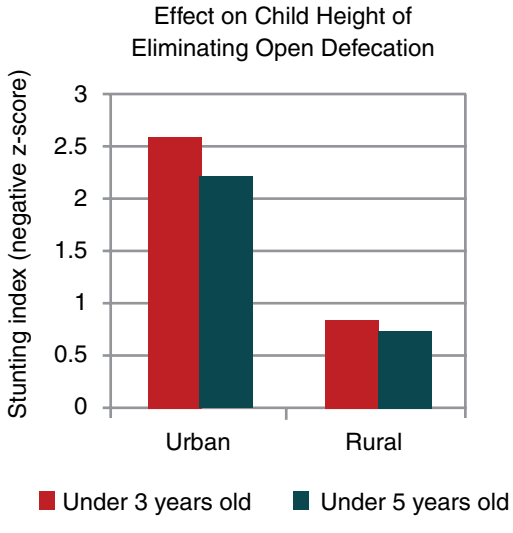
## Public Health Risk Assessment

One of the main rationales for improving sanitation is to improve public health. Statistical analysis shows that stunting, which aggregates many of the effects of poor sanitation, is closely correlated with levels of open defecation, and more so in more densely populated (urban) areas, than in less densely populated areas (Spears 2013), as illustrated in Figure 9. Many studies also show that improving sanitation reduces diarrheal disease, although a causal relationship is harder to pin down.

Public health risk has two components: ***hazard,*** or the levels of fecal contamination along the pathways from feces to mouth; and ***exposure,*** or the frequency and extent of contact with contamination.

Hazard is estimated from measurements of fecal pollution in the environment, or by taking the fecal waste flow diagram further by considering microbiological decay along the pathways. Exposure is more difficult to estimate but may involve individual and group surveys, observation, key

**FIGURE 9:** CORRELATION BETWEEN OPEN DEFECATION AND CHILD STUNTING




*Source:* Spears, D. (2013). DHS data from 130 countries.

informant interviews, GPS mapping, etc. Various initiatives are under development to assess public health risks associated with inadequate sanitation, which should help pinpoint priorities to be targeted with specific interventions.

## Urban Sanitation Status Index

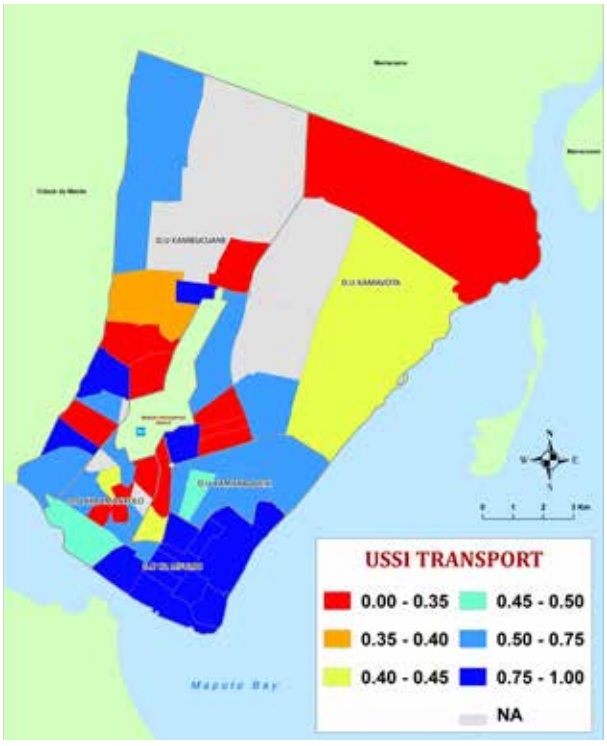
The Urban Sanitation Status Index (USSI) is a tool based on the sanitation service chain that visualizes the sanitation status of a city by ward or neighborhood—i.e., by the lowest administrative city sub-unit. The USSI is based on 20 qualitative indicators assessed via household surveys and key informant interviews. It uses similar data (but in larger quantity, allowing for spatial disaggregation) to those required to develop an SFD, but also includes some basic data on solid waste and drainage, which are important complementary aspects of sanitation in its narrower sense of excreta management.

The base indicators are aggregated into three components grouped along the sanitation service chain: (i) containment; (ii) emptying and conveyance; and (iii) treatment and disposal—and a fourth related component: (iv) complementary services (solid waste and drainage). These components are mapped to give a sense of where in a city the service chain is failing most severely (see maps in Figure 10). They can also be aggregated into an overall USSI for each neighborhood based on a weighted geometric mean of all the variables.

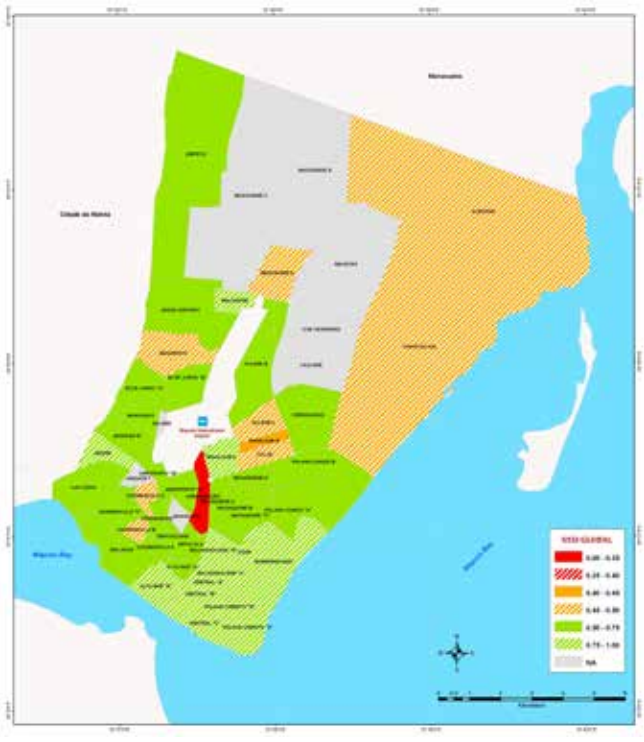
## FSM Costing

USAID are supporting the development of a FSM costing and financing tool, which is currently being field tested in Indonesia. This comprehensive tool has the potential for adaptation for use in other countries. The tool estimates the number of staff, number of trucks, capital costs and ongoing operation and maintenance costs for a complete FSM system including collection, treatment, management and community engagement. The tool calculates appropriate tariffs to cover all of these costs, based on local capital and recurrent unit cost data, and presents relevant financial data

**FIGURE 10:** EXAMPLES OF USSI OUTPUT MAPS FOR SPATIAL PRIORITIZATION IN MAPUTO, MOZAMBIQUE




**Emptying and Conveyance**



**Overall Urban Sanitation Status Index**

Source: Hawkins, Peter and Odete Muximpua. 2015. *Developing Business Models for Fecal Sludge Management in Maputo* (unpublished paper). Washington DC: The World Bank.

in a variety of formats and reports. Other functionalities of the tool include:

- Evaluation of distances and times required for collection of septage;
- Comparisons between different FSM service delivery models (private sector and government) and septage treatment options; and
- Modeling of capital and recurrent financing from government and non-government loans, grants and revenue, in addition to charges paid by serviced customers.

This tool is not widely available yet, and still requires further testing and development. It would, in any case, need to be adapted for application in any specific country or city.

# References


AMCOW (African Ministers Council on Water). 2011. AMCOW Country Status Overviews—Regional Synthesis Report. *Pathways to Progress: Transitioning to Country-Led Service Delivery Pathways to Meet Africa's Water Supply and Sanitation Targets*. Washington, DC: The World Bank/Water and Sanitation Program. http://www.wsp.org/wsp/content/pathways-progress-status-water-and-sanitation-africa.

Blackett, Isabel C., Hawkins, Peter M., Heymans, and Chris. 2014. *The Missing Link in Sanitation Service Delivery: A Review of Fecal Sludge Management in 12 Cities*. Water and Sanitation Program Research Brief. Washington DC: World Bank Group.

EAWAG/SANDEC. 2014. Edited by Linda Strande, Mariska Ronteltap, and Damir Brdjanovic. *Fecal Sludge Management: Systems Approach for Implementation and Operation*. London: IWA Publishing. http://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/publikationen/EWM/Book/FSM_Book_LowRes.pdf.

Medland, L., Cotton, A.P., and Scott, R.E. 2015. *SPLASH Urban Sanitation Research Programme Briefing Note 1: An Enabling Environment for Urban Sanitation*. Loughborough, UK: Water, Engineering and Development Centre (WEDC), Loughborough University.

Peal A., Evans B., Blackett I., Hawkins P., and Heymans C. 2014. "Fecal Sludge Management (FSM): Analytical Tools for Assessing FSM in Cities." Review Paper. *Journal of Water, Sanitation and Hygiene for Development*: 4:371–383.

Spears, D. 2013. *How Much International Variation in Child Height Can Sanitation Explain?* World Bank Policy Research Working Paper 6351. Washington, DC: World Bank.

World Bank. 2007. *Tools for Institutional, Political, and Social Analysis of Policy Reform: A Sourcebook for Development Practitioners*. Washington, DC: World Bank. *For guidance on stakeholder mapping, see p. 126ff.*

World Bank. 2011. *The Political Economy of Sanitation: How Can We Increase Investment and Improve Service for the Poor?* (Main Report). Water and Sanitation Program Technical Paper. Washington, DC: World Bank.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