88258

Targeting the Urban Poor and Improving Services in Small Towns

The Missing Link in Sanitation Service Delivery

A Review of Fecal Sludge Management in 12 Cities

April 2014

INTRODUCTION

Globally, the great majority of urban dwellers, especially poor people, rely for their sanitation on non-sewered systems that generate a mix of solid and liquid wastes generally termed "fecal sludge." In poor and rapidly expanding cities, fecal sludge management (FSM) represents a growing challenge, generating significant negative public health and environmental risks. Without proper management, fecal sludge is often allowed to accumulate in poorly designed pits, is discharged into storm drains and open water, or is dumped into waterways, wasteland, and unsanitary dumping sites. This study seeks to assess the extent of this issue, and the major constraints that need to be overcome to improve fecal sludge management.

ACTION

Study Cities

A desk study of 12 cities (see Table 1) was undertaken as a first step toward analyzing fecal sludge management in a variety of cities representing various regions, sizes, types, and levels of service delivery.

Sanitation Service Chain[1]

Figure 1 sets out the interlinked steps required to deliver urban sanitation. Sewerage systems combine the emptying and transport functions in the sewer network, whereas on-site systems are emptied by a combination of mechanical suction or manual excavation, with the sludge being carried to treatment by road.

[1] The term "value chain" is often used interchangeably with "service chain" (Trémolet 2011) but in this study the term "service chain" is preferred.

KEY FINDINGS

Fecal sludge is poorly managed

- Almost two-thirds of households in the cities studied rely on on-site sanitation facilities.
- On average, fecal waste from only 22 percent of households using on-site systems is safely managed.
- In only two of the 12 cities studied was fecal waste from more than 50 percent of households using on-site systems safely managed.

Fecal sludge management is "invisible" to policymakers

- Most fecal sludge management is unsystematic and unplanned, and provided by informal private service providers.
- Fecal sludge management is widely seen as a stop-gap solution for informal areas, but it actually serves many legal settlements too.
- There is a bias toward sewerage over fecal sludge management in most policies and projects.
- Very little data or information is available.

Technical and institutional issues requiring resolution

- Fecal sludge collection is poorly regulated, if at all, and illegal dumping is common.
- The construction of most toilets does not take emptying into account.
- Unhygienic manual emptying and overflows to drainage systems are widespread.
- Appropriate treatment and disposal facilities are generally lacking.
- There is insufficient empirical data for estimating fecal sludge accumulation rates and demand for fecal sludge management services.

wsp water and sanitation program

TABLE 1: The 12 City Case Studies

Country	City	Population (millions)	% Households Using		
			On-site Systems	Sewerage	Open Defecation
Latin America					
Bolivia	Santa Cruz	1.9	51%	44%	5%
Honduras	Tegucigalpa	1.3	16%	81%	3%
Nicaragua	Managua	1.0	56%	40%	4%
Africa					
Mozambique	Maputo	1.9	89%	10%	1%
Senegal	Dakar	2.7	73%	25%	2%
Uganda	Kampala	1.5	90%	9%	1%
South Asia					
Bangladesh	Dhaka	16.0	79%	20%	1%
India	Delhi	16.3	24%	75%	1%
East Asia					
Cambodia	Phnom Penh	1.6	72%	25%	3%
Indonesia	Palu	0.4	91%	—	9%
Philippines	Dumaguete	0.1	97%	—	3%
Philippines	Manila	15.3	88%	9%	3%
Totals			**64%**	**34%**	**2%**

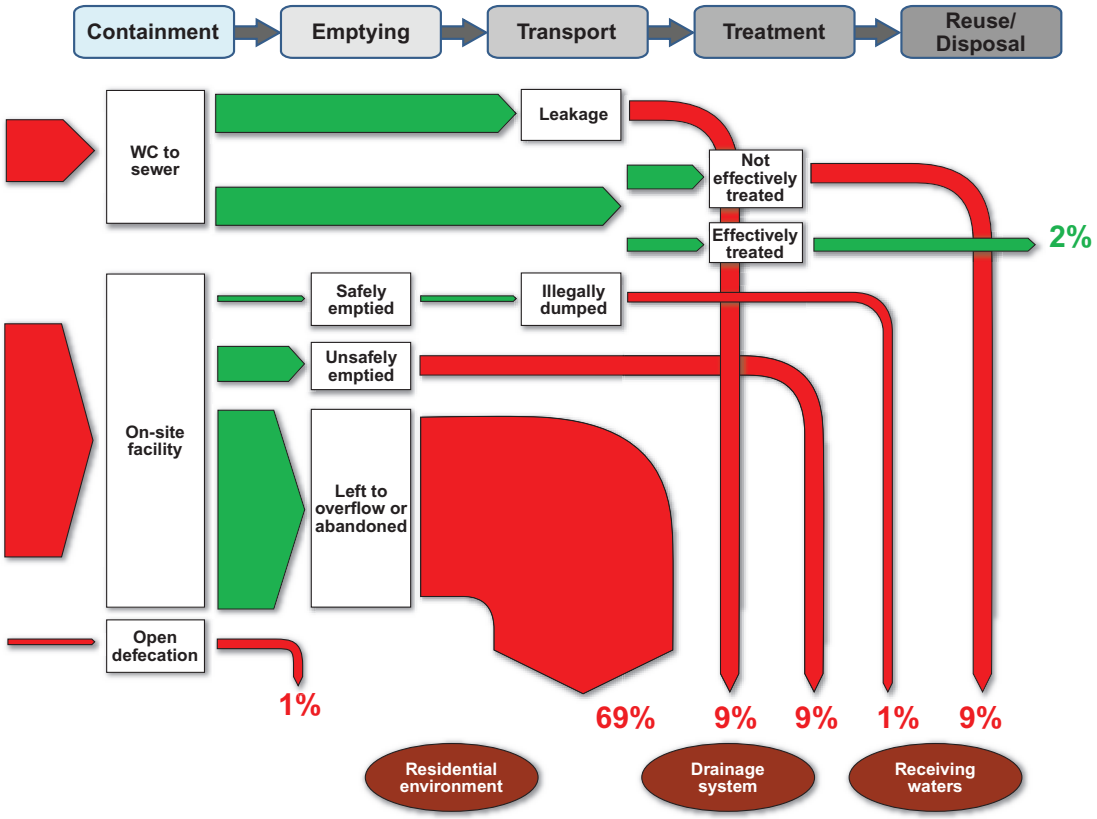
Figure 1: Sanitation Service Chain

This service chain was used as a framework for analyzing how fecal waste physically flows through the system. A fecal waste flow matrix and diagram were developed to summarize city-level outcomes and highlight bottlenecks in fecal waste management.[2] Even where limited primary data are available, the use of best estimates based on available data, expert opinions, and thorough checking with field staff was sufficient to provide a robust overview, given the extent of the problems this analysis revealed. Figure 2 illustrates the situation in Dhaka, Bangladesh.

The width of the arrows and the percentages shown represent the proportion of the population whose fecal waste takes each route. Although nearly all waste is effectively contained at the household level, unsafe management of on-site facilities combined with highly inadequate sewerage and wastewater treatment mean that fecal waste is distributed throughout the urban environment.

[2] The flow diagram developed and used is similar to concepts developed independently by Scott (2011) in Dakar, Senegal, who uses the term "sanitation cityscape" and also by Whittington, et al. (1993) in Kumasi, Ghana. Other similar frameworks and approaches may also exist.

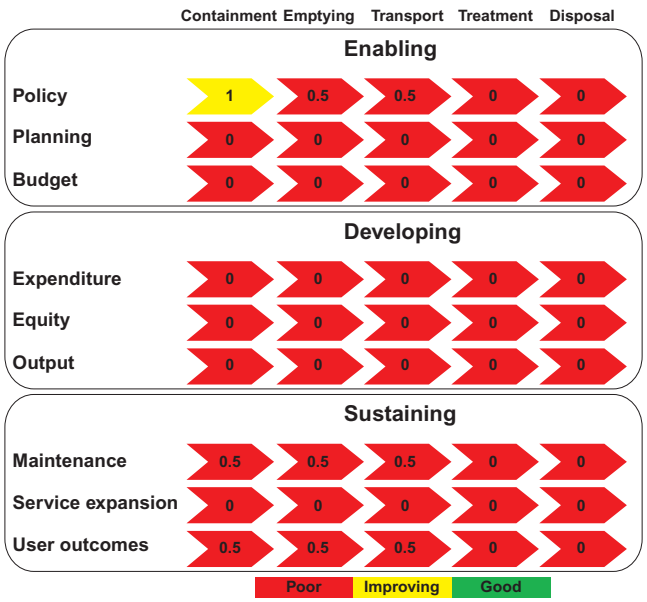
Figure 2: Fecal Waste Flows in Dhaka, Bangladesh



Service Delivery Assessment Scorecard

The second analysis tool used was the Service Delivery Assessment (SDA) scorecard (Figure 3).[3] This tool analyzes the enabling environment, the level and management of budgets and other inputs needed to develop adequate fecal sludge management services, and the factors contributing to service sustainability.[4] The scorecard was applied to each step of the sanitation service chain, resulting in a two-dimensional matrix in which bottlenecks and gaps at any point along the chain are identified and classified according to whether the issues are in the enabling environment, in service development, or in sustaining services.

Figure 3: Fecal Sludge Management Scorecard for Dhaka, Bangladesh



[3] The SDA was originally developed to provide a national-level overview of the quality of urban and rural sanitation and water supply service delivery.
[4] The tool generates a score ranging from zero (worst case) to three (best case) in response to a set of specific questions relating to components of the enabling environment (policy, planning, budget), development of services (expenditure, equity, outputs), and sustainability of services (maintenance, service expansion, user outcomes). It uses a red, amber, and green color-coding to highlight the scores.

KEY FINDINGS

Fecal Sludge Is Poorly Managed

Joint Monitoring Programme (JMP) figures show that 64 percent of the population of the study cities relies on on-site sanitation and therefore on fecal sludge management services. A population-weighted average derived from the fecal waste flow matrices for each city shows that fecal waste from only 22 percent of households using on-site systems is safely managed. It is only in the two smallest towns (Palu, Indonesia, and Dumaguete, Philippines)—where there is no sewerage—that more than 50 percent of fecal sludge is adequately managed.

Fecal Sludge Management Is Invisible to Policymakers

The study found little systematic management of fecal sludge. Most existing services tend to be informal and outside public sector control. Most cities had low scores for policies, planning, and budgeting around all elements of the service chain, indicating the low priority placed on this aspect of urban sanitation in most countries. Possible reasons for this include:

- **Fecal sludge management is seen as a "temporary" or stop-gap solution and primarily for illegal or informal settlements.** For example, although some city authorities provide limited services with a small fleet of vacuum trucks, in most cities an unregulated private sector steps in to fill the gap. In South Asia and particularly in Africa, unhygienic manual emptying predominates, whereas in Latin America and East Asia, mechanical emptying using vacuum trucks is the norm. Whilst policy mostly remains focused on long-term provision of sewerage,[5] the study showed that fecal sludge management is often the long-term solution, and that the private sector may be quicker to recognize this than public policymakers. Fecal sludge management services have been provided by private companies for more than 20 years in, for example, Santa Cruz, Bolivia; Managua, Nicaragua; and Phnom Penh, Cambodia.
- **Sewerage is usually seen as the "proper" solution.** Drivers for this include the technical bias often imparted during engineer training, and the nature of many investment projects that may favor simple, single lumpy investments over ongoing service delivery approaches.

One result of this official neglect is that there is very little data on fecal sludge management, regarding both its current status in any given city, and field-based technical data on delivering effective fecal sludge management services.

Technical and Institutional Issues Requiring Resolution

The data collected and made available by city authorities is weak, often contradictory, and rarely disaggregated in a useful way. However, it is clear that fecal sludge management services are generally highly unsatisfactory. The following significant observations stand out:

- **Illegal dumping** by private manual and mechanical pit emptiers into the sea, rivers, wasteland, and landfill sites is common in all but two cities: Dumaguete and Palu. Fecal sludge management services are mostly unregulated, and no specific regulatory framework for these services was encountered.
- The **quality of household containment is generally inadequate** and adversely affects owners' ability to have their units emptied. Poor-quality pits are often abandoned unsafely with risks to the environment and public health. This situation was reported in all but two cities. However, in a few cases where space allows, mostly on the urban fringes rather than in dense slums, the fecal sludge may remain safely buried, with the user covering the pit once it is full.[6]
- There is a **lack of treatment facilities for fecal sludge**. Usually fecal sludge is dumped into the existing wastewater treatment plant, which may jeopardize sewage treatment. Dedicated sludge treatment facilities exist in only five of the twelve cities.
- Only two cities had any **mechanism for formal reuse of treated sludge** (Dumaguete and Manila in the

[5] This is also reflected in local building regulations and/or technical standards that fail to specify appropriate on-site systems but are predicated on the assumption that new housing will be provided with networked sewerage.

[6] Often this mimics the operation of an "arborloo" (see Tilley et al. 2008).

Philippines). However, in neither city is reuse well developed or profitable.

- **Sludge accumulation rates vary widely**, and it is almost impossible to generate norms that could be used to determine requirements for emptying and transport (in terms of both capacity and the nature of the fecal sludge to be emptied and transported), which in turn has implications for the types of transport and treatment required.

Scorecards and a Typology for City Fecal Sludge Management Services

Based on a review of their fecal sludge management scorecards and fecal waste flow diagrams, the 12 cities were grouped according to the effectiveness of the service delivery framework and the level of service being achieved. Three city types were identified among the 12 case studies:

- **Poor fecal sludge management,** with no framework for service delivery and almost no services, which could be termed "institutionalized open defecation." These include Managua, Delhi, Phnom Penh, and Dhaka.
- **Basic fecal sludge management,** where some of the service delivery framework is in place and there is limited service provision. This category includes Manila and Kampala.
- **Improving fecal sludge management,** where most of the framework is in place and services exist, but there is still room for improvement. These include Dumaguete and Palu.

Figure 4 shows a summary scorecard for each of the three city types. Based on this scorecard, Table 2 gives an overview indicating the level of fecal sludge management service that is being delivered, and the proportion of fecal waste safely managed, in each of the 12 cities.

The fecal sludge management scorecard for Dhaka is presented in Figure 3, and is typical of a type 1 city. The policy and regulatory environment is predicated on sewerage, and

Figure 4: Typology of Cities and Summary Scorecards

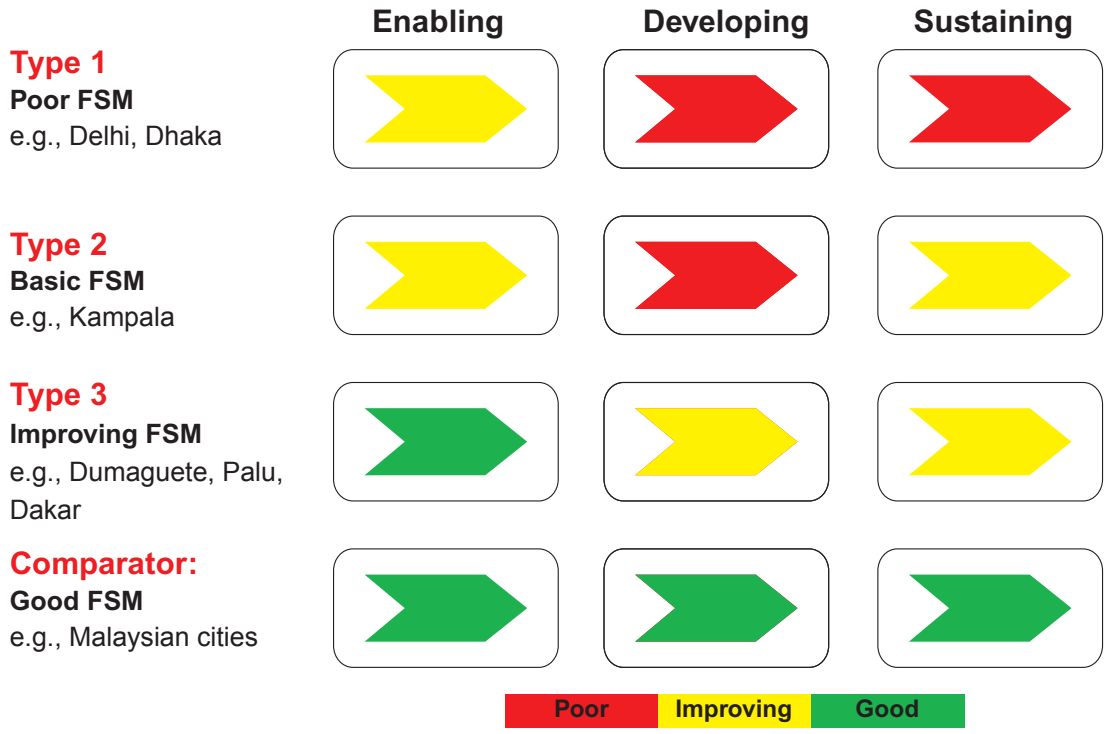


Table 2: Overview of Fecal Sludge Management Service Delivery in the 12 Cities

			% Households Using			% Fecal Waste Safely Managed		
Country	City	FSM Type	On-site Systems	Sewerage	Open Defecation	On-site Systems	Sewerage	Total
Latin America								
Bolivia	Santa Cruz	1—poor	51%	44%	5%	38%	100%	59%
Honduras	Tegucigalpa	1—poor	16%	81%	3%	31%	8%	11%
Nicaragua	Managua	1—poor	56%	40%	4%	38%	81%	52%
Africa								
Mozambique	Maputo	1—poor	89%	10%	1%	28%	12%	26%
Senegal	Dakar	3—improving	73%	25%	2%	39%	12%	31%
Uganda	Kampala	2—basic	90%	9%	1%	37%	80%	40%
South Asia								
Bangladesh	Dhaka	1—poor	79%	20%	1%	0%	10%	2%
India	Delhi	1—poor	24%	75%	1%	0%	46%	34%
East Asia								
Cambodia	Phnom Penh	1—poor	72%	25%	3%	0%	0%	0%
Indonesia	Palu	3—improving	91%	—	9%	95%	—	86%
Philippines	Dumaguete	3—improving	97%	—	3%	95%	—	92%
Philippines	Manila	2—basic	88%	9%	3%	41%	90%	44%
Totals			**64%**	**34%**	**2%**	**22%**	**42%**	**29%**

the only acknowledgement of on-site sanitation is the limited acceptance of on-site facilities.

Figures 5 and 6 depict the situation in a type 3 city: Dakar, Senegal. Although there is an established framework for FSM, the downstream end of the sanitation service chain is still deficient and its sustainability is in doubt. The amount of fecal sludge directly polluting residential areas is about 30 percent, as compared to about 70 percent in Dhaka.

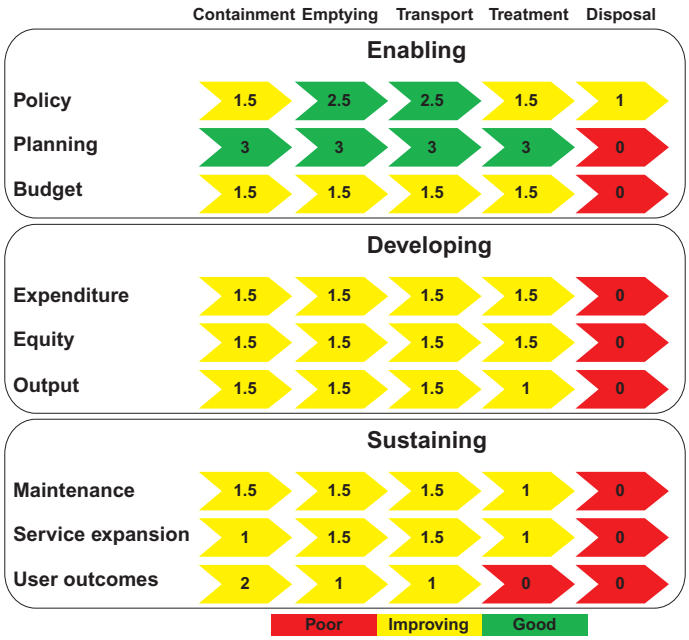
WHAT ELSE DO WE NEED TO KNOW?

As the challenge of fecal sludge management is generally over-simplified and underestimated, tools to help practitioners make rapid assessments could significantly improve the scale and impact of interventions. This could be achieved by further developing the scorecard, and by systematically assessing the volume of fecal sludge generated and the various pathways it takes from containment to disposal. The fecal waste flow analysis developed here provides a building block for developing the assessments further.

A number of knowledge gaps need to be addressed in order to design effective and sustainable interventions. These include:

- The extent and economic value of public health, environmental, and financial benefits arising from effective containment of fecal sludge within the sanitation service chain, from containment to reuse;
- The development of viable market and business models along the fecal sludge management service chain, from toilet construction, to emptying and transport, to reuse;
- The establishment of innovative institutional and management arrangements that allow for clear responsibility

Figure 5: Type 3 City—Dakar, Senegal. Improving Fecal Sludge Management (Framework in Place, Services Exist)



for fecal sludge management, and also tie this into the broader local government, utility, and community systems of governance, participation, and feedback;

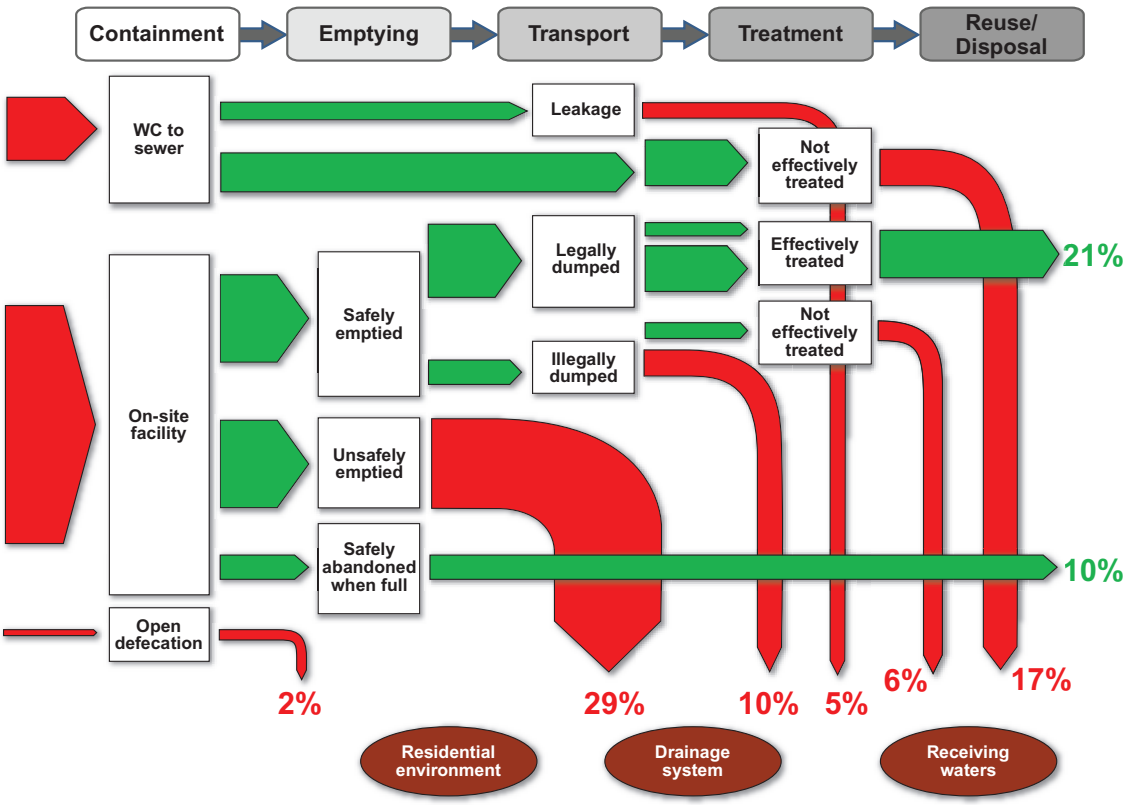
- How most effectively to fit the range of fecal sludge management technologies to the potential market opportunities, and how to link these with innovative and effective financial arrangements;
- The range of regulatory approaches and instruments across the service chain that could best incentivize optimum behaviors by users of fecal sludge management services, service providers, and managers, and effectively link the elements of the service chain together.

REFERENCES

Scott, P. C. 2011. "Unbundling Tenure Issues for Urban Sanitation Development." PhD dissertation, Loughborough University of Technology, United Kingdom.

Tilley, E., C. Lüthi, A. Morel, C. Zurbrügg, and R. Schertenleib. 2008. *Compendium of Sanitation Systems and*

Figure 6: Fecal Waste Flows in Dakar, Senegal



Technologies. Dübendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (Eawag). http://www.wsscc.org/node/831.

Trémolet, S. 2011. "Identifying the Potential for Results-Based Financing for Sanitation." Washington, DC: Water and Sanitation Program, The World Bank.

Whittington, D., D. T. Lauria, K. Choe, J. A. Hughes, V. Swarna, and A. Wright. 1993. "Household Sanitation in Kumasi, Ghana: A Description of Current Practices, Attitudes, and Perceptions." *World Development* 21(5): 733–748. Philadelphia: Elsevier, Inc.

RELATED READING

Hawkins, P., I. Blackett, and C. Heymans. 2013. "Poor-Inclusive Urban Sanitation: An Overview." Washington, DC: Water and Sanitation Program, The World Bank. http://www.wsp.org/wsp/sites/wsp.org/files/publications/WSP-Poor-Inclusive-Urban-Sanitation-Overview.pdf.

Chowdhry, S., and D. Kone. 2012. "Business Analysis of Fecal Sludge Management: Emptying and Transportation Services in Africa and Asia." Seattle: The Bill & Melinda Gates Foundation. http://www.washdoc.watsan.net/content/download/276259/2998749/version/1/file/Chowdhry-2012-Business.pdf.

Strande, L, M. Ronteltap, and D. Brdjanovic, eds. Forthcoming (2014). *Faecal Sludge Management: Systems Approach for Implementation and Operation.* London: IWA Publishing.

ACKNOWLEDGMENTS

This research brief was prepared by Isabel Blackett, Peter Hawkins, and Chris Heymans. The authors wish to acknowledge the fundamental contribution to the research by consultants Andy Peal and Barbara Evans, the active engagement and support of Ravikumar Joseph and Zael Sanz Uriarte in developing the analytical framework, the many WSP staff who took time out to gather the basic data, and the encouragement of the WSP management team.

WSP and Urban Sanitation

Over half the world's population now lives in urban areas, with the number living in slums growing by more than 20 million every year, and ever more urban dwellers lacking access to improved sanitation. Because this is an increasingly important issue for urban managers in the developing world, WSP carried out a global review on challenges, trends, and approaches to achieve viable poor-inclusive urban sanitation at scale. One of the key findings was that effective urban sanitation depends on a chain of services, and that one of the largest gaps in the chain is fecal sludge management (FSM). This study represents WSP's initial steps towards raising the profile of FSM and gaining a deeper understanding of the issue. More detailed work is in progress. For more information, please visit www.wsp.org.

Contact us

For more information please visit www.wsp.org or email Isabel Blackett or Peter Hawkins at worldbankwater@worldbank.org.

THE WORLD BANK

wsp water and sanitation program