Review Paper

Fecal sludge management: a comparative analysis of 12 cities

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ABSTRACT

This paper outlines the findings of a fecal sludge management (FSM) initial scoping study in 12 cities. This short, desk-based study assesses the institutional context and the outcome in terms of the amount of fecal sludge safely managed in each city. A range of cities was included in the review, all in low- and middle-income countries. None of the cities studied managed fecal sludge effectively, although performance varied. Where cities are seeking to address fecal sludge challenges the solutions are, at best, only partial, with a focus on sewerage which serves a small minority in most cases. FSM requires strong city-level oversight and an enabling environment that drives coordinated actions along the sanitation service chain; this was largely absent in the cities studied. Based on the findings of the review a typology of cities was developed to aid the identification of key interventions to improve FSM service delivery. Additional work is recommended to further improve the tools used in this study in order to enable better understanding of the FSM challenges and identify appropriate operational solutions.

Key words | fecal sludge management, institutions, low-income countries, sanitation, service/value chain, urban

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INTRODUCTION

This is the second of two papers that report on a study of fecal sludge management (FSM) in 12 cities in low- and middle-income countries. The research included a review of previous work on FSM; this identified reasons why it is often neglected in favour of sewerage, and highlighted the importance of supporting the increasing focus on solving the FSM challenge. The research also included development of tools for analyzing FSM in cities (as explained in Peal *et al.* (2014), in this journal); the tools were then used to review FSM in 12 cities.

This paper summarizes the findings from the analysis of the 12 cities, develops a typology of cities to aid understanding and proposes typical intervention modes for each type of city identified. The paper concludes with recommendations on additional work to further improve understanding of FSM in poor and rapidly-growing cities with limited access to networked sewerage.

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METHODOLOGY

Details of study methodology

The study looked at FSM in 12 cities. Using a combination of secondary data review and key informant interviews, data was assembled on overall fecal sludge management performance in each city. A full list of secondary data sources is provided as supplementary information to this paper (found online at http://www.iwaponline.com/washdev/004/026.pdf). Two tools were developed for the study (Peal *et al.* 2014): an adaptation of the service delivery assessment (SDA) to measure the institutional context; and secondly, a diagrammatic method to analyse and illustrate the physical flow of fecal waste through each city – a fecal waste flow diagram with accompanying matrix.

Selection of the 12 cities

The study was based on 12 cities (see Table 1) selected to represent a regional spread, size and type of city and different levels of existing formal service delivery. The smallest city is Dumaguete in the Philippines with a population of 120,000 while the largest is Delhi with more than 16 million inhabitants.

The extent of sewerage services ranges from a high of 81% in Honduras (indicated here by 19% using on-site systems or open defecation) to a low of 9% in Kampala, Uganda (91% on-site or open defecation) and the two smaller towns: Palu, Indonesia and Dumaguete, Philippines with no sewerage at all – 100% on-site sanitation or open defecation.

Data issues

The poor availability of reliable data on sanitation, and FSM in particular, was a major constraint to this rapid and desk-based review. Although the cities were selected in part because they had already been subjected to some analysis of FSM, in fact the quality of the available data was generally rather low. Much of the analytical work already done is itself cursory in nature, and there is a paucity of reliable representative technical information. Very few documents were found that contained reliable data which would have enabled the data to be cross-checked and triangulated rigorously.

Consequently, the study is based on secondary data supplemented by interviews with key informants. Where key data was found to be lacking, some assumptions had to be made and these have been noted. While the reliability of the data at the detailed level cannot be guaranteed, the degree of accuracy is considered entirely appropriate for its use here; making a rapid overall assessment of the situation in each city.

Table 1 | The 12 city case studies

Country	City	Population (millions)	% using on-site or open defecation
Latin America			
Bolivia	Santa Cruz	1.7	56
Honduras	Tegucigalpa	1.3	19
Nicaragua	Managua	2.0	60
Africa			
Mozambique	Maputo	1.9	90
Senegal	Dakar	2.7	75
Uganda	Kampala	1.5	91
South Asia			
Bangladesh	Dhaka	16	80
India	Delhi	16.3	25
East Asia			
Cambodia	Phnom Penh	1.6	75
Indonesia	Palu	0.35	100
Philippines	Dumaguete	0.12	100
Philippines	Manila	15.3	88

Sources: Authors' calculations based on secondary data and interviews with key informants.

RESULTS

FSM service delivery performance is poor

The level of data collected and made available by city authorities is poor, often contradictory and rarely disaggregated in a useful way. However, it is clear from the study that FSM service delivery performance is generally poor.

The following headline observations stand out:

- The quality of household containment is generally poor and adversely affects owners' ability to have their units emptied when they fill up. Poor quality pits are often abandoned unsafely with consequential risks to the environment and public health. This situation was reported in all but two of the cities – Dumaguete, Philippines and Palu, Indonesia.
- Similarly, illegal dumping by private manual and mechanical pit emptiers into the sea, rivers, wasteland and landfill sites was found to be common in all but the two same cities – Dumaguete and Palu.
- Except in these same two cities in Indonesia and the Philippines, municipalities and utilities rarely provide an emptying and transport service – in most cities the informal private sector steps in to fill this gap.

  - In South Asia and particularly in Africa, manual emptying by informal local service providers predominates.
  - In Latin America and the Caribbean and East Asia, mechanical emptying using vacuum trucks is the norm.
- There is a lack of FS treatment facilities. Where treatment facilities exist they are usually combined with sewage treatment; the exceptions are Palu, Indonesia; Dumaguete and Manila, Philippines; Dakar, Senegal; and Kampala, Uganda. (Note: in Kampala the Bugolobi treatment works has recently been revamped to handle 200 cu.m/day of fecal sludge (Mutono 2013)). Usually, fecal sludge is simply dumped into the existing wastewater treatment plant which may jeopardize the ability of the process to treat the waterborne sewage properly.
- Only two cities in the study set were found to have any mechanism for formal reuse of treated sludge: Dumaguete and Manila in the Philippines. However, in neither city is the activity well developed or does it raise a profit; in Dumaguete the treated FS is given away free of charge while in Manila the process reportedly accounts for a large percentage of the overall FSM operating expenses.

FSM is invisible to policy makers

The study found little 'deliberate' FSM – any services provided tend to be informal and outside of public sector control. None of the cities looked at scored maximum points across all aspects of the enabling environment; most of them had very 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:

- **FSM is largely seen as a 'temporary' or stop-gap solution** and primarily for illegal or informal settlements. This is reflected in cities where provision has been made for some limited management of fecal sludge (through for example the purchasing of a small number of vacuum trucks) but this is not reflected in policy which remains focused on long-term provision of sewerage. It is also often reflected in local building regulations and/or technical standards which fail to specify appropriate on-site systems but are predicated on the assumption that new housing will be provided with networked sewerage. In fact this review bolsters evidence that FSM is often a long-run solution and that the private sector may sometimes be quicker to recognize this than public policy makers: there is evidence of FSM services being provided by private companies in some cities for over 20 years (e.g. in Santa Cruz, Bolivia; Managua, Nicaragua; and Phnom Penh, Cambodia).
- **Usually sewerage is seen as the 'proper' solution.** Drivers include the technical bias instilled during engineer training, and the structure of conventional investment projects that may favour simple, single capital investments over ongoing service delivery.

Sludge accumulation and emptying rates vary

Sludge accumulation rates

The study observed that sludge accumulation rates vary significantly and consequently have a differential impact on public health and environmental risk.

High rates of fecal sludge accumulation are seen in many places (for instance in Kampala, Uganda and Maputo, Mozambique) where pits fill rapidly. 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.

Water usage and other external factors may also increase the rate of sludge accumulation.

In a few cases sludge accumulation rates are relatively lower. For instance, in Palu, Indonesia it is estimated that only 10% of the 50,000 household containment systems will need emptying in the short or medium term. Ninety per cent of the containers are either built very large and will take a long time to fill; and/or are open-bottomed pits which percolate very efficiently, so accumulation rates are low. However, the fecal sludge treatment facility provided is designed for a much larger loading and currently operates at less than a third of its installed capacity. Informants confirmed that this is because at the design stage, the accumulation rates, and therefore the emptying frequency, were over-estimated.

This apparently 'technical' issue is critical for policy makers since it determines the capacity requirements along the service chain; it is almost impossible to generate comment internationally or even nationally valid 'norms'. Accumulation rates in containment systems determine the requirements for emptying and transport (both total capacity and the nature of the fecal sludge to be emptied and transported) and these in turn have an impact on what types of treatment are required.

Management of full containers

The study also found that there is great variation in how users manage their 'container' once it becomes full. In some situations the fecal sludge remains buried – the user safely covering the pit once it is full – often mimicking the operation of an 'arborloo' (see Tilley *et al*. 2008). This is considered a safe system of disposal (except in situations where high groundwater is common) and is shown on the fecal waste flow diagrams as a 'green bar' because, although the sludge is not collected, transported or treated, it is safely disposed of. However, it is of course only suitable where space allows relocation of the container, and is therefore more common on the urban fringes rather than in dense slums.

Where space is limited, some users adapt their containers so that they can continue using them even when they are full by allowing the contents to overflow into an open drain or local informal sewer. The drain or sewer then discharges unsafely to the environment via a river or drain without treatment (this arrangement is common in Dhaka, Bangladesh and was identified in 22% of cases in a study in Indonesia by Mills (2013)). This solution is not safe and where practiced it is included as a 'red bar' on the fecal waste diagrams indicating that fecal waste is unsafely disposed of to the environment.

Scheduled emptying

Scheduled emptying was found only in two cities – Dumaguete and Manila (both in the Philippines) – where a three to five year emptying cycle is operated by the Water District and by the concessionaires respectively. In the majority of the other cities studied, regular desludging is unlikely to be of significant benefit; containment remains a mix of septic tanks, pit latrines and cess pits of various sizes and configurations (some of which are sealed and some of which are unsealed and allow percolation of liquid waste to the sub-soil) and consequently rates of sludge build-up are likely to vary. While some systems might benefit from being emptied on a regular cycle, many others will only need to be emptied when they are full and this will be difficult to predict. In general the demand (or need) for pit emptying will vary greatly depending on the context within each city.

However, in Dumaguete and Manila household containment is predominantly through water closets connected to septic tanks. The prevalence of containers that are well-designed, properly constructed, dual-compartment septic tanks in both cities is a significant factor in enabling regular desludging to be effectively implemented. In this situation accumulation rates can be more confidently estimated which allows desludging cycles to be more easily planned and organized; especially when combined with promotion of the benefits of their proper use and maintenance.

Analysis of the local context is key

Clearly, these various scenarios underline the importance of assessing the real demand for services and the actual fecal waste volume before investing in any downstream infrastructure in any city. This requires an analysis of not just the accumulation rates but also of the local practices of containment, how households manage their fecal waste and how they cope with full containers.

Overview of FSM in the study cities

A tool called the modified SDA was used to assess overall FSM performance in each city. The SDA assigns a score, which describes FSM performance in three broad areas; the enabling environment; the development of services and infrastructure; and the sustaining of services, including an assessment of equity in terms of the extent to which the FSM system serves the city's low-income communities. Scores are assigned along the sanitation service chain from collection (at a toilet or latrine) through transport to treatment and disposal and/or reuse.

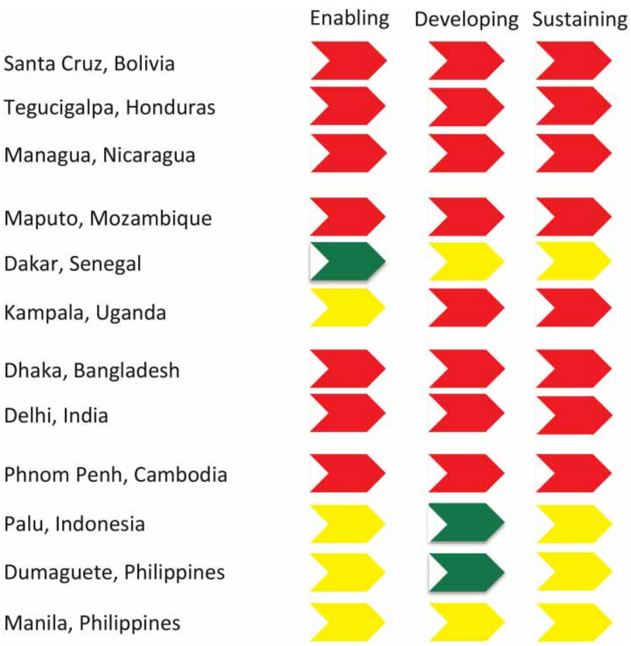

Figure 1 | Summary modified SDA scorecards for each of the 12 cities.

A summary SDA score for each of the 12 cities is shown in Figure 1. The scorecard uses shading to indicate the status, where green = good, yellow = average and red = poor. This clearly shows that whilst the context in each location is different, the extent of the service delivery framework and the level of service being achieved in a number of the cities was broadly similar. For instance, in Santa Cruz, Bolivia; Tegucigalpa, Honduras; Managua, Nicaragua; Maputo, Mozambique; Dhaka, Bangladesh; Delhi, India; and Phnom Penh, Cambodia there is little or no framework for FSM delivery and little or no services (i.e. predominantly red in enabling, developing and sustaining). In contrast, in Dakar, Senegal; Dumaguete, Philippines and Palu, Indonesia the core of the framework is in place and an average to good FSM service has been developed and is being sustained, indicated by the prevalence of yellow and green in their respective scorecards.

A fecal waste flow diagram was used to visualize the percentage of fecal waste safely managed in each city both from sewerage and by on-site systems, the latter informs the modified SDA 'outcome' area of evidence. The results in Table 2 highlight that in only two cities is the outcome satisfactory – the two smallest cities Palu and Dumaguete – where 95% of fecal waste generated on-site is safely managed. In contrast, in Dhaka, Delhi and Phnom Penh, zero per cent of the on-site generated fecal waste is safely managed, while in the remaining seven cities the review found that safe management of on-site generated fecal waste varies between 28 and 41%.

DISCUSSION

Developing a typology of cities

Further consideration of the modified SDA scorecards and fecal waste flow diagrams for each city revealed that amongst the 12 case studies there are, broadly speaking, 3 'types' of city:

- Type 1 cities have 'poor FSM' with no framework and almost no services.
- Type 2 cities have 'basic FSM' where some of the service delivery framework is in place and there is some but limited service provision.
- Type 3 cities have 'improving FSM' where most of the framework is in place, services exist but there is still room for improvement.

Figure 2 shows a typical summary scorecard for each of the three 'types' of city with the building blocks shaded to indicate the level of service. Importantly, the typology is based on the overall SDA scorecard rather than on the percentage of fecal waste safely managed. The latter is taken into account when computing the SDA score, but importantly the SDA also considers additional evidence relating to policy, capacity and investment; which indicates the potential for outcomes to be sustained and access to be improved over time.

There are cities where both the framework and service delivery arrangements for FSM are in place resulting in a complete or near-complete FSM system (what might be termed 'Type 4' cities). None of the cities included in this review fell into this category. Cities which exceed the standard of a 'Type 3' city do exist but are generally found in countries with much better developed overall sanitation frameworks, and a longer track record of investment and well-financed service delivery than is found in the cases considered here. Such cities call for a very different policy and

Table 2 | Safe management of fecal waste in the 12 cities

Country	City	% Households using			% Fecal waste safely managed		
		Sewerage (%)	On-site systems (%)	Open defecation (%)	Sewerage (%)	On-site systems (%)	Total (%)
Latin America							
Bolivia	Santa Cruz	44	51	5	100	**38**	59
Honduras	Tegucigalpa	81	16	3	8	**31**	11
Nicaragua	Managua	40	56	4	81	**38**	52
Africa							
Mozambique	Maputo	10	89	1	12	**28**	26
Senegal	Dakar	25	73	2	12	**39**	31
Uganda	Kampala	9	90	1	80	**37**	40
South Asia							
Bangladesh	Dhaka	20	79	1	10	**0**	2
India	Delhi	75	24	1	46	**0**	34
East Asia							
Cambodia	Phnom Penh	25	72	3	0	**0**	0
Indonesia	Palu	–	91	9	n/a	**95**	86
Philippines	Dumaguete	–	97	3	n/a	**95**	92
Philippines	Manila	9	88	3	90	**41**	44

Sources: Authors' calculations based on secondary data and interviews with key informants.

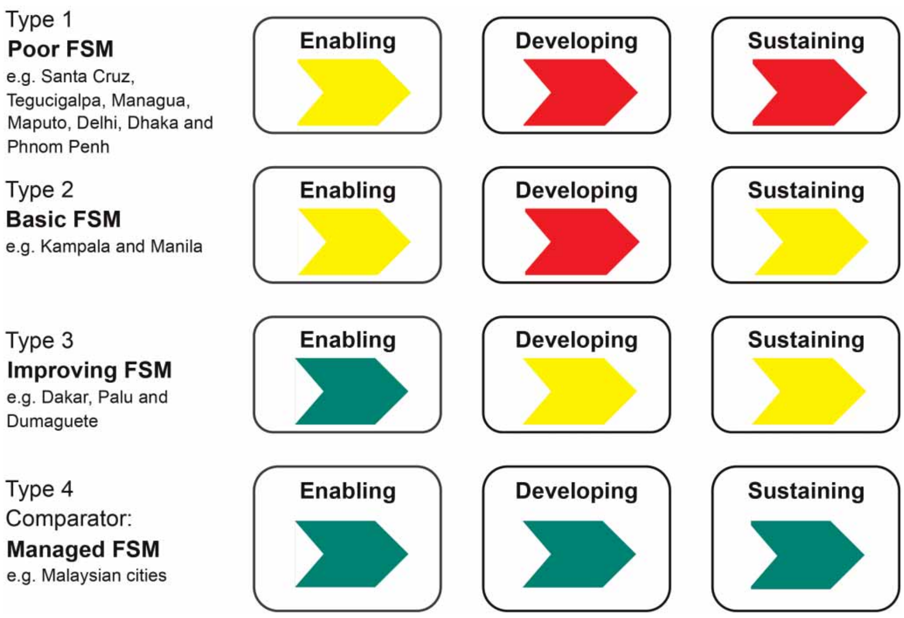

Figure 2 | Typology of cities and summary scorecards.

investment response. The available evidence suggests that cities of the three types covered in this review predominate in many low- and middle-income countries.

The following sub-section describes in more detail one city from each of the three 'types'.

Detailed results from each 'city type'

Type 1 city: Poor FSM

Figure 3 shows the FSM scorecard for Dhaka, Bangladesh. The scorecard indicates that in Dhaka there is virtually no framework within which FSM is formally delivered and there are almost no services. Overall, looking down the diagram there are very low scores in the enabling, developing and sustaining aspects of service delivery, and looking across it is evident that this is true for all aspects of the sanitation service chain. The scores confirm that national and local policy is focused on containment only while the emptying and transport components are limited to small-scale informal services.

The result of this 'Poor FSM' scenario is shown in the fecal waste flow diagram (see Figure 4). In Dhaka a large percentage of fecal waste is generated in non-sewered

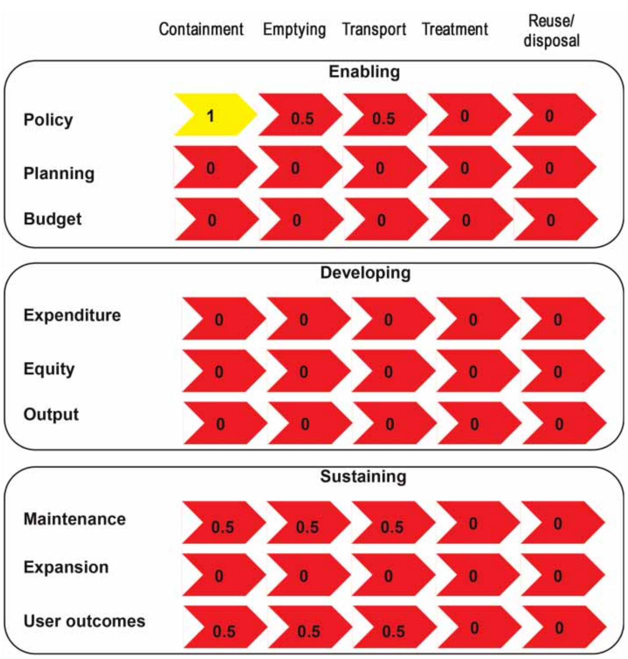

Figure 3 | FSM scorecard for Dhaka, Bangladesh.

systems. As it flows downstream, fractions of the waste drop out of the idealized system at various points and reach unsatisfactory disposal points – some through illegal dumping, some through defective treatment and even some through defects in the sewerage system which is included in the analysis. In these flow diagrams, the defects reported in the sewerage system are due to broken down pumping stations and leakage from broken pipes. The defective treatment reported is either (a) where the installed capacity is insufficient so some waste is treated and some not at all; (b) where a generally defective treatment plant is operating well below its design capacity so waste is treated ineffectively; or (c) a combination of (a) and (b). The width of the bars represents the proportion of fecal sludge at each step in the chain. The red shading represents unsafe management, and the green shading, effective management. In this case the system in Dhaka has failed, with all but a tiny proportion of the waste (from the sewerage system) entering the environment in an unregulated and uncontrolled manner; it could perhaps be best described as institutionalized open defecation.

Type 2 city: Basic FSM

Figure 5 shows the FSM scorecard for Kampala, Uganda. The scorecard indicates that the framework for service delivery is being developed and parts of it are in place, particularly at the level of policy and planning where the scores are improving but that the rate of change at the level of implementation remains uncertain. There is however, clearly, inadequate budget to facilitate significant development of infrastructure except in the treatment element of the chain which scores comparatively well. Indeed, country experts confirm that improvements in treatment capacity are expected following recent expenditure and reports suggest that more are planned.

Emptying and transport of fecal sludge is taking place; a private sector led mechanical pit emptiers' service is active and shows signs of improvement. The pit emptiers have formed an association and this service could potentially become consolidated to deliver improved and at-scale services. However, areas of weakness do persist, most noticeably in equity and output and especially in

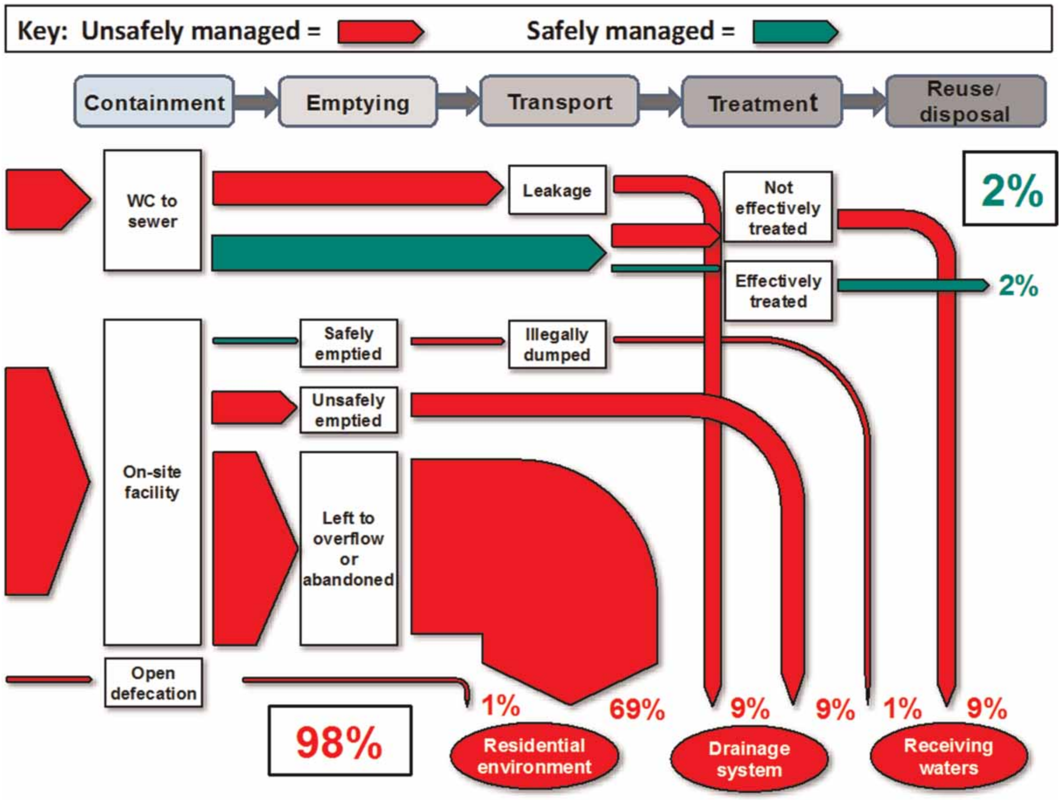

Figure 4 | Fecal waste flow diagram for Dhaka, Bangladesh. Sources: Authors' calculations from data in BMGF (2011a), UNICEF/WHO (2012), and information provided by Tayler (2013).

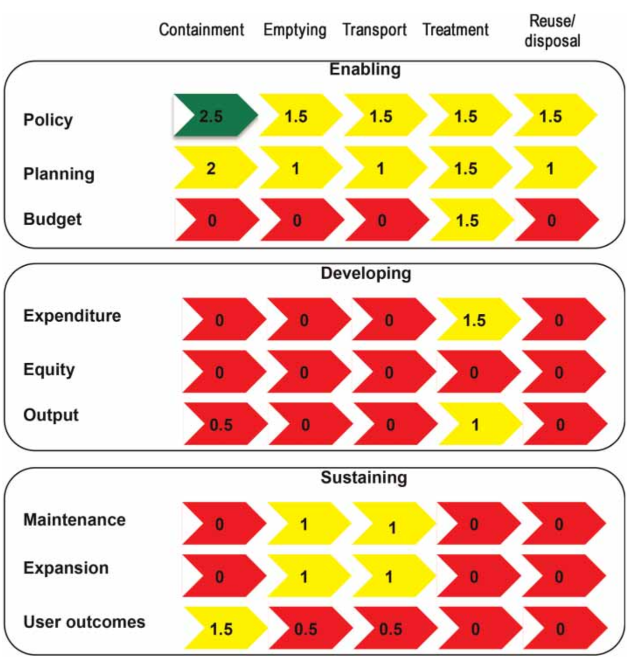

Figure 5 | FSM Scorecard for Kampala, Uganda.

containment and reuse/disposal where the scores are very low.

The associated fecal waste flow diagram for Kampala, Uganda is shown in Figure 6 which shows that the net effect is that the sanitation service chain is performing better than a typical Type 1 city with at least part of the fecal sludge moving through a formalized managed process with some level of treatment. However, despite the improvements in Kampala, over half the fecal waste generated remains untreated and is unsafely reused/disposed of to the environment.

Type 3 city: Improving FSM

Dakar, Senegal is considered to be typical of a Type 3 city; the FSM scorecard for the city is shown in Figure 7. The core parts of the enabling framework are in place and, compared to the Type 1 and 2 cities, there is considerable improvement in the developing and sustaining pillars with

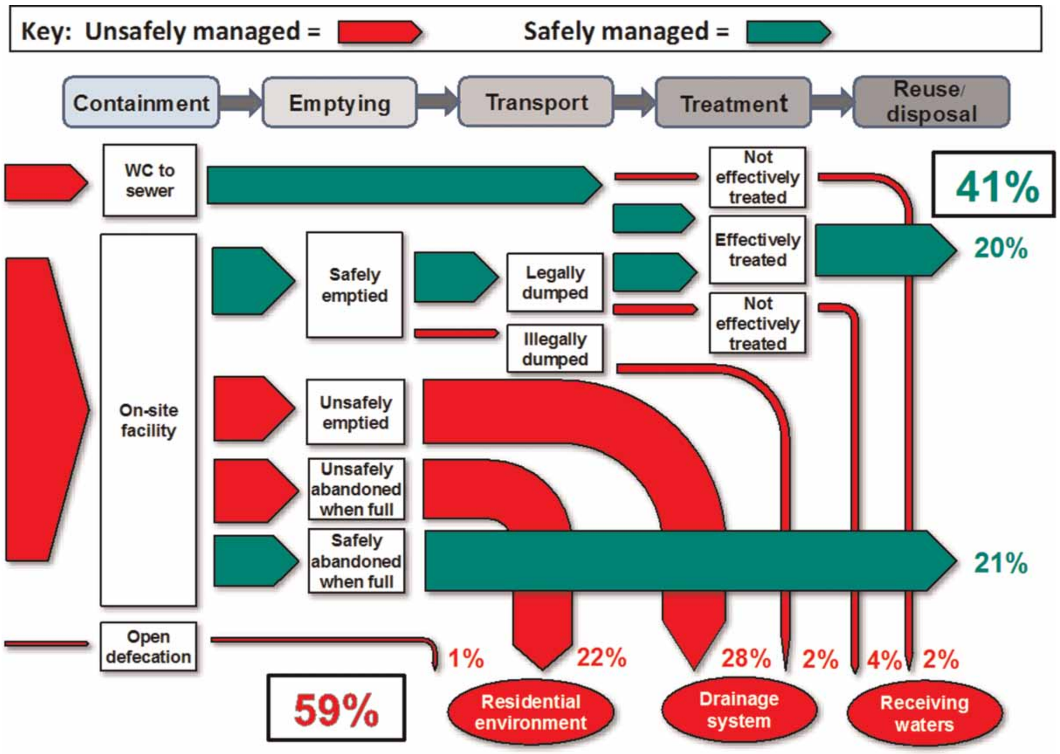

Figure 6 | Fecal waste flow diagram for Kampala, Uganda. Sources: Authors' calculations from data in WSP (2008), and information provided by Mutono (2013).

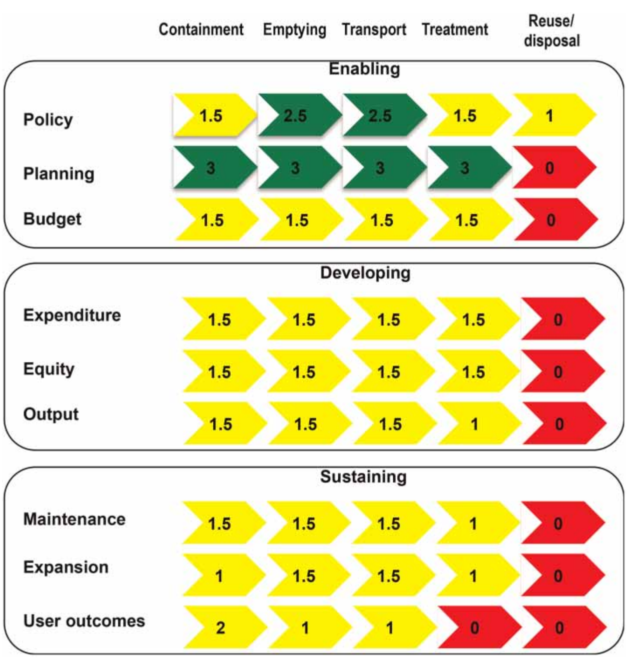

Figure 7 | FSM scorecard for Dakar, Senegal.

noticeably higher SDA scores (i.e. there are more yellow and green chevrons).

The FSM service has been developed and is being maintained although it is noticeable looking across the scorecard that this is more pronounced at the start of the service chain than at the end.

The World Bank's Project d'Assainissement dans les Quartiers Périurbains (better known as the PAQPUD project) has been instrumental to this success through infrastructure investments from containment to treatment and is considered to have had a positive influence (Scott 2011). However, the challenge remains to develop and sustain progress following completion of the project.

The key remaining weaknesses appear in 'sustaining' treatment and overall in the lack of a framework and positive management for reuse and proper disposal.

Despite this improved framework, the outcome remains unsatisfactory. The estimated fecal waste flow diagram is shown in Figure 8 and confirms that the service chain is

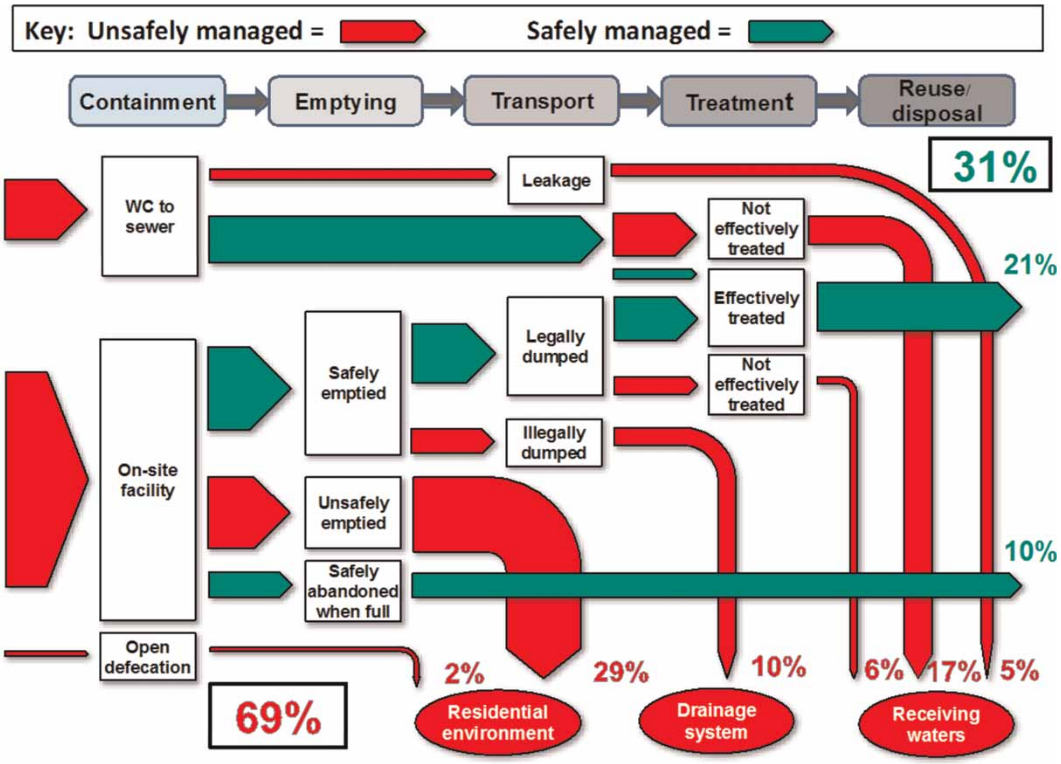

Figure 8 | Fecal waste flow diagram for Dakar, Senegal. Sources: Adapted from Scott (2011).

strengthening particularly in the emptying and transport elements, although performance is lagging behind the development of the enabling environment and investments referred to above. While the relative volume of safely managed FS is currently lower than in the Type 2 example of Kampala, Dakar scores more highly overall because the SDA analysis indicates a significantly more robust long term framework to support investment and maintain services.

Responding to the challenge

Having developed the typology of cities, the study looked at the types of interventions that are likely to be most effective in overcoming the barriers to progress identified by the review for each type of city; from the 'poor FSM' service in Type 1 cities to the 'improving FSM' service in Type 3 cities. Figure 9 summarizes the proposed menu of potential interventions. These are described more fully in the following sections.

Type 1 city: Poor FSM

In Type 1 cities, for instance in Dhaka, Bangladesh and Tegucigalpa, Honduras where the service delivery framework is non-existent and there is virtually no FSM service, the challenges are overwhelming. Having identified that the scale of the problem is so large it can be difficult to identify the most effective interventions. With the understanding that the context in each city is unique, and that interventions must be appropriate for the specific situation, the left-hand column of Figure 9 includes recommendations for critical interventions in cities where there is currently no formal FSM service.

In Type 1 cities, infrastructure investments alone, unsupported by changes in the enabling environment and the development of emptying and transport services are unlikely to be effective particularly given the challenge of 'linking' elements of the supply chain together. Thus for example, additional treatment capacity will not reduce illegal discharge of fecal sludge into the environment as

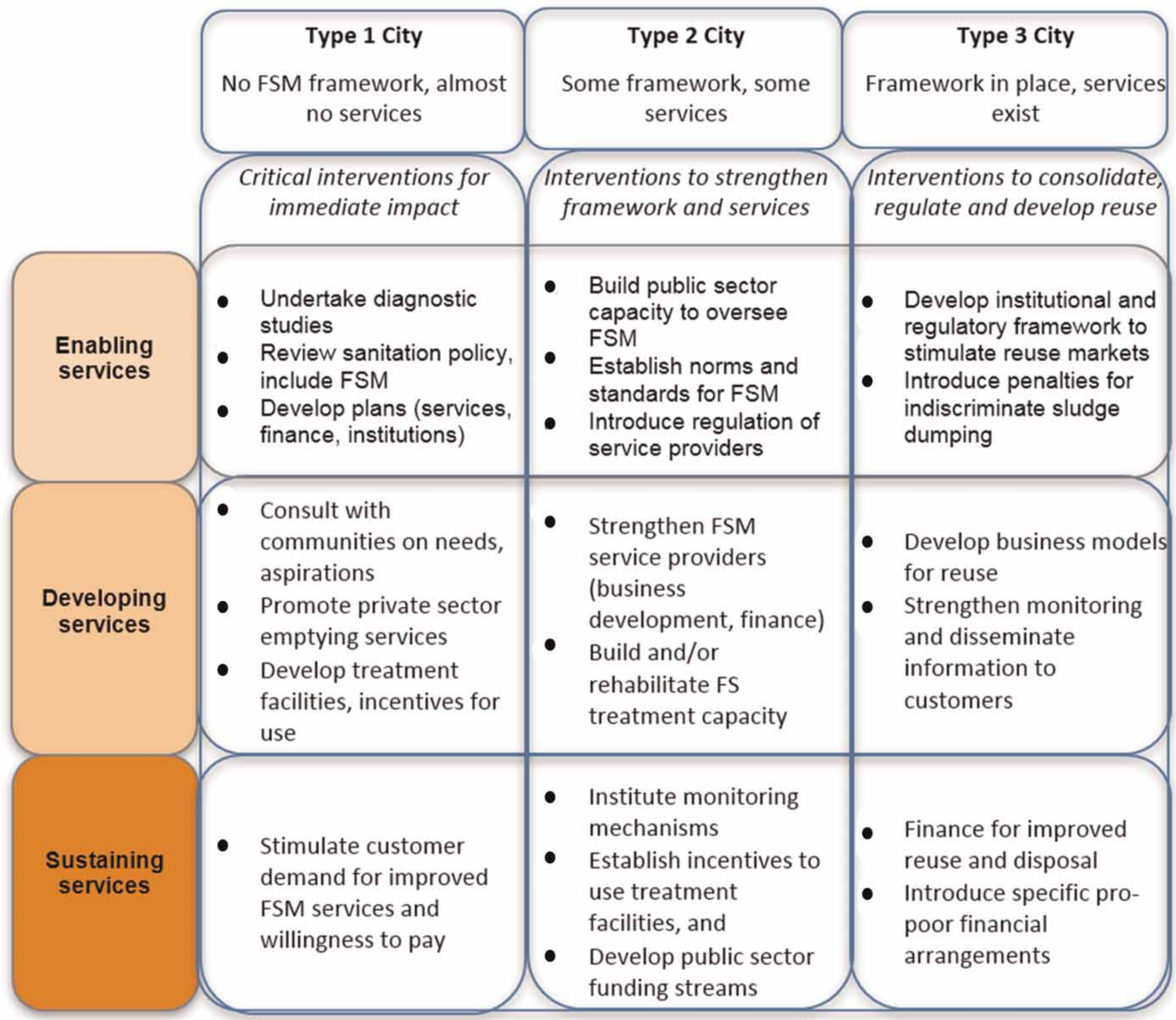

Figure 9 | Recommended interventions to improve service delivery for each city type.

collection and transport remain unregulated and out of control. Critical interventions in Type 1 cities are thus likely to focus on a combination of strengthening key elements of the enabling environment (by engaging with local and national government) with targeted interventions to strengthen the upstream elements of service delivery. These may include introducing a community consultation and planning process before making any infrastructure investments (to stimulate demand) and improving the link between households and private pit emptiers for example by providing business development support, coupled by strong public-sector oversight, to the private sector. The initial focus would therefore be on introducing hygienic emptying and transport of sludge to reduce critical public health risks where people live and developing the capacity of private sector emptying and transport service providers. In these cities, it is likely that public funding would be needed to make parts of the collection and treatment system function, even where services are delivered by private operators.

In this way, a Type 1 city could improve their understanding of FSM while making marginal improvements in service delivery and building the foundation for subsequent more long-term improvements.

Type 2 city: Basic FSM

The middle column of Figure 9 proposes key interventions in Type 2 cities that are designed to strengthen the framework for delivering services with an incremental development of the actual service delivery. For instance in Kampala, Uganda, the interventions may be more ambitious and tailored to build on capacity that already exists. Key interventions would focus on building public sector capacity to oversee and monitor service delivery whilst establishing appropriate norms and standards for FSM. There may also still be key policy interventions needed, and in particular operational tools such as regulatory instruments to support and incentivize the private sector and encourage greater confidence in this market segment – this should in turn attract further private investment to financially viable elements of the service. A market analysis and development of 'at-scale business models' for the private sector that encourage complete service-chain delivery (for example, by creating positive financial incentives for pit emptiers to carry waste to the desired location for treatment) would also be recommended. There may therefore be some critical public investments to be made to ensure the adequacy of sustainable treatment and disposal capacity.

Type 3 city: Improving FSM

In Type 3 cities, the focus would be shifting to consolidation of existing services; for instance in Dumaguete, Philippines; Palu, Indonesia; and Dakar, Senegal. Here, the basis for significant investments in infrastructure should be in place and is being supported along the service chain and at-scale across the city. With infrastructure and service delivery generally in place, then a focus on improving regulation may be appropriate to ensure that all stakeholders act in accordance with the way the system has been designed and planned. The introduction of penalties for undesirable behaviour may therefore become more relevant at this stage. Where areas of the city remain unserved – for instance low-income neighbourhoods – it may be necessary to introduce specific pro-poor financial arrangements.

Finally, a key area of focus once a city reaches this point would be on improvements to the downstream disposal arrangements and, where possible, reuse of the nutrients, water and energy value of fecal sludge (see right-hand column of Figure 9 for appropriate interventions in a Type 3 city).

CONCLUSION

This study comprised a rapid review of the status of FSM in 12 cities. The study was based on secondary data of variable quality supplemented by interviews with local informants. Despite the poor quality of the available data, and partly because of it, the study confirms earlier work which suggests that FSM is a largely neglected aspect of urban sanitation in most cities. This is despite the fact that a majority of the urban population in low- and some middle-income countries rely on on-site sanitation and hence FSM systems to access basic sanitation at home. It seems likely that all of the study cities and indeed most similar cities would need to implement significant FSM programmes in order to protect public health and garner environmental benefits.

An apparent focus on networked sewerage systems means that there has been limited attention paid to alternative sanitation management strategies, and this appears to be consistent in all regions. The sector is poorly analyzed and hence, even where cities are seeking to address the challenge, the solutions often appear to be partial. Since urban sanitation systems require the coordination of household, neighborhood and citywide infrastructure and services these partial solutions often fail to result in improved services, at least in the short term. In common with other urban sanitation approaches FSM requires strong city-level oversight and an enabling environment that drives coordinated behaviors across the sanitation service chain. This strong city-level leadership was absent in almost all the cities in the study.

In cities where FSM is least developed (the Type 1 cities) interventions need to focus on strengthening city-level capacity, addressing service delivery gaps at the household level and possibly supporting small scale interventions to demonstrate the viability of a range of management options particularly those relating to emptying and transport of waste. As capacity and the infrastructure endowment grows, in Type 2 cities, interventions can progress towards more sophisticated management of a larger segment of the service chain. Subsequently cities may get into a position where there is capacity to absorb and manage investments in downstream elements of the service chain (treatment and managed re-use), Type 3 cities.

However the sector needs to build capacity and develop tools to enable a systematic analysis of the situation; this report has presented a proposed approach but more work is needed both to refine these tools and to support their development and application in individual cities. FSM will be a major element in the delivery of sustained and effective urban sanitation for many countries for the foreseeable future. Where investment to date has been limited, such cities have the opportunity to select from a wide range of possible sanitation approaches, including improved management of on-site systems. The main challenge now is to embed it as part of the city manager's arsenal for addressing public health and environmental challenges in the future.

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