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FOR ALL IN A FAST CHANGING WORLD

Why faecal sludge management matters and what needs to be done to serve poor communities better

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This paper outlines findings and recommendations of a faecal sludge management (FSM) study in 12 cities, and looks at the need for FSM in poor communities. The study used secondary data from 12 cities in low and middle-income countries, to assess the institutional context and estimate outcomes in terms of safely managed faecal sludge. None of the cities managed faecal sludge effectively, although performance varied. Where the cities do address faecal sludge the solutions are partial, and tend to focus on sewerage systems which serve a minority. FSM requires strong city-level oversight and an enabling environment that drives coordinated actions along the sanitation service chain; and this was largely absent. This paper also looks at the sanitation services used by poor people and the FSM services they need, to provide an understanding of priority FSM challenges and as a means to identify solutions.

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 "faecal sludge." In poor and rapidly expanding cities, faecal sludge management (FSM) represents a growing challenge, generating significant negative public health and environmental risks. Without proper management, faecal 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 FSM.

Study cities

A desk study of 12 cities (see Table 1) was undertaken as a first step toward analysing FSM in a variety of cities representing various regions, sizes, types, and levels of service delivery (Peal and Evans 2013).

Table 1. Study cities

Country	City	Population (millions)	% Households using		
			On-site	Sewerage	Open defecation
Latin America					
Bolivia	Santa Cruz	1.7	51%	44%	5%
Honduras	Tegucigalpa	1.3	16%	81%	3%
Nicaragua	Managua	2.0	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	79%	20%	1%
India	Delhi	16.3	24%	75%	1%
East Asia					
Cambodia	Phnom Penh	1.6	72%	25%	3%
Indonesia	Palu	0.35	91%	-	9%
Philippines	Dumaguete	0.12	97%	-	3%
Philippines	Manila	15.3	88%	9%	3%
Totals			**64%**	**34%**	**2%**

Sanitation service chain and faecal waste flow diagram

The study used two main tools. Firstly, the Sanitation Service Chain (Hawkins et al 2013) as in Figure 1, shows the interlinked steps required to deliver adequate urban sanitation. Sewerage systems combine the emptying and transport 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.

Figure 1. Sanitation Service Chain

This service chain was used as a framework for analysing how faecal waste flows through the environment. A faecal waste flow diagram as in Figure 2 was developed to illustrate city-level outcomes and highlight bottlenecks in faecal waste management (WSP 2014).[i] 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 estimate and 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 in the diagram represent the proportion of the population whose faecal waste takes each route. Although most waste is effectively contained at the household level, unsafe management of on-site facilities combined with highly inadequate sewerage and wastewater treatment mean faecal waste is spread throughout the urban environment.

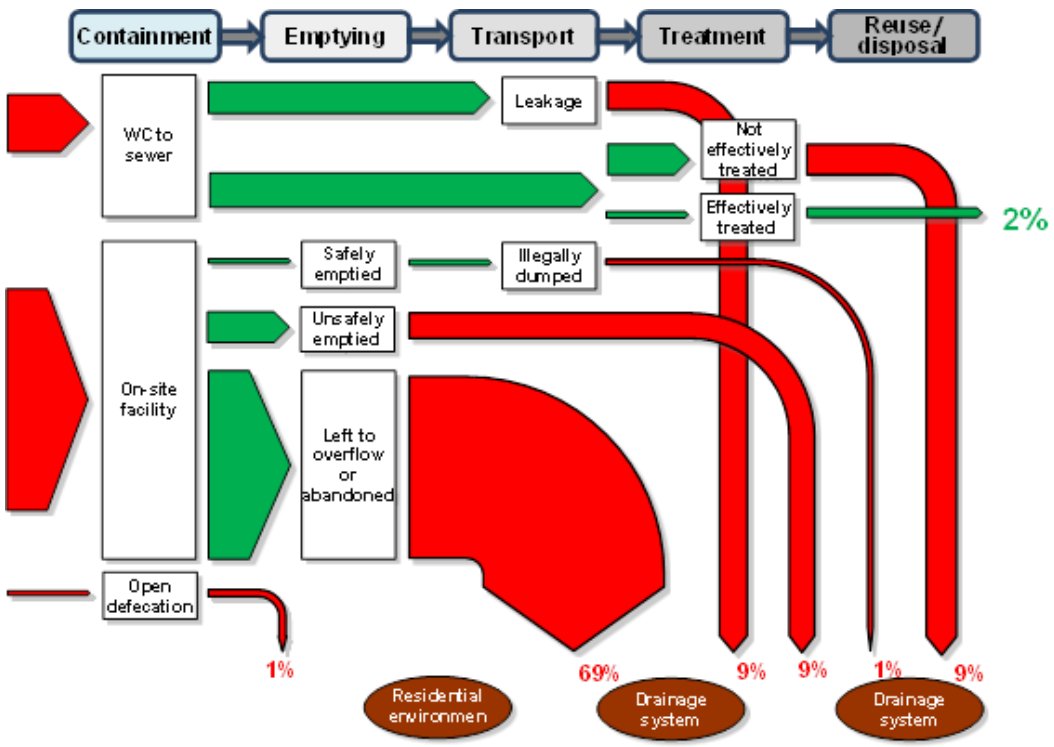

Figure 2. Faecal waste flow diagram – Dhaka, Bangladesh

Source: WSP 2013

Key findings

FSM service delivery performance is poor

Joint Monitoring Programme (JMP) figures show that on average 64 percent of the population of the study cities relies on on-site sanitation and therefore on FSM services. The remainder of the population use a mix of off-site sewerage systems and open defecation practices. A population-weighted average derived from the faecal waste flow matrices for each city shows that faecal waste from only 22 percent of households using on-site systems is safely managed. Of the 12 cities studied, seven were rated as 'poor' with almost no formal or safe faecal sludge management. Only in the two smallest towns (Palu, Indonesia, and Dumaguete, Philippines)—where there is no sewerage—is more than 50 percent of faecal sludge adequately managed.

FSM is invisible to policymakers

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

- **FSM 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. Policy is mostly focused on long-term provision of sewerage, reflected in local building regulations and/or technical standards that fail to specify appropriate on-site systems, and are predicated on the assumption that new housing will be provided with networked sewerage. The study showed that FSM is often a long-term solution, and that the private sector may be quicker to recognize this than public policymakers. FSM 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 favour simple, single lumpy investments over on-going service delivery approaches.

One result of this official neglect is that there is little information available on FSM, including both data on current conditions in any given city, and technical data from the field on delivering effective FSM 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 FSM service delivery performance is 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. FSM services are mostly unregulated, and no regulatory framework with specific provisions for FSM 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 faecal sludge may remain safely buried, with the user covering the pit once it is full, rather like an "arborloo" (see Morgan et al., 2007).
- **There is a lack of FSM treatment facilities.** Faecal sludge is frequently dumped into the existing wastewater treatment plant, which may jeopardize sewage treatment. Dedicated sludge treatment facilities exist in only five of the twelve cities.
- **Sludge accumulation rates vary widely**, but are often high. 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 faecal sludge to be emptied and transported), which in turn has implications for the types of transport and treatment required.
- **Only two cities had any mechanism for formal reuse of treated sludge** (Dumaguete and Manila in the Philippines). However, in neither city is the practice of reuse well developed or profitable.

Why do poor people need FSM services?

Globally, the majority of both urban and rural dwellers in the lowest two wealth quintiles use on-site sanitation – if they have access to a toilet at all. Figure 3 gives DHS data for Bangladesh, showing that the poorest 40 percent mostly practice open defecation or use on site pit latrines or septic tanks. This pattern is repeated, with more or less open defecation, across nearly all low and many middle-income countries.

In rural areas, where space is available, relocating latrine pits when full or manually emptying and burying the wastes is often possible, and may be associated with nutrient reuse, as in the case of the "Arborloo". In poor urban areas where space tends to be at a premium this is rarely possible, and latrine wastes have to be removed by manual or mechanical means and transported to a disposal site. Figures 3, 4 and 5 all show that as wealth increases, in many countries people move from open defecation to using on-site facilities, therefore further increasing demand for faecal sludge management services, where these people are urban dwellers.

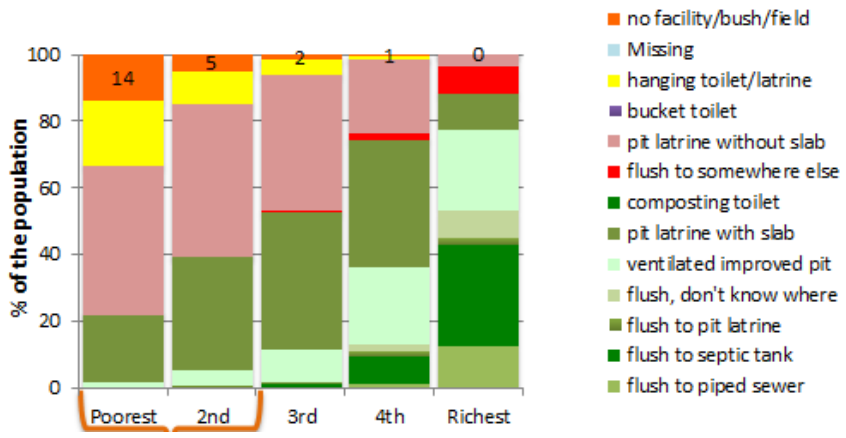

Figure 3. Type of sanitation facility by wealth quintile, Bangladesh

Figures 4 and 5 show the type of sanitation facility used by the poorest people in Indonesia (urban) and Ghana (urban and rural). Over 60 and 40 percent of the poorest quintiles and around 80 percent of the second poorest quintile, use on site facilities, with the others practicing open defecation. In addition it should be noted that faecal sludge management services are also needed to serve the many middle class households who are also without access to sewerage.

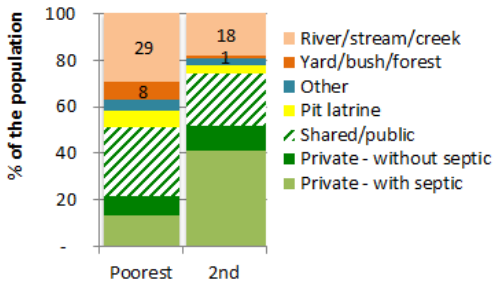

Figure 4. Type of urban sanitation facility used by the poorest 40% in Indonesia

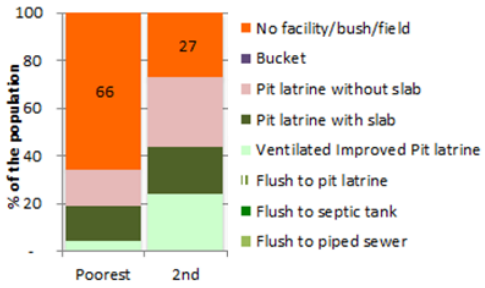

Figure 5. Type of sanitation facility used by the poorest 40% in Ghana

What are the specific FSM challenges in poor communities?

The study found that manual emptying predominates in Africa and South Asia, whilst the use of vacuum tankers is the norm in in Latin America and East Asia. The study also identified that although latrine wastes were removed from the household facility and immediate surroundings they were rarely well managed or treated.

Demand for pit emptying services varied considerably, with high rates of faecal sludge accumulation seen in many places (e.g. Kampala, Uganda and Maputo, Mozambique). This is typically due to one or more of the following reasons:

- A large number of users per pit,
- The use of sealed tanks, clay or other impermeable soils, and/or high water tables;
- The use of solid materials for anal cleansing; and
- The addition of refuse is common in poor communities. Poor refuse collection services, typical of slums and informal areas, often results in pit latrines being used for disposal of some solid materials.

Accumulation rates were lower in a few places (Palu, Indonesia; and Dumaguete, Philippines), characterised by lower numbers of users per facility, high ambient temperatures all year round, the use of

water for anal cleansing and the common use of water-sealed pour flush pans which deter users from depositing refuse in the pit.

A frequently encountered problem is that in the informal settlements where many poor people live, road access to houses is inadequate, so that conventional vacuum tankers are unable to service the toilets. This means that specially designed desludging equipment needs to be wheeled or hand carried to the house and the sludge wheeled or carried back to a transfer facility or a waiting tanker that can make the road journey to the treatment and/or disposal site. This can be undertaken by locally-based micro-enterprises on a commercial basis. In some countries longer hoses and stronger pumps may be able to do the job if the distances are not too great. Due to the historical neglect of providing services in these communities, there is still a very limited range of affordable and maintainable technology available for primary emptying for hard-to-reach households, while the need for secondary transport (or the transport of small volumes in primary emptying equipment) to the disposal sites results in a higher cost of service, which may put it beyond the reach of poor people.

This issue is far from being resolved. One approach is to subsidize the secondary transport, possibly from a fee levied on water bills, or from general municipal funds. This is consistent with the fact that transport to the disposal site is a public good; the householder simply wants the sludge to be removed from the property so that the toilet becomes useable again. This also makes sense from an equity perspective, given that sewerage systems, which typically serve the more wealthy customers in low- and middle-income countries, benefit from substantial public financing of capital, operation and maintenance costs.[ii] A study of how to finance sanitation services for the urban poor was undertaken in four cities in Africa by Water and Sanitation Services for the Urban Poor (Norman et al 2012)). The study shows that various financing mechanisms are being tried and with some success, but that far more work needs to be done.

A second possible source of funds is from re-use of treated and processed sludge. If viable sludge collection businesses can be established, the quantities will become more significant and of greater interest to end-users. Typical end-uses are as a soil conditioner/fertilizer or as solid fuel. The economics of this tend to be marginal, and the most profitable use will depend on the interest of and distance from potential customers, and the cost of alternative fertilizers or solid fuels. This requires detailed study in any given situation. This re-use may be coupled with carbon credits under the clean development mechanism.

Conclusions

Key FSM challenges for poor communities include: the prevalent use of inadequate and low quality on-site sanitation; dense settlements with difficult access for emptying; and variable but often high sludge accumulation rates. In most cities studied, there are only limited FSM services, and those tend to be ad hoc informal arrangements, often involving unhygienic manual emptying, typically resulting in wastes being discharged to water bodies or land causing widespread pollution. There are also very few examples of appropriate emptying and sludge treatment. Likewise, financing mechanisms and models that sustainably address the constraints experienced in many poor communities have to yet be developed.

These varying conditions as they apply in specific cities, need to be the basis for developing pro-poor FSM solutions. However, to be sustainable, these FSM solutions need to be part of citywide approaches that include services for the many non-poor households who also use on-site sanitation, and the provision of appropriate ‘trunk’ infrastructure where necessary. This citywide approach is necessary to ensure all faecal waste is safely managed: safely removed (or buried), properly treated and safely disposed of or, where possible, safely reused. This approach will have a direct benefit through improving public health and reducing environmental pollution. Importantly, citywide FSM systems need to be efficient and financially viable with payment mechanisms that provide the private sector with incentives for safely transporting faecal waste to treatment facilities. Further study and piloting is recommended around viable payment mechanisms that will facilitate payment by poor people and promote equity in terms of both public and private benefits.

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Note/s

[i] The flow diagram is based on concepts developed independently by Scott (2010) in Dakar, Senegal, who uses the term "sanitation cityscape" and also by Whittington et al. (1993) in Kumasi, Ghana. Other similar frameworks and approaches also exist.

[ii] For example, *Evaluating the Effectiveness of Public Finance for Sanitation*, 2013 (Trémolet and Mansour 2013) found that 99% of public spending for sanitation in Dar Es Salaam, Tanzania is allocated to the sewerage system, which serves around 10% of the Dar Es Salaam population.

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